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Ilie Magdalena, Cover Designer and Books Coordinator at Publishing House of România de Măine Foundation

ADDRESS OF EDITORS AND PUBLISHERS**Editorship:**

Office Address: 46 G Fabricii Street, Building B, 2nd Floor, Room No. 23, District 6, Bucharest, Romania, Postal Code: 060821

Phone: +4021 316 97 83/85/88/89 - ext. 151

Phone/Fax: +4021 316 97 93

E-mail: ashues@spiruharet.ro

Website: <http://anale-economie.spiruharet.ro/index.html>

Deputy Editor-in-Chief:

Elena GURGU, Associate Professor, Ph.D., Department of Economic Sciences, Spiru Haret University, Bucharest, Romania

Office Address: 46 G Fabricii Street, Building B, 2nd Floor, Room 23, District 6, Bucharest, Romania

Office Phone: +40 21 316 97 85/88/89 - ext. 152

VPN: +40 21 455 10411, Fax: +40 21 316 97 93

E-mail: elenagurgu@yahoo.com, maci_elenagurgu@spiruharet.ro, se_egurgu@spiruharet.ro, elenagurgu@profesor.spiruharet.ro

ResearcherID: E-8516-2014

Publons: <https://publons.com/a/1437881>

ORCID: <https://orcid.org/0000-0001-6964-8516>

SSRN: <http://ssrn.com/author=1307203>

ResearchGate: https://www.researchgate.net/profile/Elena_Gurgu

LinkedIn: <https://www.linkedin.com/in/elena-gurgu-5099b494/>

JOURNAL HISTORY

The *Annals of Spiru Haret University. Economic Series* was established in the year 2000 through the initiative of two distinguished professors from Spiru Haret University: **Professor Ph.D. Gheorghe Zaman**, a corresponding member of the Romanian Academy, and **Professor Ph.D. Constantin Mecu**, one of the university's founders and a vice-rector.

Between 2004 and 2010, the journal was led by **Professor Ph.D. Constantin Mecu**, serving as editor-in-chief, with **Associate Professor Ph.D. Aurelian A. Bondrea**, also a vice-rector, serving as deputy editor.

In 2011, **Associate Professor Ph.D. Aurelian A. Bondrea**, then rector of the university, assumed the role of editor-in-chief and has continued to oversee the journal's development to date.

Initially published annually from its inception in 2000 until 2009, the journal transitioned to a new format in 2010. It adopted a quarterly publication schedule, exclusively in English, with editorial and peer-review processes meeting rigorous international standards.

In 2007, the *Annals of Spiru Haret University. Economic Series* received a B+ rating from the National Council of Research in Higher Education in Romania, recognizing it as a publication of significant scientific value. Since 2009, the journal has been indexed in prominent databases such as REPEC, SSRN, and Google Scholar.

Beginning in 2016, the journal embarked on a rebranding process aimed at enhancing its international visibility and expanding its indexing strategy in global databases.

Over the years, the journal has served as a platform for disseminating the research output of the academic staff of Spiru Haret University, which includes professors, associate professors, lecturers, and teaching assistants affiliated with six economics faculties, specialized departments, and the Central Scientific Research Institute. The journal also features contributions from academics, researchers, and doctoral students from universities and research institutions worldwide.

The journal's subject matter reflects its commitment to modernizing the teaching of economic sciences in higher education. Topics include, but are not limited to, marketing, management, finance, banking, accounting, auditing, international economic relations, trade, business, tourism, administrative data processing, political economy, commercial law, cybernetics, environmental economics, statistics, ethics in economics, insurance, advocacy and lobbying, economic philosophy, and econometrics.

The articles published in the journal address both theoretical and practical issues, focusing on the development and consolidation of the Romanian market economy, advancements in scientific and technical progress, and strategies for promoting these developments within the Romanian economy. Furthermore, the journal explores themes related to the evolving global economy, including globalization, economic integration, and Romania's participation in these processes. It also includes analyses of economic phenomena and trends from diverse regions worldwide.

The editorial team and scientific advisors comprise esteemed Romanian scholars, including members of the Academy, university professors, and experts from various economic and social fields. The journal's scientific committee includes reviewers affiliated with notable Romanian institutions such as the Academy of Economic Studies from Bucharest, West University of Timișoara, the National Scientific Research Institute for Labour and Social Protection, the Romanian Court of Auditors, the Body of Expert and Licensed Accountants of Romania (CECCAR), and the Institute of National Economy.

In addition, the journal benefits from the expertise of international academics and researchers from countries such as Australia, Azerbaijan, Algérie, Bosnia and Herzegovina, Bulgaria, France, Germany, Greece, Iceland, India, Indonesia, Italy, Lithuania, Northern Ireland, Norway, Poland, North Macedonia, Serbia, Russia, Slovenia, South-Africa, the Netherlands, Turkey, Ukraine, and the United Kingdom.

To meet the needs of its audience, the journal is distributed to libraries across Bucharest and Romania and is shared with universities and economic faculties internationally.

COVERAGE

The *Annals of Spiru Haret University. Economic Series* encompasses a broad spectrum of topics within the field of Economic Sciences. These include, but are not limited to, marketing, management, finance, banking, accounting, auditing, international economic relations, trade, business, tourism, administrative data processing, political economy, geopolitics, commercial law, cybernetics, environmental economics, statistics, ethics in economics, insurance, advocacy and lobbying, economic philosophy, and econometrics.

Each issue of the journal focuses on a specific theme, which serves as a subfield within the journal's overarching areas of coverage, offering an in-depth exploration of targeted topics.

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Contributions to the journal are expected to present original research, employing either theoretical or empirical methodologies. Accepted submissions may take the form of research

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To support the development of emerging scholars, the journal features a dedicated section for young researchers, particularly Ph.D. students, encouraging them to contribute their insights and perspectives to the academic discourse.

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FOREWORD

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It is with great pleasure that we introduce Issue 1/2026 of *Annals of Spiru Haret University. Economic Series*. This edition brings together a multidisciplinary selection of peer-reviewed contributions that examine the evolving dynamics of the global economy in the context of persistent uncertainty, technological acceleration, and structural transformation during the first quarter of 2026.

The period from January to March 2026 has been characterized by a global macroeconomic environment defined by **moderate growth, gradual disinflation, and increasing geoeconomic fragmentation**. While the post-pandemic adjustment phase has largely stabilized, new structural challenges continue to shape economic trajectories across both advanced and emerging economies, particularly in relation to trade reconfiguration, debt sustainability, and productivity shifts driven by digital transformation.

According to the **International Monetary Fund (IMF, World Economic Outlook Update, January 2026)**, global economic growth is projected at approximately **3.3% for 2026**, reflecting stronger-than-expected performance in emerging Asia and continued resilience in the United States. However, the IMF also emphasizes significant downside risks stemming from geopolitical tensions, trade fragmentation, and financial market volatility (IMF, 2026).

In contrast, the **World Bank (Global Economic Prospects, January 2026)** provides a more cautious outlook, estimating global growth at **2.6%**, highlighting weakening global trade momentum and persistent structural constraints in developing economies. Global trade expansion remains subdued, with growth estimated below historical averages, reflecting ongoing supply chain restructuring and policy-driven fragmentation (World Bank, 2026).

In advanced economies, the United States maintained stable expansion supported by robust labor market conditions and sustained investment in high-technology sectors, particularly artificial intelligence and digital infrastructure. Inflation continued its gradual decline but remained above target in several components, especially in services and housing markets, reinforcing a cautious monetary policy stance.

The Eurozone experienced **modest but fragile recovery**, constrained by weak industrial output and persistent energy market adjustments. Although inflation showed signs of stabilization, underlying price pressures in services and wage dynamics remained elevated, limiting the scope for rapid monetary easing (OECD, 2026).

Emerging markets presented a heterogeneous performance landscape. Emerging Asia continued to act as the primary engine of global growth, supported by strong domestic demand and export competitiveness in technology-intensive sectors. In contrast, several economies in Latin America and Sub-Saharan Africa faced persistent constraints related to fiscal space,

external debt vulnerabilities, and currency volatility. According to the IMF (2026), this divergence is expected to widen unless structural reforms and productivity-enhancing investments are accelerated.

Global trade dynamics in Q1 2026 reflect a continued shift toward **regionalization and strategic supply chain realignment**. UNCTAD (2026) highlights the increasing prevalence of near-shoring and friend-shoring strategies, driven by geopolitical uncertainty and industrial policy interventions. While these strategies improve resilience, they simultaneously contribute to higher structural costs and reduced global efficiency gains.

Financial markets entered 2026 with a cautiously optimistic sentiment, supported by expectations of monetary policy stabilization and continued innovation-driven growth. However, the **Bank for International Settlements (BIS, 2026)** warns that elevated levels of sovereign and corporate debt, combined with high-interest rate environments, continue to pose systemic risks to global financial stability.

Overall, the first quarter of 2026 reflects a global economy in a phase of **structural rebalancing rather than cyclical recovery**, characterized by uneven growth patterns, persistent but moderating inflation, and increasing fragmentation of trade and investment flows. Policy coordination, institutional resilience, and productivity-enhancing reforms remain essential to sustaining long-term global economic stability.

The articles included in this issue reflect these macroeconomic dynamics by addressing a broad range of contemporary economic challenges, including digital transformation, artificial intelligence adoption, financial stability, and governance frameworks in an increasingly complex global environment. Particular emphasis is placed on the interaction between technological innovation and economic performance, as well as the regulatory and ethical implications of rapid digitalization.

Collectively, the contributions provide multidimensional insights into how economies, institutions, and organizations adapt to structural change in an era defined by uncertainty and transformation. By integrating theoretical analysis with empirical investigation, this issue aims to advance understanding of the mechanisms through which innovation, policy, and market forces interact to shape contemporary economic systems.

This volume assembles a broad and diverse set of thirty-one scholarly contributions that collectively explore the evolving intersections between law, economics, governance, and emerging technologies. Rather than forming a single thematic argument, the collection reflects a pluralistic intellectual landscape in which classical legal doctrines, socio-legal theory, and technological transformation are continuously reinterpreted through new analytical lenses. The articles included in this first part already indicate the scope and ambition of the volume: a sustained inquiry into how legal systems adapt to increasingly complex and decentralized forms of regulation.

The opening contribution, *“The Autonomy of Internal Decision-Making in Partial Systems, The Autopoiesis of Private Law, and Economic Self-Regulation. Private Government in The Sociology of Law”*, authored by Gino FONTANA, sets a strong theoretical foundation for the volume. It engages with systems theory and the concept of autopoiesis to argue that private law

operates as a self-referential normative system. Within this framework, internal decision-making in economic organizations acquires a high degree of autonomy, contributing to what the author conceptualizes as forms of “private government” within contemporary socio-legal structures.

Building on questions of doctrinal functionality in commercial practice, “*From Anomaly to Utility: Ventilating and Streamlining the Place of Undisclosed Principal in Contemporary Commercial Transactions*”, written by Rufus Tooohukwu OKWARA, Kelechi Enyinna UGWU, Valentine Osita OKWARA, and Basil Uchenna NWOKEFORO, revisits a classical doctrine of agency law. The authors challenge its traditional characterization as an anomaly and instead emphasize its functional relevance in modern commercial transactions, particularly in relation to confidentiality, flexibility, and transactional efficiency in global trade.

A historical and conceptual reconfiguration of legal governance is proposed in “*From Imperium to Algorithm: The Lex Rhodia De Iactu as The Source Code of Maritime Governance. From Roman Dogmatics to Utopian Ships: An Analysis of Law & Economics*”, authored by Gerardo Marco BENCIVENGA. The article reinterprets the Roman maritime principle *Lex Rhodia de Iactu* as an early form of structured risk distribution that anticipates algorithmic forms of governance. By linking Roman legal rationality to contemporary computational logic, the author traces a conceptual evolution from imperial legal orders to algorithm-driven regulatory systems.

The increasing centrality of artificial intelligence in legal and socio-economic systems is addressed in “*Overview of Artificial Intelligence-Based Technologies: Legal, Ethical and Economic Challenges in the Context of Human Rights and Liability*”, by Roxana-Daniela PAUN. The article examines key challenges arising from AI deployment, including liability attribution, transparency, and the protection of fundamental rights. It highlights the regulatory difficulties associated with automated decision-making and the need for robust legal frameworks capable of ensuring accountability and ethical governance.

Complementing this perspective, “*The Impact of Artificial Intelligence (AI) on Accountants and Accounting Profession*”, authored by Adetunji Abdul-Azeez ADEREMI, Ayodele Joseph ILORI, and Busari Ganiyu ADENIRAN, explores the transformative effects of AI on professional accounting practice. The authors emphasize both the disruptive and generative dimensions of automation, showing how routine tasks are increasingly replaced by algorithmic systems while new roles emerge centered on interpretation, advisory functions, and strategic analysis.

The article “*Ethical Implications and Challenges in AI-Augmented Decision-Making*”, authored by Elena GURGU, Victor-Nicholas GURGU, and Ioana-Andreea GURGU, examines the normative tensions generated by the increasing reliance on AI systems in decision processes, particularly in relation to responsibility, transparency, and ethical accountability. The authors emphasize the continuing need for human oversight in contexts where algorithmic systems influence or partially replace human judgment.

“*Psychological Aspects of Acceptance and Use of Artificial Intelligence in Management and Business Decision-Making*”, by Milica ČOLOVIĆ and Vladimir MITIĆ, extends the discussion by focusing on the human and behavioral conditions underlying the adoption of artificial

intelligence in organizational settings. The article highlights the importance of trust, perceived utility, and cognitive readiness in shaping how AI systems are integrated into managerial decision-making processes.

The contribution “*Sovereign Edge Agentic LLM Systems (SEALS), Toward a Personal AI and Organizational Sovereign AI Decision Assistant*”, authored by Jovan IVKOVIĆ, introduces a conceptual framework for decentralized and agentic AI architectures. It explores the development of large language model-based systems capable of functioning as autonomous decision-support tools, embedded within both personal and organizational governance structures, and capable of adapting to context while maintaining operational independence.

In “*The Role of Artificial Intelligence in the Competitiveness of Family Businesses*”, Marco IMPERIO analyses the impact of artificial intelligence on the strategic positioning of family-owned enterprises. The study considers how AI adoption enhances competitiveness through improved efficiency and innovation, while also generating tensions with traditional governance models and long-standing organizational values characteristic of family businesses.

The article “*The Rise of Agentic Enterprises: From Data-Driven Operations to Value-Driven, Human-Centered AI Governance*”, authored by Elena GURGU and a wide group of co-authors, develops a macro-level perspective on organizational transformation under conditions of advanced AI integration. The authors describe a transition from data-driven operational models toward agentic enterprises in which AI systems participate actively in governance and value creation, while stressing that human-centered principles remain essential to maintaining coherence, legitimacy, and ethical alignment.

The article named “*Maintenance 4.0 in the Contemporary Industrial Ecosystem. Economic Analysis from a Digital Optimization Perspective. Industrial Risk Analysis and Assessment Models*”, authored by Gino FONTANA and Mario FONTANA, examines the evolution of maintenance systems within modern industrial environments shaped by digital technologies. The authors analyse how Maintenance 4.0 frameworks contribute to the optimization of industrial processes through predictive systems and data-driven models, while also addressing the implications for industrial risk assessment and operational reliability in increasingly automated ecosystems.

“*Non-Financial Employer Branding Systems’ Impact on The Pro-Social Behaviour of Workforces*”, written by Nnenna E. UKANDU, Francis E. MONYEI, Ruth E. UFOMBA, and Wilfred I. UKPERE, investigates the influence of organizational branding strategies beyond financial incentives. The study highlights how non-financial employer branding mechanisms can shape pro-social behaviour among employees, reinforcing engagement, cooperation, and organizational commitment within workplace environments.

The contribution “*Drivers of Vertical Career Immobility: Voices of Atypical Workers*”, authored by Wilfred Isioma UKPERE, Jeremy MITONGA-MONGA, and Nyasha MAPIRA, explores structural and experiential barriers to career progression. The authors focus on atypical workers and identify key factors contributing to vertical career stagnation, including organizational rigidity, labour market segmentation, and institutional constraints affecting upward mobility.

In “*Exploring the Impact of Workplace Learning on Organisational Outcomes, Branding and Competitive Advantage*”, Adeola AROTIBA and Wilfred Isioma UKPERE analyse the role of continuous learning within organizations. The article argues that workplace learning is a strategic asset that enhances organizational performance, strengthens employer branding, and contributes to long-term competitive advantage in increasingly dynamic markets.

“*Change Management and Employee Conformity to Organizational Objectives in Medical Diagnostic Centers*”, authored by Marcellinus Chukwuka IHIONU, examines the relationship between organizational change processes and employee behavioural alignment. The study highlights how effective change management strategies can influence employee conformity to institutional objectives, particularly within highly structured and regulated environments such as medical diagnostic centers.

“*Decision-Making Processes, Expertise and Limited Rationality: Cognitive, Organizational Models and Strategies for Choosing Between Risk, Forecasting and Creativity in Organizational and Business Contexts*”, authored by Stefano AMODIO, examines the limits of rational decision-making within complex organizational environments. The study explores how cognitive constraints and organizational structures influence the balance between risk assessment, forecasting accuracy, and creative problem-solving in managerial decision processes.

“*Entrepreneurial Competence, Ethical Economy and Creative Problem Solving: Education, Global Citizenship and Sustainable Development in the European and International Framework*”, written by Melina ALLEGRO, investigates the relationship between entrepreneurial skills and broader ethical and educational frameworks. The article emphasizes the role of education in fostering entrepreneurial competence aligned with principles of ethical economy, global citizenship, and sustainable development at both European and international levels.

“*Moderating Effects of Educational Qualification and Work Experience on The Relationship between Human Resource Accounting and Financial Performance*”, authored by O.J. AKINTAYO and A. OLAGUNJU, analyses how human capital factors influence the connection between human resource accounting practices and financial outcomes. The study highlights that both educational attainment and professional experience significantly shape the effectiveness of human resource investments in improving organizational performance.

“*Earnings Management and Firm Growth in Emerging Markets: An Empirical Investigation*”, by Saheed Akande SHITTU, explores the relationship between accounting practices and corporate expansion in emerging economies. The article focuses on earnings management strategies and their impact on firm growth, emphasizing the complex trade-offs between financial reporting practices and long-term organizational sustainability.

“*The Effect of Cost Stickiness on the Financial Performance of Deposit Money Banks*”, authored by Oladimeji Emmanuel OLUWADARE and Adesola Omowoleola OLUWADARE, examines how asymmetric cost behaviour influences banking performance. The study investigates the phenomenon of cost stickiness and its implications for financial efficiency and

profitability within deposit money banks, contributing to a deeper understanding of cost dynamics in financial institutions.

The study *“Digitalization of Tax Services and Tax Gap”*, authored by Rotimi OLADELE, Adetunji Abdul-Azeez ADEREMI, John ACHILE, and Busari Ganiyu ADENIRAN, examines the impact of digital transformation on tax administration systems. The authors highlight how the digitalization of tax services contributes to reducing compliance gaps, improving efficiency, and enhancing revenue collection mechanisms within modern fiscal frameworks.

Closely connected to fiscal governance, *“Effect of Value Added Tax Revenue on Government Infrastructural Development”*, written by Opeyemi OSO, Adetunji Abdul Azeez ADEREMI, Olusegun Efuntade ALANI, and Busari Ganiyu ADENIRAN, investigates the relationship between VAT revenue generation and infrastructural development. The article emphasizes the role of indirect taxation as a key driver of public investment in infrastructure and broader economic development.

A broader institutional perspective is provided in *“From Governance to Welfare: Institutional Quality and Human Development Dynamics”*, authored by Stephen I. ODO, Oluchukwu F. ANOWOR, Victor O. ANINWAGU, and Wilfred I. UKPERE. The study explores how institutional quality influences the transition from governance structures to measurable human development outcomes, emphasizing the central role of effective institutions in shaping welfare dynamics.

Complementing this analysis, *“The Effect of Foreign Direct Investment (FDI) and Green Technology Adoption on Sustainable Development”*, authored by Oladimeji Emmanuel OLUWADARE and John Ayodele ADEKANMBI, examines the dual impact of international capital flows and environmental innovation. The article highlights how FDI and green technology adoption jointly contribute to sustainable development objectives, particularly in balancing economic growth with environmental responsibility.

The article *“Impact of Sub-National Debt on Poverty and Unemployment”*, authored by Eugene A. OKPE, Clever A. GBANADOR, and Simeon G. NENBEE, analyses the socio-economic consequences of sub-national borrowing. The study focuses on how debt levels at regional and local government levels influence poverty rates and unemployment, highlighting the fiscal trade-offs between public borrowing and socio-economic stability.

The article *“Informal Sector Dynamics, Business Networks, and BRICS Opportunities: Challenges and Prospects for SMMEs”*, authored by Brian Ngwako MAHOSI, examines the structural role of informal sector activity in shaping small, medium, and micro enterprise (SMME) development. The study highlights how business networks and emerging BRICS-related opportunities can both enable and constrain growth within informal and semi-formal economic environments.

“Community-Based Entrepreneurial Ecosystems: Beyond Individual Entrepreneurship”, written by Ayanda SIBIYA, shifts the analytical lens from individual entrepreneurship to collective and community-driven innovation structures. The article emphasizes the importance of localized entrepreneurial ecosystems in fostering sustainable economic participation, resilience, and inclusive development.

The contribution “*Impact of Total Quality Management on Business Performance in the Hospitality Sector*”, authored by H. O. OJODU, V. A. ADEYEYE, I. O. ONIKOYI, and D. A. MORAKINYO, investigates the role of quality management systems in enhancing organizational performance within the hospitality industry. The study underlines the significance of Total Quality Management practices in improving efficiency, customer satisfaction, and competitive positioning.

In “*Post Covid-19 Pandemic Business Turnaround Strategies for Guesthouses*”, authored by Wilbert MUTOKO, Hellen MLOTSWA, Phillis MUTOKO, Patrick EBEWO, Knowledge SHUMBA, the focus is placed on recovery strategies within the hospitality sector following the Covid-19 pandemic. The authors explore adaptive business models and operational adjustments aimed at restoring viability and competitiveness in a post-crisis environment.

The article “*A Segmented Stochastic Mortality Framework for Life Insurers: Evidence from Contrast Tree Analysis*”, authored by Godson Chukwunwike MESIKE and Leke Ebenezer AKINDIPE, introduces an advanced actuarial modelling approach for mortality risk assessment. The study applies segmented stochastic frameworks and contrast tree analysis to improve predictive accuracy in life insurance contexts, contributing to more robust risk management practices.

Finally, “*Completion Time of PhD Programs and its Implications for Higher Education Efficiency*”, authored by Ganiyu Oluwaseyi QUADRI, Amos Olorunwa AGBOJO, and Wilfred Isioma UKPERE, examines doctoral education efficiency through the lens of program completion timelines. The study highlights how institutional structures, supervision models, and academic support systems influence PhD completion rates and overall higher education productivity.

The contributions gathered in this issue of the *Annals of Spiru Haret University. Economic Series* present a comprehensive and interdisciplinary exploration of contemporary economic, managerial, technological, and socio-institutional challenges. Taken together, the thirty-one studies reflect the growing complexity of a global environment in which economic systems, organizational practices, and public institutions are increasingly shaped by technological innovation, structural transformation, and evolving social dynamics.

A key characteristic of this volume is its integrative and multidimensional perspective, which brings together macroeconomic analysis, sectoral studies, organizational research, and behavioural insights. Across the issue, particular attention is devoted to the accelerating influence of digitalization, artificial intelligence, and data-driven decision-making processes, all of which are fundamentally reshaping governance models, market behaviour, and competitive strategies. At the same time, the contributions consistently emphasize the importance of human-centered dimensions, including ethics, leadership, education, labour dynamics, and social inclusion, reaffirming that sustainable development cannot be understood outside the context of human agency and social responsibility.

The volume also sheds light on the specific challenges and opportunities faced by emerging, developing, and transition economies, with a focus on institutional performance, labour market adaptability, fiscal structures, entrepreneurial ecosystems, and sectoral resilience. Whether

addressing issues related to informal economic activity, industrial transformation, public finance, or service-sector recovery, the studies collectively underline the importance of adaptive institutions and coherent policy frameworks capable of responding to uncertainty and structural change.

From a broader policy perspective, the findings presented throughout this issue strongly support the need for evidence-based governance, interdisciplinary collaboration, and long-term strategic thinking. The analyses demonstrate that effective responses to contemporary global challenges—ranging from technological disruption and demographic shifts to fiscal pressures and environmental sustainability—require coordinated approaches that integrate economic efficiency with ethical responsibility and institutional transparency.

Ultimately, this issue is intended not only as an academic contribution, but also as a platform for reflection and practical engagement. By connecting theoretical perspectives with empirical investigation, it aims to support policymakers, researchers, and practitioners in understanding and navigating ongoing transformations in the global economy. In this sense, the *Annals of Spiru Haret University. Economic Series* continues to function as a space for rigorous scholarly dialogue, fostering knowledge exchange and contributing to the advancement of sustainable development, institutional resilience, and inclusive growth.

It is our sincere hope that readers will find this issue both insightful and valuable, both in terms of its analytical depth and its relevance to real-world challenges. Academic research plays a vital role in questioning established assumptions, identifying emerging trends, and supporting informed decision-making in times of rapid change.

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Associate Professor Ph.D. Elena Gurgu

Deputy Editor-in-Chief

Annals of Spiru Haret University. Economic Series



ACADEMIA PAPERS

THE AUTONOMY OF INTERNAL DECISION- MAKING IN PARTIAL SYSTEMS, THE AUTOPOIESIS OF PRIVATE LAW, AND ECONOMIC SELF-REGULATION. PRIVATE GOVERNMENT IN THE SOCIOLOGY OF LAW

Gino FONTANA¹

¹ *S.S.M.L - Scuola Superiore Per Mediatori Linguistici " Teseo" Salerno,
 Corso Umberto I, 16, 84099 San Cipriano Picentino Salerno, Italy,
 Phone: +39 089 202 7721, E-mail: sl.gf@libero.it*

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Abstract

This essay examines, from an advanced and systematically oriented sociological-legal perspective, the processes of increasing decision-making autonomy that characterize partial social systems, with particular attention to the autopoiesis of private law and the structural function of economic self-regulation in the configuration of so-called private governance. This phenomenon cannot be traced back to traditional categories of state law or to a mere lack of public intervention, but rather manifests itself as a functional outcome of the high complexity produced by globalization, digitalization, and the spread of transnational regulatory frameworks. In this context, forms of self-referential coordination emerge, capable of generating rules, standards, contractual models, and disciplinary mechanisms with global effectiveness, often able to impact economic and social practices to an extent equal to or greater than that of state regulations. This paper situates these dynamics within theories of functional differentiation, legal autopoiesis, and studies of global private regulation and police systems. Through a comparative analysis spanning several geopolitical regions, the paper shows how private governance represents a structural feature of global economic governance,

rather than a circumscribed anomaly. While it responds to the demands of efficiency and adaptation, it raises significant tensions regarding democratic legitimacy, accountability mechanisms, and the protection of fundamental rights. Finally, the essay proposes an interpretative model aimed at integrating the functionality of self-regulating systems with a framework of public legitimacy, outlining dialogical and reflexive forms of normativity appropriate to contemporary complexity.

Keywords: *autopoiesis, partial systems, private law, self-regulation, private government, systems theory, sociology of law.*

JEL Classification: K20 ; K22 ; K40 ; L51 ; P48

1. Introduction

In contemporary societies, characterized by an exponential increase in complexity, the coexistence of economic flows that transcend political boundaries, and the intense functional specialization of social subsystems, law can no longer be understood as a unitary normative apparatus tied to a sovereign territorial center. Instead, it is configured as a polycentric set of communications that develop within and at the margins of social systems, generating parallel, overlapping, or intertwined orders. The forms of private regulation that have emerged in recent decades are not sporadic episodes or pathological deviations from the classical state structure, but rather structural responses to the growing inability of state law to autonomously govern social phenomena unfolding on a global scale (Sassen, 2006). It is in this scenario that a new form of governance is emerging, *private governance*, a set of regulatory devices produced by economic, technological, and organizational actors capable of shaping the behavior of individuals, businesses, and entire sectors of the global economy (Goldmann, 2017).

The aim of this essay is to investigate the dynamics through which the autonomy of decision-making processes within partial systems, the autopoiesis of private law and economic self-regulation converge in the formation of *private government*, highlighting the theoretical, sociological and political implications. legal aspects of this transformation. The approach adopted combines three main theoretical lines : the theory of functional differentiation, which allows us to understand the structural autonomy of social subsystems (Luhmann 1984), the theory of legal autopoiesis, which sheds light on the legal system's capacity to produce norms from its own operations (Teubner 1989; Lessig, 1999), and the

critical theory of private regulation, which analyzes the growing importance of non-state actors in the production of effective, binding, and sometimes pervasive norms (Morgan & Yeung 2007; Levi-Faur 2011) . The theoretical approach integrates sociology of law, systems theory, comparative law, and political economy, highlighting how private normative production through standards, digital protocols, algorithms, and codes of conduct has assumed a regulatory role equal to or superior to traditional state authorities.

However, understanding the nature of *private governance* means going beyond the mere cataloging of economic self-regulation practices and questioning the profound transformations of the very idea of normativity. The issue lies not only in recognizing that many rules relevant to the functioning of global markets are not produced by states, but in understanding that these rules interact with public law in complex ways, sometimes replacing it, sometimes complementing it, sometimes challenging its boundaries. Contemporary legal pluralism cannot therefore be interpreted as an anarchic mosaic of norms, but rather as a systemic configuration in which legitimacy is no longer the monopoly of state law, but is distributed among multiple norm-producing centers, each endowed with its own form of authority, rationality, and power (Fontana, 2025).

In outlining these transformations, the essay brings together literatures from different traditions , such as the sociology of law, which has analyzed the normative power of organizations (Selznick 1969; Edelman 2016); global law, which studies transnational legal systems (Zumbansen, 2012); political economy, which highlights the centrality of private actors in economic governance (Hall & Soskice, 2001); and studies of digital platforms, which demonstrate the growth of new forms of technical sovereignty (Klonick, 2017). The result is an investigation that does not limit itself to describing empirical phenomena, but reconstructs the profound logic of transformation, identifying in contemporary social systems the tendency to produce not only operational decisions, but actual private orders. The essay explores the evolution of private law from a space of individual will to an autonomous and transnational regulatory infrastructure, showing how legal autopoiesis, private economic regulation, and the digitalization of governance contribute to the formation of *private government* . The analysis unfolds along four lines, the transformation of normative sources, the intersection of law and digital, an international comparison of regulatory models, and theoretical reflections on sovereignty, legitimacy, and compliance.

2. Partial systems, complexity and decision-making autonomy

In the theory of functional differentiation, one of the most influential contributions to the understanding of contemporary law, modern society is no longer conceived as a hierarchical set of institutions functioning from a single sovereign center, but rather as a set of functional systems operating in an operational manner, each with its own code, rationality, and decision-making structures (Luhmann, 1984). This operational manner does not imply isolation, since the systems are constantly interdependent ; rather, it implies that each system selects communications from the environment according to internal criteria, reducing complexity through its own operational categories.

The economic system does not understand ethics, morality, or politics, but translates what it encounters into a binary of payment/non-payment; the scientific system interprets the world according to a binary of true/false; the political system according to can/cannot; the legal system according to lawful/unlawful. This differentiation allows society to address otherwise unmanageable levels of complexity, as each system specializes in managing a specific type of problem. But this differentiation also leads to increasing difficulty in coordinating between systems, since what is rational from an economic perspective may not be so from a legal perspective, and what is efficient from a technological perspective may not be legitimate from a political perspective.

The autonomy of partial systems is therefore not an accident of modernity, but a structural condition that allows society to function. However, this autonomy has profound effects on the law, and economic, scientific, or technological decisions cannot be simply translated into the legal system without a complex semantic transformation, since the law cannot directly "host" external functional logics without losing its own identity. This means that the regulation of systems cannot be completely external or completely internal ; the law must observe the economy from the outside, but at the same time must integrate its demands without allowing them to dissolve the legal structure itself.

It is in this space of tension , between operative clause and systemic interdependence , that the need for intermediate regulatory devices arises, capable of translating complex needs into operational rules. Private norms, guidelines, technical standards, codes of conduct, and international contractual protocols respond precisely to this need . In fact, they provide the economic system with faster, more flexible, and more adaptive rules than state law, but in doing so, they profoundly influence the structure of the law itself.

In this sense, the autonomy of partial systems is the structural premise of private lawmaking. It enables what state law alone can no longer guarantee, and thus represents the capacity to govern a hyper-specialized world. But at the same time, it paves the way for forms of normative power that escape democratic legitimation mechanisms, creating a new field of tension between systemic efficiency and public accountability.

3. The autopoiesis of private law and the endogenous production of normativity

Among the most significant transformations characterizing contemporary law, the thesis of legal autopoiesis, as articulated in the Luhmannian tradition and subsequently elaborated by Teubner, constitutes one of the most powerful keys to understanding the role of private law in the construction of new global normative regimes. Autopoiesis implies that law is not a mere reflection of political authority nor a direct instrument of state administration, but a system that produces its own norms from its own operations, by differentiating itself from other systems and through an internal selection that translates what comes from the environment into legal communication (Luhmann, 1993). Its identity derives not from the content of the norms, but from the form of legal judgment, from the licit/illicit code that selectively organizes the complexity of the social world.

When we view private law through this lens, we understand how it represents a privileged space in which autopoietic dynamics are observed. The contract, far from being a simple agreement of wills, becomes a communicative device that internalizes a multiplicity of economic, social, and technological practices within the legal system, transforming them into normative elements. The negotiation practices emerging in global markets, the standardized contractual models, the risk allocation models developed by professional associations or industry bodies, are not elements external to the law, but materials that the law reworks to reproduce itself.

The so-called *New Lex Mercatoria* appears to be the most accomplished example of this autopoietic movement: not a chaotic set of mercantile customs devoid of state legitimacy, but a transnational legal order that draws its strength from its ability to create norms, circulate them through globalized professional networks, and enforce them in international arbitration forums that represent an effective alternative to state courts (Schmitthoff 1964) (Goldmann 2017). International commercial arbitration, in fact, manifests a form of legality that cannot be reduced either to state law or to spontaneous law, since the normativity

that operates there is the fruit of a continuous translation between economic and legal logics.

This ability of private law to produce norms beyond state borders is not entirely new, the history of medieval and modern commercial law demonstrates the persistence of autonomous mercantile regulations but today it takes on a completely new dimension. This is because global markets operate in a state of simultaneity, interoperability, and hyper-connectivity that requires highly technical, instantaneous, and uniform regulatory forms. State law, with its legislative production times and the territorial scope of its action, is no longer capable of providing an adequate response. Hence the emergence of a transnational legal ecosystem in which the private sector is no longer merely a regulated actor, but a primary producer of rules.

International financial standards (ISDA Master Agreements), *force majeure clauses* developed by industry associations, logistics and commercial standards (INCOTERMS), global supply chain codes of conduct, and corporate compliance guidelines are not simply technical tools, but rather true sources of regulation that shape the actions of economic operators and, through complex judicial recognition procedures, become integrated into the fabric of positive law.

The result is that the autopoiesis of private law does not manifest itself as an aristocratic closure of law towards the economy, but rather as a process of continuous translation and reworking that allows law to survive in an increasingly complex environment. Far from being a surrender to economic logic, autopoiesis is what allows law to preserve its systemic identity, while absorbing and transforming the normativity emanating from other subsystems. It is in this dialectic between openness and closure, between external influences and internal identity, that the theoretical core of *private governance* lies, as a form of normativity that emerges at the intersection of different systems.

4. Economic self-regulation, standardization, and private governance. The autopoiesis of private law, the emergence of a trans-systemic private governance.

In observing the contemporary transformation of private law, what becomes increasingly evident is the progressive dissolution of the traditional boundaries between public and private normativity. This dissolution occurs not through the subtraction of one from the other, but rather through a more complex internal metamorphosis that leads functional systems to generate, absorb, and transform norms according to criteria no longer reducible to the hierarchical framework of

classical legal positivism. From the perspective of systems theory, it becomes clear that private law is not the least public part of law, but rather the place where the *legal system's capacity* to produce itself through internal operations is most intensely felt, a place where the *lowercase letter* of autopoiesis demonstrates its most radical generative power (Morgan & Yeung, 2007).

Private normativity, far from being a mere precipitate of individual will, emerges as a form of legal production born of systemic coordination needs, needs no longer adequately satisfied by the legislative structures of the modern state. Economic globalization has acted as an accelerator of this dynamic, and the decentralized spaces of finance, logistics, digital, and technical standardization require rules that must operate well beyond territorial boundaries rules that adapt with a speed no parliamentary process could realistically replicate. Thus, ISDA standards in the financial sector, ISO standards in global industry, digital interoperability protocols, ESG codes of conduct, and the contractual architectures of digital platforms take on a regulatory function that can no longer be seen as derivative, but rather as a quasi-constituent function of social order.

Private standards not only perform technical functions, but also create what can arguably be called a true "implicit normative rationality," a regulatory content that influences behaviors, exchanges, and expectations. They assume the role of internal criteria for the self-description and stabilization of the economic system, performing tasks of *minimal* control, certification, oversight, and sanction, to the point of defining, in some cases, the functional equivalent of a jurisdiction. And when state courts recognize the binding nature of standards, or when legislators incorporate them into legislative texts, what is produced is a new structural coupling in which the public and private are no longer separable, but intertwined in a process of mutual constitution.

The concept of *private governance* thus emerges as an essential category for understanding this metamorphosis. It does not indicate a privatization of law, but rather the emergence of a regulatory power that is sedimented within non-state organizational structures a power that is no longer episodic, but systemic, no longer contingent, but stable, no longer marginal, but central. Through algorithms, standardized contracts, reputation systems, rating mechanisms, and audit networks, large economic organizations construct comprehensive regulatory regimes, equipped with their own *code*, *rationality*, and capacity for self-observation. When we observe these phenomena on a global scale, we understand that they do not represent a deviation, but a new form of diffuse sovereignty that does not replace the state, but rather forces it to rethink itself.

In this framework, European public law, the American regulatory tradition and Asian models of driven capitalism offer three distinct versions of such coevolution, three different ways of articulating the interaction between public authorities and private regulatory powers.

To fully understand the phenomenon of economic self-regulation, it is necessary to observe how economic actors spontaneously produce rules that do not merely govern their internal relationships, but influence entire sectors of activity, shaping behaviors and expectations. Contemporary regulatory theory shows how the distinction between public and private regulation is now untenable, replaced by hybrid forms in which the state often assumes the role of *meta-regulator* (Parker 2002), defining frameworks within which private organizations are called upon to develop rules that, while formally voluntary, become de facto mandatory.

International standards, such as ISO standards, the OECD guidelines on corporate governance, the IFC principles for responsible investment, and the IFRS accounting standards, act as global regulatory devices that do not require a state source to be binding. Their strength comes not from legal coercion, but from a combination of factors, including market pressure, the need for interoperability in global value chains, reputation, obligations arising from contractual mechanisms, and the threat of exclusion from global networks.

Economic self-regulation, however, should not be interpreted as a horizontal system in which all actors have an equal say; Standardization is a process that creates hierarchies regarding those who define the standards and exerts power over those who must comply. Global digital platforms are a prime example, where the terms of use of giants like Amazon, Google, or Meta are not simple contracts, but complex regulatory regimes that govern access, permitted behaviors, forms of visibility, and internal sanctions (Klonick 2017). These platforms do not simply provide services, but govern entire social and economic ecosystems, exercising regulatory powers that, in intensity, pervasiveness, and technicality, surpass those of many state authorities.

The same occurs in global financial markets, where the regulation of derivatives, complex securities, and investment instruments is not primarily determined by state laws, but by technical standards developed by private international organizations. In this context, the category of *private governance* does not designate an anomaly, but the normal form of transnational economic governance. Corporations are not simply private entities, but become regulatory institutions, endowed with sovereignty that they exercise through contractual models, algorithms, consortia, protocols, and standards.

The crucial aspect is that these private regulations profoundly influence not only economic actors, but also states themselves, which are pushed to adopt global standards to preserve the competitiveness of their domestic markets. Private self-regulation thus becomes a mandatory reference point for legislators, who find themselves incorporating non-state norms in order to ensure the attractiveness of their own legal system. It is precisely this reversal, from public law as the primary form of regulation to public law as the locus of reception, that defines the logic of contemporary *private governance*.

5. Private government as an emerging form of diffuse sovereignty

The concept of *private governance*, far from being a recent invention, has its roots in the sociology of work and organizations. Selznick (1969) had already shown how large industrialists exercised regulatory powers that transcended the confines of the employment contract, building disciplinary and normative internal regimes. Today, however, this dimension no longer concerns only industrial relations, but the entire functioning of global markets.

The contemporary form of *private governance* cannot be interpreted as simple normative privatism. It represents a structural shift in the relationship between law, economics, and politics, with regulatory power no longer a state monopoly, but distributed among multiple actors who produce, apply, interpret, and enforce norms.

Private governance manifests itself in three main ways:

- a) Normative production : standards, codes, guidelines, decision-making algorithms ;
- b) Application and Enforcement: private audits, rating systems, reputation mechanisms, internal sanctions ;
- c) Private jurisdiction: arbitration, private dispute resolution, algorithmic rating systems that replace judicial decisions.

Private sovereignty is not unlimited power: it is functional power, but precisely for this reason it tends to escape democratic control. It is rooted in technical superiority, rapid decision-making, and control of economic and technological infrastructure. And it is in this sense that *private governance* represents not just a descriptive category, but a normative challenge: how can we ensure compatibility between the functionality of systems and democracy?

6. International comparisons: three models of private regulatory production

A comparative examination of private regulation models in different geopolitical regions allows us to observe how *private governance* takes on different forms depending on institutional structures, legal history, and political dynamics. The systemic dimensions discussed in the previous sections take on concrete meaning when observing practices comparatively, because the phenomenon is not uniform. While in the United States it arose as an almost natural development of the tradition of *self-regulation* and institutional *laissez-faire*, in the European Union it takes on a cooperative and meta-regulated form, while in East Asia it is embedded in state structures that maintain a strong capacity for direction while leaving ample room for private initiative. This section will therefore offer a discursive, non-schematic comparison capable of demonstrating the plurality of trajectories and their interaction with global mechanisms.

6.1 United States: Self-regulation, financial markets and privatized “regulatory capitalism”

The United States has historically been the most advanced laboratory of *private governance*. The doctrine of *self-regulation* from the Securities Exchange Commission to stock exchanges, from professional associations to large technology corporations has entrenched the idea that the private sector is not only capable, but often preferable to the state in producing technical standards. Since the 1930s, American stock exchanges have established rules of conduct for their members that have assumed the force of material law for the functioning of the market. Today, that tendency manifests itself in even more profound forms, the ISDA's standardized contracts, the internal regulations of clearing houses, the algorithms of digital platforms and automated *trading systems* have constructed a private regulatory universe that often anticipates and influences federal regulation.

regulatory capitalism is not a vacuum of public regulation, but a form of structural delegation: the state regulates through the private sector, allowing the market to develop standards and codes that are then incorporated, directly or through mandates, into formal regulation (Vogel, 2018). Thus, we witness a virtuous/ambiguous cycle, private entities produce norms, public bodies recognize them, and subsequently independent authorities use them as control parameters. This is evident in the digital sector, where platforms like Meta, Google, or Amazon exercise regulatory power that affects millions of users and businesses: they decide who can participate in the market, what content is permitted, what practices are

prohibited, and impose sanctions that are often more severe than state sanctions (Klonick, 2017).

Furthermore, the federal structure of the United States further fragments regulatory production. State and local authorities adopt different regulations, creating room for competitive solutions or *regulatory shopping*, which favors uniform private standards as a means of harmonization.

The result is a regulatory ecosystem in which *private government* operates not as an alternative to the state, but as its natural interlocutor, often anticipating trends that are then incorporated by legislators. Private power is here a natural component of regulation: this constitutes a model that has inspired many global dynamics, despite its profound challenges in terms of accountability, transparency, and the protection of rights.

6.2 European Union: soft law, co-regulation and police systems

In the European Union, the phenomenon takes on significantly different characteristics. The EU has never fully believed in total deregulation, and the idea of a passive state arbiter has not been met with the same approval. On the contrary, Europe has developed a sophisticated form of *co-regulation*, in which public and private norms interact structurally. European soft law guidelines, recommendations, codes of conduct, benchmarks does not represent a concession to privatization, but rather a tool through which the Union creates flexible and adaptive governance networks (Trubek & Trubek, 2005). However, this apparent cooperative plurality masks an underlying dynamic: public soft law often depends on private expertise and is fueled by the standardization efforts of European and international technical bodies.

ISO standards, for example, take on a quasi-legislative role in the European legal system because they are accepted as a benchmark for compliance; codes of conduct on privacy or artificial intelligence are developed by industry stakeholders and then formalized by institutions. In the financial sector, the Union has adopted a hybrid model based on independent agencies (ESMA, EBA, EIOPA) interacting with global private consortia, creating a layered regulatory framework in which technical standards assume quasi-binding force.

In the field of data protection, the GDPR demonstrates how Europe combines regulatory sovereignty and private responsibility: codes of conduct and certification mechanisms are tools that private entities use to monitor themselves under public oversight. The EU thus attempts to mediate between economic

freedom, protection of rights, and innovation, without completely succumbing to a privatistic logic.

However, even the European Union does not escape the logic of global private governance: most technical regulations on products, safety, sustainability, or accounting are derived from standards developed by private international bodies. The EU has thus created a model of moderate and institutionalized *private governance*, capable of integrating the private sector without abandoning any form of political leadership.

6.3 East Asia: regulatory capitalism, the strategic state, and embedded private standards

East Asia particularly China, Japan, South Korea, and Singapore offers a different model. Here, *private governance* emerges neither as an alternative nor as a proxy, but as part of a state strategy. In China, large digital platforms like Alibaba, Tencent, and Baidu function as internal regulatory systems with enormous regulatory powers, but the state retains a capacity to direct regulatory flows systemically. The Chinese platform governance model combines private functional autonomy and political control: it does not aim to limit the growth of the private sector, but rather to bend it to the macro-structural objectives of the Party-state (Zhang, 2020).

In Japan, private law has for decades incorporated forms of industrial self-regulation *keiretsu*, technical consortia, and industry standards which have created a coordinated economy through networks of trust and cooperation. Private regulation is an integral part of the economic structure, but the state guarantees its stability and steers the balance through long-term industrial policies.

In South Korea, the *chaebol*'s immense influence has created internal regulatory systems that govern not only production, but also labor relations, supply chains, investment, and innovation (Scott, 2004). Here, *private governance* takes an oligopolistic form, in which large conglomerates wield regulatory powers that span diverse sectors, but are modulated and sometimes challenged by public authorities.

Finally, Singapore represents the most sophisticated model of integration between private efficiency and public guidance, the government promotes private standards, incentivizes regulatory innovation, and builds co-regulatory mechanisms in which the private sector is responsible for implementation, but the public retains control over strategic directions.

East Asia thus demonstrates that *private governance* is not an exclusively liberal or Western phenomenon: it also manifests itself in systems protected by

strong state direction, assuming hybrid forms in which public and private sovereignty co-constitute.

7. Theoretical and political implications for legal theory

The evidence collected shows that *private governance* cannot be interpreted simply as a privatization of law or a symptom of state crisis. The phenomenon is more profound and concerns the very way society produces normativity in complex conditions. If legal modernity was built on the premise of a sovereign center capable of producing general and abstract norms applicable to a given territory, contemporary times present a polycentric legal order, in which normativity emerges as the product of multiple centers, each endowed with its own form of authority. This finding has at least three theoretical implications. (Klonick, 2018). (Djelic & Sahlin-Andersson, 2006). The first concerns legitimacy. Private power produces effective rules, but they lack traditional democratic legitimacy. Private legitimacy is based on functional criteria efficiency, competence, and technical capacity that cannot be directly translated into the normative criteria of representative democracy. It is therefore necessary to rethink legitimacy not as the exclusive property of public authority, but as a widespread quality of decision-making processes, to be guaranteed through mechanisms of transparency, participation, and accountability. The second concerns accountability. Global platforms, professional associations, and technical bodies exercise quasi-sovereign powers, but their accountability is fragmented, often self-referential, and sometimes opaque. Legal theory must question new forms of systemic accountability that go beyond the paradigm of individual responsibility, recognizing that many normative effects emerge from networks of distributed decisions. The third concerns the identity of law. If law is no longer solely that produced by the state, then legal theory must fully recognize normative plurality. But simply acknowledging it is not enough: we must understand how this plurality can be coordinated without resorting to a hierarchical sovereign. Systems theory suggests that coordination cannot occur by command, but by structural coupling: law must create mechanisms that allow systems to communicate without dissolving into one another. The future of law, in this sense, is not the restoration of the sovereign state nor capitulation to private power, but the construction of a dialogical order in which public and private norms interact within a multilevel framework of reflexive governance.

8. Systemic autonomy, autopoiesis and private law as an emerging form of government

When we observe private law not only by focusing on its formal structures but also on its profound dynamics, on its ability to construct normative worlds even before regulating them, it becomes clear that the classical paradigm of legal positivism is no longer sufficient to account for its current function. Contemporary society has fragmented the linearity of normative production into a plurality of centers, places, agencies, and regulatory devices that no longer orbit around the State as an exclusive and, possibly, privileged hub. (Fontana (a), 2025). In this scenario, private law takes on a role that is not simply that of standardizing individual relationships, but rather that of a language for self-description of the global economic system, a language that operates according to selection criteria that reflect not political will but a *systemic logic*, a *tiny* binary code of legality/illegality, capable of translating into legal form the complexity of inputs from increasingly interconnected contexts.

This metamorphosis cannot be understood without recalling the notion of *legal autopoiesis*, which Luhmann defines as "the system's ability to autonomously produce its own operations and reproduce itself over time." Law, in this view, is not an apparatus that responds to the will of the legislator like a gear responds to a driving force, but rather an organism that filters, selects, and institutionalizes. It operates through distinctions that are its own, not those of the surrounding world. Society can raise problems; the legal system decides which of them to transform into legal communication, which to ignore, and which to reformulate. And in doing so, it reproduces itself.

Now, if we shift our focus from the structural dimension of law to its operational side, we understand that the materials that fuel this autopoiesis come not so much from laws as from practices. This is particularly evident in the field of private law, where normative evolution is driven by the circulation of contractual models, standards, guidelines, protocols, clauses, algorithms, and reputational mechanisms. State norms end up recognizing, incorporating, and adapting to this emerging normativity, as if public law had transformed from a primary source into a sort of "*translator*" of private normativity into official legal language.

Thus, we understand how so-called "*private autonomy*" is no longer the freedom of individuals to negotiate, but the ability of functional systems to produce rules that have the same force as state regulations, even though they do not originate from a public decision. The *New Lex Mercatoria*, the ISDA in the financial sector, the ISO and IEC standards in global industry, ESG codes of

conduct, and the contractual architectures of multinational digital platforms are emblematic examples of a normativity that not only regulates but also shapes markets, behaviors, expectations, and responsibilities. Their nature is legal because their function is legal: to reduce complexity and stabilize relationships.

In this framework, *private governance* appears not as a deviation, but as the spontaneous outcome of the systemic autonomy of law when it operates within the context of the global economy. Large corporations, digital platforms, financial systems, and supply chains become not only actors, but *producers of norms*, capable of creating comprehensive regulatory regimes, equipped with compliance tools, control procedures, evaluation criteria, and sanctioning mechanisms, to the point of configuring what Selznick had already envisioned as "authoritative institutions."

It is as if the normative content of law had found a new form of sovereignty, a diffuse sovereignty that is not proclaimed but exercised.

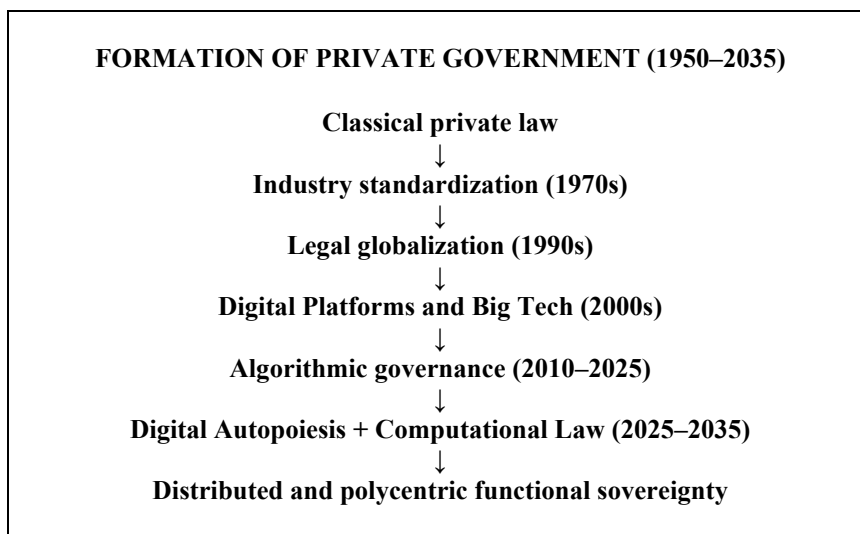
9. Digital autopoiesis and computational law: towards a new code of normativity

With the emergence of digitalization and, more recently, algorithmic decision-making and governance systems, legal autopoiesis takes on a further dimension, as law no longer merely translates economic practices into legal form, but interacts with devices that produce normativity through computational codes. (Fontana, (b) 2025). The distinction between *law* and *computer code*, made famous by Lessig in the phrase "*code is law*", must be read in light of systems theory: digital code is a form of organization that imposes structural choices, constraints, possibilities, rights, and duties that are undeclared but embedded in technical logic.

Platform moderation algorithms, risk assessment algorithms in the financial sector, and those that interact with access to digital services not only regulate, *they decide*. And in making decisions, they construct an implicit normativity. The phenomenon of *digital autopoiesis* consists precisely in this: a growing portion of regulatory behavior is no longer produced through linguistic negotiations, but through programmed systems that compete according to optimization logics.

These algorithms, often opaque and unverifiable, determine which content can circulate, which transactions are suspect, which users can access certain services, and which logistical routes are privileged. They construct what we might call a "*normativity without norms*", based not on prescription but on architecture. Computational law *does* not represent a new field of law, but rather a new mode of operation of legal autopoiesis.

Table 1: Genealogical evolution of private government



What is produced is a slow but inexorable transformation of the concept of sovereignty, which moves from state monopoly to polycentric distribution, up to the possible “emergence of post-state forms of normativity”.

When normative sources are no longer located at a single apex but distributed across networks, when decisions are no longer deliberative but executive (in the algorithmic sense of the term), when standards become more binding than laws, when *compliance* is more important than imperativeness, when effectiveness replaces authority, then the law changes its ontological status. It is no longer structure but flow, no longer corpus but process, no longer order but coordination, no longer guarantee but architecture. The law becomes a network of nodes, a *regulatory infrastructure*, an *ecosystem*.

And it is in this complex ecosystem that *private government* finds its full place: not as arbitrary power of the private sector, but as a regulatory vector for a system that can no longer be governed by a single center.

Modern law has built many of its categories on the distinction between public and private, between authority and autonomy, between sovereignty and contract, between regulation and market. However, in today's complex society, these distinctions no longer constitute stable lines but historical vectors that intersect and

contaminate one another, producing new forms of normativity, often not traceable to a single decision-making center. The emergence of self-regulating systems, international standards, algorithms governing entire global platforms, and transnational codes of conduct binding businesses, consumers, and even states, demonstrates the emergence of an “*other normativity*”, diffuse and networked, not attributable to a command but not to pure spontaneity either.

This phenomenon is neither accidental nor the result of technological innovation alone, but rather the expression of a deeper evolutionary logic: the growing functionalization of law, its need to adapt to increasingly diverse and globalized systems, the need to operate with speed, technicality, and adaptability. Private law, in its role in coordinating economic exchanges and interactions, has become a privileged locus of this transformation, to the point of embodying a unique form of autonomous normative production.

This essay examines this metamorphosis using systems theory as an interpretive key, delving into the mechanisms through which legal autopoiesis combines with the private production of standards, algorithmic governance, and the digitalization of regulatory infrastructures, giving rise to what can be defined as *private government*. This concept does not imply a privatization of state power, but rather the emergence of new forms of functional sovereignty exercised by private actors through technical devices, market rules, and digital architectures.

Luhmann showed how law is a system that reproduces itself through internal operations, independently of environmental expectations. Legal autopoiesis consists in this ability to select what becomes legally significant and translate it into recognizable normative communications. This nature does not imply isolation, on the contrary, law is maintained through continuous interaction with economics, politics, science, and technology, but this interaction does not automatically determine the content of norms. In private law, this process is particularly evident. Normative production arises from economic practices, contractual models, industry standards, uniform clauses, professional guidelines, and codes of conduct (Fontana, 2025). Legislators no longer create the norm, but often recognize it, adopt it, incorporate it, or translate it into positive legal language. Thus, private autonomy becomes, in the global context, a form of “functional autopoiesis,” in which the economy, through its technical logic, provides materials that the law transforms into norms. The crucial point is that this private normativity is not ancillary, but constitutive: it defines the structure of exchanges, determines responsibilities, creates expectations, and produces enforcement mechanisms. (Morgan & Yeung, 2007). Thus, the *New Lex Mercatoria* is not a set of practices, but a true

transnational legal order founded on professional networks, arbitration chambers, technical standards, and contractual practices. The concept of *private governance* should not be understood as a marginal phenomenon or a simple offshoot of neoliberal deregulation. It designates a new way of exercising regulatory power. Large economic organizations multinational corporations, platforms, financial consortia, and standardization bodies produce, apply, and enforce rules that have an impact comparable, if not greater, than that of state regulations.

Table 2: Tools of private governance

Private government operates through several instruments:

- a) global standards , such as ISO, IFRS, ISDA, and cybersecurity protocols;
- b) codes of conduct and compliance that establish non-negotiable obligations;
- c) decision-making algorithms that regulate access, priority, visibility, and risk;
- d) ratings and reputation , which function as sanctions or rewards;
- e) private arbitration that replaces state jurisdiction.

These regime mechanisms create rules with their own internal coherence, the ability to identify violations, impose sanctions, and establish obligations. They are not informal, but are more rigid and binding than many public rules. With digitalization, a new type of normativity emerges, one based not on texts but on software architectures. Rating, matching, and moderation algorithms, blockchain protocols, and smart contracts are regulatory tools that operate according to a technical logic. In computational law the rule is not interpreted, it is executed and does not admit exceptions but it's planned. Digital autopoiesis is the ability of digital systems to generate operational norms based on computational, not linguistic, logic. Law, when it intertwines with such systems, changes. It is no longer a corpus but a code, no longer interpretation but architecture.

Table 3: Genealogy of private government

1950–1970 Regulatory State
1970–1990 Private sector standardization
1990–2005 Regulatory globalization and arbitration
2005–2020 Digital platforms and algorithms
2020–2035 Functional Sovereignty and Digital Autopoiesis

Table 4: Comparison table: legal and digital autopoiesis

Size	Legal autopoiesis	Digital autopoiesis
Form of language	Textual, conceptual	Computational, algorithmic
Validation mechanism	Interpretation	Autorun
Transparency	Motivation	Code opacity
Enforcement model	Sanction	Technical configuration
Legitimacy	Politics and judiciary	Technical and functional

The distinction between public and private law, between sovereignty and autonomy, between regulation and market, has represented the conceptual axis of modern legal theory for centuries. However, in today's complex society, this dichotomy appears increasingly fragile. Indeed, normative production emerges not from a single state center, but from plural networks, organizational processes, digital platforms, industry standards, codes of ethics, and algorithmic protocols. (Fontana, 2025) These elements create a diffuse, polycentric normative order, no longer reducible to a vertical hierarchy, where the autonomy of partial systems and the capacity of private law to produce its own norms lead to the emergence of new forms of governance, discussed in the literature as *private government* (Edelman, 2016). This study integrates perspectives from systems theory, legal sociology, and comparative political economy, examining how legal autopoiesis and private regulation contribute to market stabilization and norm-making, often with greater effectiveness than public institutions. The comparative framework between the United States, the European Union, and East Asia allows us to delineate different models of public-private interaction, revealing the plurality of ways in which private regulatory power emerges and consolidates. Luhmann defines law as an

autopoietic system, capable of producing and reproducing itself through its own operations, selecting what becomes relevant legislation without being directly dependent on environmental pressures. In contemporary private law, this capacity manifests itself in the creation of operational norms through professional practices, sectoral standards, contractual protocols, and codes of conduct. These instruments are not merely technical tools: they generate obligations, regulate economic interactions, and produce binding effects on global actors, serving as functional normative sources that complement and often transcend public law. Private regulation is not ancillary, but rather constitutive: it defines responsibilities, stabilizes markets, reduces complexity, and generates expectations. The *New Lex Mercatoria*, ISDA standards, ESG codes, and the contractual architectures of digital platforms are concrete examples of this emerging normativity, the effectiveness of which is often recognized by states, which incorporate them into national legislation and judicial decisions.

Table 5: Regulatory distinctions

Private *Government* , regulatory authority by private actors through instruments:

- a) global standards, codes of conduct and industry protocols;
- b) decision-making algorithms that regulate access, priority, and visibility;
- c) rating and reputation systems capable of incentivizing or sanctioning behaviors;
- d) private arbitrations that replace or complement state jurisdiction.

These tools constitute coherent regulatory regimes, capable of enforcing violations, applying sanctions, establishing obligations, and determining incentives and penalties. This is a phenomenon of distributed functional sovereignty that does not replace the state but rather expands and modifies its role. With digitalization, legal autopoiesis intertwines with computational law (Sunstein, 2018). Moderation algorithms, smart contracts, blockchain protocols, and rating systems function as enforceable normativity, with a binding force greater than many traditional laws. Digital rules are not interpreted: they are enforced. Normativity emerges from the technical design itself, configuring an “embedded rule” and transforming law into an algorithmic infrastructure.

Table 6: International comparison table : United States, European Union, East Asia

Size	United States	European Union	East Asia
Basic logic	Self-regulation, market as primary source of rules	Co-regulation, multi-level integration between public and private authorities	Strategic, private state as an instrument of national objectives
Role of the State	Weak supervision, ex post	Strong supervision, ex ante and ex post	Structural political direction of private dynamics
Private legislation	Standardized contracts, algorithms, reputation systems	Soft law, European codes, standards integrated into legislation	Industry standards and platforms integrated into the state project
Application	Platforms, arbitration, professional reputation	Independent regulators and integrated private enforcement	Mixed public-private control
Emerging sovereignty	Widespread and competitive	Dialogical and polycentric	Hybrid and state-driven

The traditional distinction between public and private law, between sovereignty and autonomy, between state regulation and the market, has constituted the conceptual axis of modern legal theory for centuries. However, the evolution of contemporary complex societies demonstrates that this dichotomy is no longer sufficient to describe the actual dynamics of law production. Normativity today emerges from police networks, complex organizational systems, digital platforms, global industry standards, and private codes of ethics, shaping a diffuse, non-hierarchical normative order that is not always anchored to a single decision-making center. The capacity of partial systems to produce autonomous norms, combined with legal autopoiesis and economic regulation, generates a phenomenon that can be defined as *private governance*, understood as the exercise of functional sovereignty by private actors. The proposed analysis integrates perspectives from systems theory, legal sociology, and comparative political economy, exploring how the autonomy of partial systems contributes to market stabilization, the creation of transnational standards, and the production of effective normativity. International comparisons allow us to identify different models of public-private interaction, from the highly liberal systems of the United States to the potential for co-regulation in the European Union, to the hybrid and strategic models of East Asia.

Luhmann emphasized that law is an autopoietic system, capable of reproducing itself autonomously by selecting what is normatively relevant, without being directly determined by the external environment. In contemporary private law, this capacity manifests itself through professional practices, codes of conduct, contractual protocols, industry standards, and international professional networks. These instruments are not mere technicalities, which require obligations, regulate economic interactions, and generate constraints that often exceed the functions of public law. The phenomenon of the *New Lex Mercatoria*, ISDA standards, ESG codes, and the contractual architectures of digital platforms are illustrative: they produce binding rules, stabilize complex markets, and generate consistent expectations. States often incorporate them, recognizing their effectiveness and legitimacy. Private economic self-regulation, therefore, is not ancillary, but rather constitutive of global governance, creating forms of polycentric normativity and functional sovereignty that coexist with state institutions. The phenomenon highlights a general trend, namely that private normativity is becoming increasingly autonomous, technologically mediated and globally coordinated, reducing the directive role of the State and increasing the complexity of regulatory systems. In contemporary complex societies, law can no longer be conceived as a hierarchical corpus of norms, but as a regulatory network, where standards, codes, algorithms, protocols, and enforcement tools interact to produce compliance, stability, and consistency. From this perspective, *private governance* is not a threat to sovereignty, but an emerging manifestation of functional authority, forcing the state to redefine its modes of interaction with the private sector, develop polycentric governance tools, and reconsider the traditional concept of regulatory legitimacy. The adaptability and self-regulation of private regulatory networks has become a crucial indicator of economic and social stability, influencing public policies, corporate strategies, and individual behavior on a global scale.

10. Conclusions

Private law and digital normativity today converge in a complex and polycentric system, in which the autonomy of partial systems, legal autopoiesis, and algorithmic regulation produce forms of distributed governance. *Private governance* represents a concrete expression of functional sovereignty, capable of integrating public and private, norms and technology, local and global. The theoretical and practical implications are profound: redefining sovereignty, reconsidering democratic legitimacy, and recognizing new forms of emerging legality. The challenge for legal and social sciences now is to understand the

mechanisms of interaction between public and private regulatory systems, to assess the risks and opportunities of algorithmic normativity, and to identify governance tools that are effective, transparent, and compatible with democratic values and fundamental rights. The essay has shown that the contemporary transformation of normativity cannot be understood within traditional categories such as public/private, state/market, command/contract. The autonomy of partial systems, the autopoiesis of private law, and economic self-regulation are not separate phenomena, but facets of a single structural transformation. *Private governance* is not an anomaly, but a manifestation of growing social complexity, which requires normative forms capable of operating at global speeds, levels of technology, and scales that state law can no longer monopolize. However, private power brings with it profound challenges: the crisis of traditional mechanisms of legitimacy, the difficulty of ensuring transparent accountability, the possibility of oligopolistic concentrations of regulatory power, and the risk of erosion of fundamental rights through contractual and algorithmic regimes. The task of legal theory and democratic politics is not to oppose the autonomy of systems, but to govern it, building forms of meta-regulation that ensure that private lawmaking is compatible with public values. From this perspective, the challenge is not to choose between state sovereignty and private power, but to build institutional mechanisms capable of ensuring that normative plurality is coordinated, accountable, and open to democratic challenge. The law of the future will be polycentric, dialogical, and intersystemic: a law without a single center, but not without direction. A law that recognizes the weight of private normativity, but does not abdicate its role as guarantor of the fundamental values of social coexistence.

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FROM ANOMALY TO UTILITY: VENTILATING AND STREAMLINING THE PLACE OF UNDISCLOSED PRINCIPAL IN CONTEMPORARY COMMERCIAL TRANSACTIONS

Rufus Toochukwu OKWARA¹, Kelechi Enyinna UGWU², Valentine Osita OKWARA³, Basil Uchenna NWOKEFORO⁴

^{1,2,3}*Federal University of Technology Owerri, 1526, PMB, Owerri, Ihiagwa, Imo State, Nigeria, Phone: +234 807 249 9419, E-mails: toochukwu.okwara@futo.edu.ng, kelechi.ugwu@futo.edu.ng, osita.okwara@futo.edu.ng*

⁴*University of Agriculture and Environmental Sciences, Off Owerri-Port Harcourt Road, Umuagwo-Ohaji, Imo State, Nigeria, Phone: 08173273467, 08085586781, 08033864024, E-mail: basuche@yahoo.com*

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Abstract

The doctrine of undisclosed principal is a problematic area in the law of agency. Jurists refer to it as an anomaly because it is at variance with the long-established contractual logic. How can a person be bound to another of whom he knows nothing about and who he did not intend to contract? How can the law not distinguish between acting in one's own name and acting in another's name? While the commercial imperative for allowing the doctrine is well recognized, the failure to apply one theoretical approach consistently in explaining the doctrine has caused confusion. Worse still, the simultaneous application of many approaches have resulted in common law rules that at times favour the interests of the third party and other times those of the principal. This paper interrogates the principle of undisclosed principal through doctrinal research method. After showing why the standard contract

theory and other theories failed despite their soundness, the paper accepts the doctrine as a commercial necessity in modern world equipped with Artificial Intelligence. It then streamlines the law and recommends among other things that the doctrine be only permitted in specific situations. By so doing, the spirit of the muddled doctrine looks pacified.

Keywords: undisclosed principal, anomaly, artificial intelligence, commercial benefits

JEL Classification: K12, K22, K20

1. Introduction

The doctrine of undisclosed principal has come to stay in business world. This is because business owners cannot be everywhere or do everything by themselves, most times they depend on the representation of the agents. The agent therefore serves as an intermediary or an instrument through which the principal transacts with the third party (*National Orthopedic Hospital Board v Ajogwu*, 1901, AC 240). We witness this agency arrangement in most business arrangements ranging from international trade (import and export agents), real estate transactions (property management), financial transactions (stockbrokers, financial advisers), Manufacturing and distribution sector (sales representatives, marketing, advertising), travel agents, employees as agents of the employer etc. In fact, Beebejaun (2016:163) holds that commercial activities would be very difficult to function in a modern economy without interacting with an agent of some kind. For instance, without checking to see if the stranger we meet or negotiate with in a shop is an agent or principal, we willingly hand over money to him and take the goods away, signifying that sale has taken place.

In these arrangements, the law of agency provides that where there is breach of contractual obligations, the principal can sue and be sued by the third party while the agent is considered not a party (*Ologbosere v Ezenwa*, 1962). Where an agent acts for a principal, whose existence is known by the third party and who expressly authorized the agent to act on his behalf in relation to a third party, no problem is experienced at all. However, what happens where the agent acts for an undisclosed principal whose existence is not known by the third party is the meat of this research. It will appear logical that the legal position should not be the same with the stand of the disclosed principal, unfortunately, this is not so. According to Goodhart and Hamson (1932:326), the law is that where an agent acts for an

undisclosed principal, the position is virtually the same as one which is disclosed. In other words, although the third-party deals only with the agent and the agent only, and is not aware of the existence of the undisclosed principal, yet the undisclosed principal can sue and be sued in his own name in as much as he authorized the agent to act on his behalf and the agent obediently acts within that scope of authority. Consequently, many academic writers, lawyers and judges consider the doctrine of undisclosed principal as an anomaly (Barnett, 1987) because it is at variance with the elementary doctrines of privity of contract (Ibbetson, 2001, p.241). They consider it not right for one person to sue another on a contract not really made with the person suing. Unfortunately, the holders of the above view are criticized for not considering the soundness of the doctrine. The contrary view is that the rationale of the doctrine is based on equity and trust, commercial convenience, vicarious liability in tort, consent, furnishing of consideration and so on. Despite these theoretical justifications, the right of one person suing another on a contract not really made with the person suing is still not generally accepted to many legal systems. We are not here to vindicate the anomalous doctrine but to streamline the law for commercial benefits.

2.Statement of the Problem

No textbook, no decision and no opinion has refrained from expressly calling the doctrine of undisclosed principal an anomaly in the law of contract. For instance, Lord Lindley in *Keighley, Maxsted & Co V. Duran* declared that "there is an anomaly in holding one person bound to another of whom he knows nothing and whom he did not intend to contract." Chesire, Fifoot and Furnstone (1972, p. 353) stated that "the doctrine of the undisclosed principal is anomalous in the sense that it allows a person to sue and be sued upon a contract that he has not in fact made." In particular Sir Fredrick Pollock (1887) has repeated several times that "the plain truth ought never to be forgotten that the whole law as to the rights and liabilities of an undisclosed principal is inconsistent with the elementary doctrine of the law of contract. The right of one person to sue another on a contract not really made with the person suing is unknown to every other legal system except that of England and America". Oliver Wendell Holmes (1909) submitted that even "common sense is opposed to allowing a stranger to my overt acts and to my intentions, a man of whom I have never heard, to setup a contract against me which I had supposed I was making with my personal friend" and James Barr Ames (1909) added that whatever an established doctrine ignores, the doctrine of the undisclosed principal

ignores fundamental legal principles, it is highly important that it should be recognized as an anomaly.

Barnet (1960) in clear terms put forward "hard cases" illustrating why the doctrine of undisclosed principal is an anomaly. His illustrations are provided below:

First illustration

Agent (A) and Third Party (TP) manifest to each other assent to a contract for some goods. Agent bargaining for Third Party's rights to the goods and Third-Party bargains for Agent's payment. Unknown to Third Party, Agent represents Undisclosed Principle (UP), if Third Party (TP) fails to deliver the goods, can Agent (A) sue Third Party? Can Undisclosed Principle (UP) sue Third Party (TP)? If Undisclosed Principal (UP) fails to pay Third Party (TP) for the goods, can Third Party (TP) sue Agent (A)? Can Third Party (TP) sue Undisclosed Principal (UP)?

Agents are contractually liable to third party and vice versa under the standard contract principles and arrangements. Each has negotiated for the other's resources or promise. The conceptual issue arises when we examine the liability of the undisclosed principal to the third party and the third party to the undisclosed principal. In accordance with standard contract theory, an undisclosed principal never gave his consent to a third party and is not a party to the agreement between an agent and a third party. Additionally, the third party never expressed her agreement to the undisclosed principal. It was the third party promised to sell the goods and the agent promised to pay for them; the third party does not know the principal. Since Agent kept Undisclosed Principal's existence a secret from Third Party, what explanation can justify this undisclosed agency doctrine?

Second Illustration

The facts are the same as in the first illustration with the exception that the undisclosed principal pays the agent for the goods after the third party delivers them to the agent who then delivers them to the principal. Before paying the third party for the goods, the agent goes bankrupt. Can a the third party demand payment from an undisclosed principal? In the first illustration, a third party might be able to sue an undisclosed principal for non-payment, however, in the second illustration, most people will contend that the third party entered into a contract with the agent and only relied on the agent's credit and they will deny the third party the ability to sue an undisclosed principal for non-payment. Others, however, will allow a third to recover from undisclosed principal, requiring the undisclosed principal to make two payments.

Third Illustration

Now Third Party is purchasing goods from Agent, Undisclosed Principal who is worried about the Agent's financial condition tells Third Party that he is the Agent's principal and as such the real seller and that Third Party should pay him directly for the goods. Disregarding this information, Third Party pays Agent. Can the Undisclosed principal sue the agent or a third party for payment if the agent becomes insolvent and fails to pay the Undisclosed Principal? This was the case in *Scrimshire v Alderton* (1743).

Fourth Illustration

Same facts as in first illustration. After entering into the contract with Agent, Third Party, an arch-competitor of Undisclosed Principal learns of Undisclosed Principal's existence and identity and refuses to deliver the goods. May Undisclosed Principal or Agent sue Third Party for breach? Recall that in the first illustration, the law of undisclosed agency permits Undisclosed Principal to sue and be sued as a party to the contract without regard for the secret nature of the relationship between Undisclosed Principal and Agent. In this case however, if either Agent or Undisclosed Principal knew of Third Party's attitude, that he will not be willing or interested in doing business with the person of Undisclosed Principal, then most courts would permit Third Party to rescind the contract. The Principal or the Agent knows that the Third Party would not enter into the contract with the principal but fails to disclose that fact. This happened in the case of *Cummings v Jorgensen* (1971).

Fifth Illustration

Undisclosed Principal installs Agent as the manager of his hotel or business venture. Agent's name appears above the door. Undisclosed Principal instructs Agent that he may purchase only beer and that all other supplies will be purchased by Undisclosed Principal. Contrary to the instructions, Agent purchased cigars, bovril and other items from Third Party. Is Undisclosed Principal liable to Third Party for Agent's unauthorized purchase? This illustration is based on the famous case of *Watteau v Fenwick* (1893) where the court held the undisclosed principal (Fenwick) liable even when the agent (Humble) exceeded his actual authority.

Armed with the above scholarly submissions and hard cases, the questions are:

1. What is law of agency and how does the concept of undisclosed principal arise?
2. What are the legal relations among those three actors, Principal (P), Agent (A) and Third Party (TP)?

3. Do Agent and Third Party have a valid contract with the exclusion of the Undisclosed principal?

4. If yes to question (3) why should the Third Party sue Undisclosed Principal for breach?

5. Can Third Party refuse to perform when she discovers the reality or existence of Undisclosed Principal?

6. What are the justifications for allowing the doctrine?

7. To what extent is the doctrine fair and sustainable given that someone is bound even when he does not intent to contract with the other party?

8. If the doctrine is at variance with the basic requirements of a binding contract, why is it permitted?

9. Which is important in contract, the intention or the rule?

10. What are the advantages and disadvantages of the doctrine?

11. Are there any theory or theories capable of giving direction?

12. What impacts does the doctrine of undisclosed principal have on the legal system?

3. Conceptual framework

A. Agency

Agency is the fiduciary relationship which is established between two persons, one of whom expressly or impliedly manifests assent that the other should act in his behalf so as to affect his relations with third parties, and the other of whom similarly manifests assent so to acts pursuant to the manifestation (Reynolds and Graziager, 2006, para. 1.10). Put differently, an agency is the relationship that exist between two persons when one, called the agent, is considered in law to represent the other called the principal, in such a way as to be able to affect the principal's legal position in respect of strangers to the relationship by the making of contracts or the disposition of property (Fridman, 1996, p.11).

From the above definitions, agency relationship is made up of three parties. The principal, the agent and the third party. The principal is the one who authorizes the agent to carry out an act on his behalf, the agent on the other hand accepts to act and serve as an intermediary between the principal and the third party. He takes instruction from the principal and relates with the third party on the principal's behalf. The third party interacts with the agent with the believe that he is dealing with the principal through the agent.

The diagrammatic expression of the relationship

Sealy and Hooley (2009, pp. 103-104) gave us examples of an agents as follows:

1. Auctioneers: These are agents who act for the seller, but may also be agents for the buyer in certain circumstances (*Hinde v Whitehouse*, 1806). They facilitate the contract of sale between the seller and the buyer.

2. Directors: Directors are elected by the shareholders of a company to act as agents of the company and they usually act collectively as a Board of Directors or through the chairman of board of directors as the company's Articles of Association may provide (*Hely-Hutchinson v Brayhead Ltd*, 1968). In *Ferguson v Wilson* (1866) Cains L.J. said that directors are agents of the company. This is because "the company itself cannot act in its own person, for it has no person; it can only act through directors and the case is, as regards those directors, merely the ordinary case of principal and agent."

3. Partners: Partners act as agents of the firm and their other partners for the purpose of the business of the partnership.

4. Solicitors are agents of their clients (principal) in legal matters. They are authorized to act on the principal's behalf and take certain decisions that will affect the legal position of their principal (*Waugh v HB Clifford & Sons Ltd* (1982).

Anyone who deals with the auctioneers, directors, partners and solicitors are deemed to have dealt with their principals.

The authority that empowers the agent to act on behalf of the principal are classified into five as follows:

1. Actual Authority: Diplock L.J. in *Friedman v Lockyer v Buckhurst Park Properties (Mangul) Ltd* (1960) explained that this type of authority is created by a consensual agreement between the principal and the agent alone. In consensual agreement, the principal expressly or impliedly gives the agent the authority to act on his behalf and the agent agrees to act within the scope of such authority (*Ireland v Livingston*, 1872). Here the agent is not party to the contract but an intermediary between the principal and the third party.

2. Apparent or Ostensible Authority: This is the type of authority that is created when the principal makes a representation to the third party which the third party reasonably believed that the agent has authority to act based on the principal's representation or conduct. The representation when acted upon by the third party operates as an estoppel, preventing the principal from asserting that he is not bound by the contract. For this authority to be established, there must be three ingredients: (i) representation by the principal (ii) reliance on the representation by third party

(iii) an alteration of third party's position resulting from such reliance (*Rama Corporation Ltd v Proved Tin and General Investment Ltd* (1952) 2 QB).

3. Usual Authority: This is the type of authority that an agent is assumed to have because it is customary for someone in that position to have such authority even though such authority has not expressly been granted by the principal. This type of authority is commonly implied through what is normal in a particular industry or type of relationship (*Supra*, n.17).

4. Authority by Operation of Law: or Agent of necessity: From the authority of *Boustead and Reynolds on Agency* (2006) a person may have authority to act on behalf of another in certain cases where he is faced with an emergency in which the property or interests of that other are in imminent jeopardy and it becomes necessary in order to preserve the property or interest, so to act. In such emergency, a person is deemed to have the legal authority to act as an agent without express or implied agreement because the law automatically assigns that authority due to the circumstances (*China-Pacific SA V Food Corporation of India, The Winson* (1982) AC 939 HL).

5. Ratified Authority: This authority happens when the principal affirms an agent's unauthorized act after it has been performed. Ratification validates the agents' actions with effect from the time those actions took place. Ratification may be express or implied from the principal's unequivocal conduct (*Koenigsblatt v Sweet* (1923) 2 Ch 314).

B. Disclosed principal

Disclosed principal is the type of principal whose existence is not hidden from the third party at the time the contract was entered into or established. This is to say that the third party knows that he is not entering into the contract with the agent as the agent is representing the principal. Therefore, where there is breach it is the principal that will be held liable.

There are two types of disclosed principal: named (identified) principal and unnamed (unidentified) principal.

(i) Named Principal: It is the type of disclosed principal where the name and identity of the principal is revealed to the third party by the agent at the time the contract is made. As Akansi (2005) explained, where an agent having authority disclosed his agency, that is, the name ... of his principal is disclosed, only the principal can sue or be sued on the agent's act. This was also the case in *Akin Bojor Bros. v Crek West Africa Line* (1970)

(ii) Unnamed (unidentified) Principal: If the third party does not know the principal's name but is aware of his existence, the principal is then called an

unnamed principal. In *University of Calabar v. Ekpo Ephraim and ors* (1993) it was decided that if the agent discloses that there is a principal behind his acts, the name and identity of the principal need not to be revealed, it is enough that the third party is aware or ought to be aware that the person he is relating with is representing another person.

C. Undisclosed principal

By undisclosed principal here, we mean a principal whose existence is not known to the third party. For instance, UP (an undisclosed principal) employs A (an agent) to contract with TP (a third party) in A's own name. Third party believes he was dealing with A not knowing A is just an Agent. By agent we meant a person who in his own name contracts ostensibly for his own account but behind whom there stands an undisclosed principal.

According to Goodhart and Hamson (1932: 320-356) the doctrine of undisclosed principal" ... allows a person to sue and be sued upon a contract that he has not in fact made." This is so because the undisclosed principal is not known by the third party to be connected with the particular transaction (Chitty, 1826). Thus, Treitel (2003) explains undisclosed principal as a principal whose existence the third party is unaware unlike the disclosed principal whose existence is known by the third party even though his name is unknown.

4. The emergence of the doctrine of undisclosed principal

It is generally said by many authors that *Schrinshire v Alderton* is the first case in which the rights of an undisclosed principal were discussed (Barnet, 1960). Ames (1909) for instance submits that the anomalous doctrine is not a modern notion as there was a judicial sanction of it by Lee, C.J. as late as 1743. The case was instructive as it shows the reluctance of the jury to accept the direction of the judge to invoke the doctrine of undisclosed principle. The action in the case was brought by an undisclosed principal for the price of goods sold by his agent to a buyer. As detailed in the illustration 3 of the "paradigm cases" above, the agent had failed and the principal had sent a notice to the buyer not to pay the agent but to him directly. Notwithstanding this notice, the buyer paid the agent. The judge directed the jury in favour of the plaintiff/principal but the jury returned a verdict for the defendant/agent. The Jury was sent out three times to reconsider their decision but they still adhered to their verdict in spite of the statement by the Lord Chief Justice that "an agent's sale does by the general rule of law create a contract between the owner and buyer". The jury justified their verdict by stating that from the circumstances of the case, no credit was given as between the owner and the

buyer and that the buyer was answerable to the agent only and the agent only to the owner. Lord Chorley writing in 1929 rightly calls the jury's verdict "an outrage to legal theory." This marks the beginning of the problem with the principle of undisclosed principal.

Apart from the historical trace of the principle of Undisclosed principal from *Schrinshire v Alderton*, Searly and Hodley made it clear that the doctrine of Undisclosed Principal developed before the theories of contract law requiring (objectively determined) consent of the parties became established (p. 181). This is why Cheng-Han declared that "it makes no more sense to say that the doctrine of undisclosed principal is anomalous when measured by contract principles than it is to say that the doctrine of privity of contract is anomalous because it is inconsistent with the undisclosed principal doctrine."

5. Undisclosed principal: analytical and theoretical discourse

In order to provide a strong basis for this study and sharpen the research problem, a number of literatures have been reviewed to examine the existing work in the field.

We start with Ames (supra, no. 40) who agree that the doctrine of undisclosed principal is condemnable and give three reasons for saying so. The first is for violating the fundamental principles of contract. This is so because contract is based on consent and privity of contract but under agency, the principal never intended to contract with the principal, he only intended to contract with the agent. Secondly, for giving no relief to the third party. The third party may face obligations to someone he never had the time to evaluate or trust. Thirdly, for operating unjustly between undisclosed principal and the third party. There is imposition of liability on third party which is unfair. Ames further observed that those who introduced the English doctrine wrongly believed that it will guarantee more perfect justice without any sacrifice of the elementary principles of the law of contract. They fail to recognize that true justice could be brought in another way other than to wrongfully allow undisclosed principal to sue and be sued in contracts made by his agent.

He also came up with three theories, namely; the theory equating the agent with a trustee and the undisclosed principal with beneficiary, the theory of indemnification and the theory of exoneration. Among them, the theory of trust remains outstanding.

According to him, the soundness of the doctrine of undisclosed principal lies in analyzing the relationship that exists between an undisclosed principal, agent and

the third party with the concept of trust whereby the agent is seen as a trustee to the undisclosed principal. With the institution of trust, it means that the agent has the legal title as a trustee while the undisclosed principal retains the equitable ownership. For him, this is a better way of recognizing the rights and liabilities of an undisclosed principal than the doctrine based on the principle of consideration.

Ames illustrated his idea by analyzing the common case of a sale on credit of a specified good by A to B, who without A's knowledge is buying for the benefit of C. The title to the goods sold must pass from A to B because that was the clear intention of both parties. The actual transaction is therefore, a sale by A to B. But this sale by A to B excludes the possibility of the sale of the same goods by A to C. In other words, A could prove a case for goods sold by A to B in an action against B, but could not prove a case for goods sold to C in an action against C. The rule therefore which permits A to charge either B or C at his option is wrong as it permits a plaintiff to recover on his allegation regardless of his evidence. But although B and not C, acquires the legal title from A, B holds that title from the outset for the benefit of C. The truth of the matter is therefore, that B in buying for undisclosed principals and not acting as an attorney or representative of his employer but as his trustee. According to Ames, if we suppose the subject of the purchase to be land, this statement may be more convincing. When A conveys the land to B, no one will say that the title passes to C. But B who gets the title does not hold it for himself but as trustees for C. To say that A may charge C upon B's contract of purchase is to maintain what no one would maintain, that a cestui que trust (beneficiary of trust) may be sued and at law, upon contracts between the trustee and third persons.

Ames came up with "a mode of legal procedure" by which the third party can indirectly "compel the undisclosed principal to make good the contract of his agent". He opined that, two duties usually exist in the relationship between the agent and the undisclosed principal, that is, the duty of reimbursement and the duty of exoneration. By these duties, the undisclosed principle undertakes not only to provide the funds to the agent to make payment for what the agent transacts with the third party, but also undertakes to cover the agent and the third party. This right of exoneration belonging to the agent can be enforced against the undisclosed principal at the suit of third party who transacts with the agent.

However, one of the important critical aspects of law that Ames' theory did not consider before equating agent with trustee is the independence of trustee. An agent is acting under the authority of his principal while trustee is not under the authority or control of the beneficiary. Thus, the principal is a master which the

beneficiary is not. The theory did not also consider the existence and essence of consent in the relationship between the agent and the principal to the extent that, as between the agent and the principal, no legal relationship can "be created, nor can it continue to exist without the consent of the parties" (Seavey, 1919: 859-863). The element is lacking in the relationship between trustee and the beneficiary.

Another contradiction is that, while the third party can directly sue the undisclosed principal for the contract between the third party and the agent of the undisclosed principal, the beneficiary of a trust cannot be sued by the third part on contract between him (the third party) and the trustee.

Another writer whose work is very influential in undisclosed principal is Goodhart and Hamson (supra n. 5, pp. 320-356). They talked about assignment theory as the only way of justifying the application of undisclosed principal. This is occurred by placing the undisclosed principal in a similar position with an assignee. In other words, the contract originally made between the agent and the third party is automatically transferred to the undisclosed principal through a primitive and highly restricted form of assignment. Assignment means the transfer of rights by the agent to the principal. Thus, an undisclosed principal may only sue a third party where the benefits of the contract can be assigned and the burden performed vicariously but where the rights of the agent are personal, such as the painting of a portrait that requires the skill of the agent, the undisclosed principal may not sue because assignment would be excluded. While this justification is appealing, its usage is limited. From a theoretical perspective, the assignment theory is considered a "legal fiction" (*Cook v Eshelby, 1887*) that lacks foundation in an actual contract law (Fridman, 2012) as it is created just to justify the anomalous doctrine. This is because there is no actual assignment in the real sense of it as the principal was never mentioned expressly in the contract and the third party did not consent to any such assignment. Again, the theory of assignment cannot explain the situations where the principal was involved in a transaction from the onset but remained undisclosed, such situation makes the idea of assignment unnecessary and illogical. Also, assignment principle cannot work in situations where there is personal or trust-based contracts (*Said v Butt, 1920*).

Heyler (1951:409-420) has also lend his voice to the principle of Undisclosed principal. His contribution targets the election rule for criticism. The election rule holds that the third party has the right to choose whether to hold the agent or the undisclosed principal liable upon the discovery of the existence of undisclosed principal. Heyler questions the rationale for selecting one (either the principal or agent) for liability when they are in reality two. His idea is that the election rule

arose because logically the undisclosed principal is not by conventional agreement, a party to the contract between the agent and the third party. Consequently, the rules relating to the undisclosed principals' rights and liabilities have been subjected to some arbitrary limitations as follows:

1. There is refusal to extend the doctrines of undisclosed agency to sealed contracts and negotiable instruments.

2. There are also the rules that the third party cannot pursue both principal and agent, but must elect which one of them he will hold responsible. This is because of the technical view that since there is only one contract involved, there can be only one cause of action based on it. This was seen in the *Ewing v Hayward (1920)* the first case where election rule was applied in California. The rationale for holding unto election was that there is only one contract upon which the plaintiff can bring suit, either against agent or his principal. He cannot make two contracts out of the contract by seeking to hold each of those persons liable severally.

Whereas Heyler has no problem with the first limitation above, the second formed the basis of his article. He gave reasons why the doctrine of election if allowed, should allow only the principal to be liable:

1. Both the undisclosed principal and the agent intended that he (the principal) should be the owner and beneficiary of the contract.

2. Furthermore, the principal was responsible for the plaintiff's situation either because of his own refusal to perform or his choice of an irresponsible agent. Thus, it is unjust not to require him shoulder the burdens of the contract.

3. The principal's liability has been justified on the ground of the agent's right to exoneration which the third party sues to enforce. Because of this right, the agent need not be a joinder in the case. Although, it should be noted that the right of exoneration exists only where the agent has acted with authority though this is not true in some situations.

According to Heyler, one of the criticisms of election principle is that it puts an added burden on the already wronged third party since it forces him not only to fight his case but to determine which defendant is more solvent and more likely to stay solvent until a judgment can be satisfied. This means that election need not be made until after the close of the trial and establishment of the agency relationship. In some cases, the agent and the principal may be held liable.

Heyler holds that while "the election by judgment rule" was accepted in California on the theory that there was only one contract and only alternative liability, there is a new view known as "an election of remedies doctrine" which recognizes that the third party has different or distinguished rights against principal

and agent which permits plaintiff to sue both agent and principal to judgment on the theory that he is enforcing the agent's right to exoneration against the principal. The idea that one who has been wronged must seek relief on a single theory or a judgment against a single person where principal and agent have combined to produce his difficulties or suffering is outdated. In *Commercial Centre Realty Co. v Superior Court* (1923) the court recognized that ordinarily an election should have been required but the agent still had possession of the principal's deed. The tangible nature of the benefit sought made it crystal clear to the Court that adequate relief could only be obtained by a decree against both.

Also considering a scenario where a judgment was first obtained against the agent while plaintiff was still ignorant of the principal's existence, American courts overwhelmingly hold that the first judgment in this situation does not constitute an election stopping a subsequent judgment against the principal. A plaintiff can hardly be said to have "elected" when he had no indication that a choice was available. Even where the agency has been disclosed before the judgment has been obtained against only agent or principal, a subsequent judgment should not be precluded. This is true especially where the plaintiff makes it clear that he does not intend to abandon his claim against the other party in the event the first judgment failed to satisfy him. Suit against the agent while indicating an intent to rely on the principal does not indicate readiness to abandon the claim against the principal. For example, in a Massachusetts case of *Evans, Coleman and Evans Ltd v Pistorino* (1923) the plaintiff had obtained a judgment against the agent after discovering the undisclosed principal's existence. The judgment could not be satisfied so the principal and agent were joined in an equity action brought to establish and subrogate the plaintiff to the agent's right to exoneration.

However, where judgment was first obtained against the principal, this argument may not be quite strong. This is because the principal was the chief beneficiary in the transaction.

The summary is that an election rule which makes the undisclosed principals liability alternative to the agent's is not upheld. Rather, liability of undisclosed principal should be available to the third party in addition to that of the agent. Only when this is done can the agent have any fair assurance that he will be able to satisfy his claim.

In his article, Muller-Freienfels (1953:298-317) in three sections also shared his thought on undisclosed principal. In the first section, he acknowledged that the principle of undisclosed principal is far from being settled. He made reference to the decision of Denning L.J in *Smith & Snipes Hall Farm Ltd v River Douglas*

Catchment Board (1949) where Denning was quoted as stating that the principle "that a man who makes a deliberate promise which is intended to be binding, that is to say under seal or for good consideration, must keep his promise, and the court will hold him to it, not only at the suit of the party who gave the consideration but also at the suit of one who was not a party to the contract, provided that it was made for his benefit and that he has a sufficient interest to entitle him to enforce it, subject always to any defenses that may be open on the merits." By saying this, Muller-Freienfels accused Denning of exposing undisclosed principal to criticism as he has no regards to real and nominal parties.

In the second section, Muller-Freienfels analyzed the two English Concept of contract which are contracts under seal and the simple contracts, to show that the law does not apply generally or the same way to them against what Dennings explained.

Contracts under seal: According to Muller-Freienfels, contracts under seal are not consensual just like the principle of undisclosed agency is not created consensually. Thus, one would have expected Denning in the *Smith & Snipes case* to give full expression to this. This is because deed when directed to the creation of contractual obligations, operates immediately upon the significance of assent by the party to be bound and does not require the consent of the other party to enable it operate (see *Fletcher v Fletcher (1844) 4 Hare 67*; *Re Kay's Settlement (1939) Ch 329*). Since there is absence of any necessity for agreement in a contract under seal, it has been described as a "regrettable anomaly" just like the undisclosed agency principle in the light of popular contractual theory because there is lack of agreement between the third party and undisclosed principal. Unfortunately, this expectation is not so with Denning. Denning seems to forget that it is a well-known rule of law that an undisclosed principal is not able to sue or be sued if the contract is under seal. The presence of consideration is only an essential requirement in the law of simple contracts. It plays no role at all in the law of contracts by deed. These contracts do not require a valuable consideration as a cardinal necessity of the formation of a contract (*Combe v Comb, 1951, 2 KB*). The consequences of this is the non-recognition of the principle of undisclosed agency since that is what goes with contract under seal. So Dennings did not differentiate between a contract under seal and that of a simple contract. In simple contract, the principle of consideration is superior to those of private intentions and consensus. Thus, consideration moves from the undisclosed principal to the third party and the agent is seen as the stranger to the contract, mere conduit pipe. Since the agent is not a party to the contract, it means he cannot sue or be sued. For this reason, it is

submitted with respect that the opinion of Denning L.J in *Smith & Snipes case* that the basis of the undisclosed principal's right to sue is the principle that a man who makes a deliberate promise which is intended to be binding must keep his promise and the court will hold him to it, not only at the suit of the party who gave the consideration but also at the suit of one who was not a party to the contract, is not correct explanation.

In the third section, Muller-Freienfels further considers the anomalies in the development of undisclosed agency originating in the lack of underlying general principle. It considers two sides of argument between the English legal approach and the continental (European) legal approach to the doctrine. The popular notion of undisclosed principal is as seen from the English law approach of considering the agent as a conduit pipe, thus not part of the contract while the continental approach considers the agent as part of the contract and that liability only moved from agent to undisclosed principal through assignment. Muller-Freienfels used the decision or judgment of Blackburn J. in *Armstrong v Strokes* (1872) LR as one of the first examples where the court shows that it is moving away from the old (English) basis of undisclosed agency.

Blackburn had in the case given an example of exception to the old principle, with a situation where undisclosed principal paid his agent the price of the purchase he authorized at a time when the third party did not know of the principal's existence. Here the third party will unsuccessfully sue the principal for the price of the goods after the agent had stopped payment and the undisclosed principal was discovered. According to Blackburn, it would produce intolerable hardship if a third party could sue the undisclosed principal who had bona fide and without moral blame paid his agent at a time when the third party still give credit to the agent alone and knew of no one else. The point of difference with the old practice or English practice is that in old practice, there is no exception, whether the principal had paid the agent or not will not relieve him of liability in favour of the third party. In other words, the English position is shown by the rule that the undisclosed principal may be sued by the third party even when the agent has no right to an indemnity from the principal because their contract is void or the agent has acted contrary to his instructions. Without the agent's right of indemnity from the principal in this scenario, it means the idea of indirectly holding the undisclosed principal responsible for the fulfillment of the agent's contracts through the **process of assignment does not work in English approach. For instance, in *Danziger v Thompson* (1944) KB** an infant had rented a flat from the plaintiff under an agreement in writing and expressed to be made between the plaintiff and the infant,

who was therein described as the "tenant". It was held that oral evidence was admissible to show that the infant entered into the agreement as an agent of her father, the real tenant, and the plaintiff recovered judgment against the father. This presumed that the infant had never been a party to the contract, but only a mere "conduit pipe" as agent in which role contractual incapacity was irrelevant. Consequently, the decision in *Armstrong v Stroke* (Supra, no. 58) must be considered a deviation from the popular principle of undisclosed agency because preaches that agent is not a conduit pipe per se but can be held liable if need be.

Criticizing the English doctrine, Freienfels referenced Lord James and Lord Macnaghten to have expressed their reservation of the English approach. They held that doctrine of undisclosed agency was developed to take care of situation where, although the agent acted in his own name, it was well known that he had a principal behind him. However, the English common law does not distinguish in the first place between acting in another's name and acting in one's own. This is why the decisions in *Humble v Hunter* (1848) 12 QB and *Fornby v Fornby* (1910) 103 L.T. 116 were criticized and received wide disapproval. In both cases, the court had held that where an agent had contracted as the proprietor, no evidence was admissible to charge the undisclosed principal, because it would contradict the terms of the written contract.

Muller-Freienfels also talked about the doctrine of merger where there are numerous decisions that tend towards the liability of the agent and whittling away at least of the third party's right of election between the agent and the principal which is so characteristic of the English institution. The doctrine of merger states that recovery of judgment against the agent amounts to a "conclusive election" (*Priestly v Fernie*, 1863, 3 H & C 977). Even if the judgment remains unsatisfied and even if the existence of the undisclosed principal was not known until after the judgment, the third party's right against the principal is barred in law. In addition to the explanation in terms of election, this solution is also sometimes justified by the doctrine that when a contract is merged into a judgment, there is no longer room for another judgment. Because there cannot be any further action against the same defendant or against any other person upon that cause of action.

In conclusion, Muller-Freienfels says that the old conception that the third party has a right to make the principal liable as well as the agent is avoided in many instances. He further reiterates that the English law of undisclosed agency despite its different point of departure approaches the continental system of "indirect agency" and the continental law also tends to find a solution looking at the English principle. There are several exceptions which diminish the difference between the

two conceptions. The consequence is that, although both systems start from opposed principles, their practical results do not differ so much in the end. Therefore, the work does not support the application of the English doctrine or practice without the blend of the continental approach and vice versa. In so doing, it means law of undisclosed agency is not yet settled. The mixture of the opposing ideas can only lead to more confusion.

The major criticism in Freienfels exposition is his misunderstanding of the concept of consideration. As one of the requirements in the formation of contract, consideration must be ascertained from the beginning. Thus, since the principal is undisclosed, it is wrong to infer that he is the one that provided consideration. It is rather the agent who got involved in reciprocal contractual exchange. Therefore, the agent is the one who provides the consideration and not the principal. Again, if it is the principal who provides consideration and the agent acts like a mere conduit pipe for the consideration, the question is what consideration does the agent herself provide that entitles him to sue or be sued on the contract? This question has not been answered.

The next writer whose analysis of the doctrine of undisclosed principal is excellent is Professor Barnett (1987). He observed that nearly every legal theorist who has considered the law of undisclosed agency from the point of view of contract theory has concluded that the established rules are anomalous. After showing that standard contract theories have really been unable to explain the established doctrine of undisclosed principal because its obligation is anchored on promise-based philosophy, that is, obligation derived from the (binding) promise A made to TP and the reciprocal promise TP made to A. Thus, it remains a mystery why Undisclosed Principal (UP) to whom TP (Third party) made no promise whatsoever, has any contractual rights against TP and vice versa. Prof Barnett applied a consent theory of contract and entitlement theory to explain and critically evaluate the law of undisclosed agency. The consent theory of contract sees an agency relationship as a commitment by an agent to transfer to the principal any rights obtained on the principal's behalf. Prof. Barnett analyzes the nexus of obligations using a consensual "triangular flow of rights" among the three parties to the paradigm undisclosed agency relationship. He then extends this analysis to treat several "hard cases"

Prof. Barnett exposition is in three parts:

In part 1, he shows why the law of undisclosed agency is considered to be anomalous by sketching four illustrative cases that conventional theories of contractual obligation cannot explain (the illustrative cases are already presented in

the statement of problem section). He further mentioned five traditional theories of contract namely: Will, Reliance, Efficiency, Substantive fairness and Bargain theories and argued that none of these theories adequately explains the law of undisclosed principal because of their inherent deficiencies.

In part 2 Prof Barnett summarized the consent theory of contract and critically applied it to the law of undisclosed agency. His conclusion is that most current undisclosed agency doctrine is supported by sound modern entitlement theory and a consent theory of contract. He identified the doctrine of *assumpsit* in part three which is the product of promise-based contract theory, as the source of the seeming anomaly of undisclosed agency law. *Assumpsit* rests contractual liability on the voluntary assumption of a duty to act or refrain from acting. In other words, liability is based on injury caused by the failure to perform a promise. As long as a contractual law is conceived of as a merely "promisory", anomalies like the law of undisclosed agency will persist.

Prof. Barnett sees the consent theory of contract as the answer to the anomalous promise-based contract theory. His reason is that the consent theory of contract is based on entitlement and not promise-based. Finally in part four, the writer traced the evolution of the doctrine of undisclosed agency and its development through the common law.

The strongest criticism leveled against Barnett's consent theory of contract is that the third party never consented to the contract with the undisclosed principal in the true **sense of it**. What we have is implied or imputed consent. Therefore, there is no meeting of mind between the third party and the undisclosed principal

Tan Cheng-Han (2004) on his part put forward a theory anchored on the existence of an implied contract between third party and undisclosed principal. He relied on the dictum of Diplock LJ in *Teheran-Europe Co Ltd v St Belton (Tractors) Ltd* (1968) 2 QB that ordinarily the third party in a commercial contract is willing to treat with anyone on whose behalf the agent has been authorized to contract as a party. The idea is that the third party intends to contract with anyone including the undisclosed principal except where he expressly states otherwise.

Another scholar that made a sound contribution to the anomalous undisclosed principal theory is Sule (2010). In his article, Sule investigates whether or not the doctrine of undisclosed agency should be retained or discarded. He looks and analyzes some of the arguments for and against the doctrine. He started his arguments against undisclosed principal by making reference to the cases of *Edmunds v Bushell & Jones* (1965) QB 97 and *Watteau v Fenwick* (1893) QB 346. With these cases, one of the most repeated objections being raised against the

doctrine of undisclosed principal is that, it contradicts the rules of privity of contract. A contract confers rights and obligations only to parties to it, so the objection is that an undisclosed principal is not a party to the agent's contract with third party. Therefore, neither right nor liability is to be conferred on him.

He further criticized the theory propounded by GoodHart and Hamson as influenced by the Privy Council in *Sui Yin Kwan v Eastern Insurance Co.* (1994) 2 AC 199. The explanation of GoodHart and Hamson to the anomaly of undisclosed principal is that contract made by the agent is not between the undisclosed principal and the third party. The undisclosed principal is a stranger to the contract and that is why even in the law of agency it is always being said the undisclosed principal intervenes. Supporting their argument, they asked the question that "if the principal is a contracting party, how can he be said to be intervening in a contract which is declared to be "really" his own. To Goodhart and Hamson, the anomaly of the doctrine of undisclosed principal should be "best considered as a primitive and legally form of assignment." Because there is no contract between the third party and the undisclosed principal, the third party may not have direct action against undisclosed principal from the agent's right against the principal. The principal also derived his right to sue the third party from the agent's assignment to the principal of his right to sue the third party.

In bringing out the argument for undisclosed principal, Sule said that if Good Hart and Hamson's position is to be accepted for instance, what then could an infant agent assign to his principal as he (the infant) could not enforce the contract himself? In this sense therefore, the theory of assignment, contradicts the established rule in agency that allows an infant to enter into a contract on behalf of his principal. This is so because an infant as an agent is not a party to the contract, so his incapacity is immaterial. Holding contrarily implies that the contract is not between the principal and the agent (who could be an infant and who could not enforce the contract), but between the principal and the third party through the agent, as an instrument used to affect a transaction. Because the contract is in law that of the principal, he can intervene even if there is provision in the contract that it shall not be assigned. It is therefore submitted that the idea of assignment be rejected because it does not represent the English approach.

Cases used by Sule to put forward the case for retainability or the acceptability of undisclosed principal include *Siu Yin Kwan v Eastern Insurance Co. Ltd* (Ibid) *Keighley Maxstead & Co. v Durrant*, (1901) AC 240 *Tehran-Europe Co. Ltd v S.T. Bolon (Tractors) Ltd* (1968) 2 QB 545 *Jenkins v Hutchinson* (1849) 13 QB 744

In *Siu Yin Kwan*, Lord Lloyds of Birwicks delivering the advice of the Privy Council stated that it seems to be generally accepted that while the development of this doctrine is anomalous because it runs counter to the fundamental principles of privity of contract, it is justified on grounds of commercial convenience.

Also, in the judicial pronouncement in *Keighley,Maxstead & Co. v Durant* (1901) AC 240 it was explained that, the contract between an agent and the third party is in truth, although not in form, that of the undisclosed principal himself. This is so because both the principal and the authority exist when the contract is made and the person who makes it for him is only the instrument by which the principal acts. In allowing him to sue and be sued upon it, effect is given so far as he is concerned, to what is true in fact, although that truth may not be known to him.

Sule also states that it is generally undisputable in undisclosed agency that what is legally material is the undisclosed principal's authority to the agent and the agent's intention as at the time of contracting with the third party. A reference is made to Diplock L.J in the case of *Tehran-Europe* that where an agent has actual authority and enters into a contract with another party intending to do so on behalf of his principal, it matters not whether he discloses to the other party the identity of a principal, or even that he is contracting with on behalf of a principal at all, if the other party is willing to treat as a party to the contract anyone on whose behalf the agent may have been authorized to contract. In case of ordinary commercial contract such willingness of the other party may be assumed by the agent unless either the other party manifests his unwillingness or there are other circumstances which show the agent to realize that the other party was not so willing.

The undisclosed principal's authority to the agent is what makes the contract to belong to the principal and not to the agent. In ordinary commercial transactions, the fact that the agent does not make mention to the third party the fact of him representing a principal is usually immaterial to the third party who is willing to transact with the agent without knowing who his principal is. And where the principal's identity matters to the third party, it is apparent that the third party would refuse to transact with the agent without knowing who his principal is (Diplock L.J in *Dyster v Randal & Sons* (1926) Ch. 932. An argument could therefore be maintained that, the criticisms being made against the doctrine of undisclosed principal do not reflect protection of the interest of the third party. Thus, as far as the interest of the third party is concerned in commercial transactions, the objections seem valueless because the circumstances as well as the principles of the law of agency do not prevent him from fighting the case himself

when he finds out that the disclosure of the agent's principal is material to him. Thus, it could be submitted that a contract between the third party and the undisclosed principal could be implied by the third party's willingness to treat as also party to the contract, any person from whom the agent gets authority. Of course, it could be argued that in fact the third-party contracts with the agent and the agent only because he does not know that the agent is representing a principal. However, in commercial transactions involving an agent, practically, it matters not to the third party whether or not the agent discloses his principal.

In conclusion, Sule pointed out that the central objection that the doctrine of undisclosed principal contradicts the rules of privity of contract could not in the modern day be acceptable. Although such argument was successfully sustained in the 18th century when the tempo of trade was not growing faster, at this time, the contradiction of the doctrine of undisclosed principal with rules of privity of contract could be practically understandable. This is because contractual relations were more or less built upon individual agreements. But presently the doctrine of undisclosed principal has since developed beyond the individual focus of 18th century practices. In fact, the rules of privity of contract have proved inadequate in meeting the challenges of modern-day commercial transactions and therefore undisclosed agency should be allowed to stand on its two feet. The individual two-party relationship of the past must be transformed into a multi-party relationship where there are different categories of people or parties ranging from Architects, Surveyors, Building Engineers and insurance companies, all in one complex contract and all claiming being parties to the contract.

At the end, it can be seen that Sule's recommendation is that the doctrine of undisclosed principal should be taken as an exception to the rules of privity of contract for the following reasons: commercial convenience; contract between an agent and the third party is in truth that of the undisclosed principal, not in form; the intention of the both undisclosed principal and the intention; and multi-party contractual relationship of the modern day.

On his part, Dalley (2011:495) observes that despite the ubiquity of agent in the modern world, agency law does not have a coherent explanation or a unified theory. He states that this is one of the problems that makes undisclosed principal a difficult subject. Dalley described agency law as that which enables principals to act through agents and in return ensures that principals using agents do not thereby escape liability or other consequences of their choices. In order to explain agency law better, Dalley developed a theory known as cost-benefit internalization theory. The theory's simple premise is that the principal who has chosen to conduct his

business through an agent must bear the foreseeable consequences of that choice. The foreseeable consequences can either be the benefits or risks created by the agency relationship.

To explain his theory properly, Dalley divided his work into six parts. Part 1 as introduction explained the cost-benefit internalization theory as a theory that explains agency law doctrine in a way that other theories have not been able to. This is because the theory is based on the moral and economic principle that the principle must bear the consequences of the internal impulses that made him to hire an agent to the extent that it is foreseeable that harm will result from the agent's unauthorized contracts when the contract is one that a third party is likely to enter into with the agent given the circumstances of the agent's employment.

Part 2 considers the nature and purposes of agency law in the light of the fundamental features of agency. In terms of its nature, the author emphasized that the best explanation for agency doctrine is based on the moral and economic principle as seen in part 1 above. With regard to the purpose, the premise of the cost benefit internationalization theory of contract is that agency law has a single underlying policy goal which is to mitigate the effects of using an agent. This is to say that the use of agency does not alter the legal consequences of an actor's behaviour. The agency law according to the new theory does this by treating acts accomplished through the use of the agent as if they were accomplished by the principal himself, that is, the restoration of the status quo. Without this, the use of agent would be pointless or extremely expensive. The cost-benefit internalization theory is built on certain concepts as follows: Responsibility, use of agent, in the principal's business, reasonable foresee-ability and causation.

Part 3 and 4 describe the use of contract and tort theories respectively and their inability to address a variety of agency problems. For instance, contract principle is based on the parties' consent to be bound but agency law goes beyond this and holds principals liable even when they have not actually consented to a particular transaction. It is on this basis that undisclosed principal doctrine provides that a contract arises between a principal and a third party even when the agent is not acting as an agent at all.

With respect to an agent's torts, the principal is liable when an agent commits a tort that is a foreseeable consequence of the use of the agent in this way in the principal's business. The principal is not liable if the tort is not foreseeable in light of the way the principal operates this business, or if the tort is a consequence of someone else's business. For example, the independent contractor exception

restricts the principal's liability to tort that are consequences of the principal's business, not of someone else's.

Part 5 describes various other attempts that have been made to explain agency law including references to its supposed history.

In all, one of the biggest objections that have been raised against the cost benefit internalization theory is the fact that its idea of causation is too broad to be streamlined.

Ania (2010:137) is another author whose article throws more light on the principle of undisclosed principal. He started by agreeing that in a standard agency relationship, the principal's right to sue is based on direct contractual privity between the principal and third party whereby there is understanding that the agent the third-party deals with is acting on behalf of the principal. Where the agency is undisclosed, this rationale cannot hold. However, the principal may sue the third party even though the third party is ignorant of the principal's existence.

Ania's article examines the two possible conceptual bases upon which the principal sues or is being sued under the undisclosed principal doctrine. The first is in the light of Tan Cheng-Han's position that there is an implied contract arising directly between the third party and the principal. The second is that the principal intervenes on a contract existing between the third party and the agent. The position of the article is that the later approach should be preferred in order to bring the law more in line with commercial expectations, civil law practices and common sense particularly where an undisclosed principal's right to sue or be sued is challenged. Moreover, intervention thesis, posits a contract as that of the agent and that the principal is allowed to intervene in a contract by operation of law even though he was not named or known at contract formation. The intervention thesis reflects the approach of case law and affords the most appropriate practical consequences. The intervention thesis should therefore be recognized expressly as the conceptual basis of the undisclosed principal doctrine. The fact that doing so would take the relationship of undisclosed agency further away from standard agency principles, which firmly rooted in the maxim *qui facit per alium facit per se* (he who acts through another does the act himself), might explain the historical resistance against consistent adherence to this view. Such hesitation leads to uncertain law. Once the intervention thesis is recognized, the confusion that subsumes the exceptional case of undisclosed agency under standard agency principles would be avoided. Undisclosed agency must be acknowledged as more than just a different way for principals using agents to enter contracts; its peculiar dynamic should entail a different set of rights and liabilities.

Only the intervention thesis can adequately account for the situation where a contract directly precludes an undisclosed principal's intervention. This is an important qualification on the undisclosed principal doctrine and strikes an adequate compromise. It positions the undisclosed principal's rights as subservient to the freedom of contract of third parties by allowing parties to exclude their liability against direct actions. Where privity of contract between the undisclosed principal and third party immediately established, no such limitation could be enforced without voiding the contract entirely.

Also accepting that the principal intervenes on an agent's contracts would void inconsistency in cases. The article seeks to establish why it is desirable to think of the contract as that of the agent and draw out some notifications that could be made to bring the law in line with this preferred view.

The central criticism is that Lang's theory allows a stranger to 'join' a contract after it has been formed. This bridge the contractual foundation which provides that contract rights and obligations arise only between parties at formation. Again, it overlooks that consent is essential to contractual liability.

Another great contribution in terms of comparative analyses of theoretical and practical problems of agency law in terms of business relationships is the work of Mitkus and Jurkevicius (2014) The most relevant and interesting part of their work is the codification of laws prohibiting application of the principle of undisclosed principal. The authors acknowledged the problem of undisclosed principal which has led some countries into drafting soft laws as an effective tool for formulating suitable solutions to tackling the problems of representation or agency. A reference point is the Draft Common Frame of Reference (hereinafter, the DCFR) which has the objective of providing a possible source of inspiration within the European Union, at both national and community law levels. For example, in order to prohibit the effect of undisclosed principal, Article 11. -6:105 of the DCFR establishes two exact conditions the acts of the agent should comply with in order for them to affect the principal's legal status. Firstly, the agent should act in the name of the principal or otherwise in such a way as to indicate to the third party an intention to affect the legal position of the principal. Secondly, the agent should act within the scope of gained authority.

There are also emanating from the rules of the DCFR on representation, the laws in Lithuania and Russian private law which the writer compare with each other. The two prerequisites of representation presented in DCFR are similar to those expressed in Lithuanian and Russian. In fact, Article 182 of the Civil Code of the Russian Federation (herein after RF CC) just like Article 2.134 of the new Civil

Code of the Republic of Lithuania (herein after - the LR CC) states that the agent shall not conclude contracts on behalf of the principal in his own interest or his own name. So, the combined effect of the provisions of RF CC, LR CC and DCFR is that if a contract is made by the agent in his name, the principal cannot sue a third party and the third party does not have a right for the claim against the undisclosed principal.

What this means is that the doctrine of undisclosed principal is forbidden in these countries' jurisdictions since an agent must always indicate that he is standing in for a principal. Article 2.132 of LR CC also provides that agents can be either legal person or a natural person who have legal capacity, that is, the person must be above 18 years old and must be mentally sound.

From the foregoing, it can be seen that the current thinking and justification attached to the use of undisclosed agency doctrine lies on the concept of trust by Ames, the theory of assignment by Goodhart and Hamson, election doctrine by Heyler, the consideration analysis by Freienfels, Barnett's entitlement theory, the idea of implied contract by Cheng-Han, Commercial convenience theory by Sule, tort and cost-benefit internalization theory by Dalley, the intervention theory by Ania, and the concept of codification by Miktus and Jurkevicious. Others are principles of indemnity and exoneration. All of them acknowledged the doctrine as anomalous, but there is gap with regard to the functional necessity of the doctrine in the face of modern commercial realities laced with information technology (IT) and Artificial Intelligence. Moreso, exposing how new contracting technologies like market places and anonymized agent affect disclosure and agency norms is also begging for recognition.

6. The usefulness of undisclosed principal in modern commercial transactions

The fundamental truth today is that the modern commercial activities need the services of undisclosed agency. Of all the writers reviewed above, only Sule hinted on the relevance of undisclosed principal in modern commercial transactions. He explained that the tempo of trade in the 18th century was not as fast as it is today, therefore emphasis on privity of contract is no longer adequate in all circumstances. This is evidenced in the challenges of the modern commercial transactions equipped with information technology which is overwhelming for individual two-party relationship that has been in vogue in the past. Today, Contracts now involve multi-party relationship with different categories of people or parties all claiming to be parties to the contract.

Radu (2025:555) exposed the impacts of information technology in the commercial world today. His exposition shows that the world has become a global village where it is becoming difficult to distinguish agent from the principal. This is so given that Artificial Intelligent (AI) has become a core part of how business functions, whether it is through the instrumentality of algorithms or others. In fact, the integration of artificial intelligence into business operations has brought about revolution in decision making process, workforce management and data analysis. Artificial Intelligence represents principals by functioning as digital agents that carries out the tasks traditionally performed by human agents (Chatterjee et al, 2021). For example, AI can negotiate prices and contract, they can execute trades automatically (algorithmic trading), communicate with third parties through chat bots etc (Davenport et al, 2024). The point made here is that AI is equipped with preprogrammed authority to represent the principal's will and interests even though it lacks legal personality.

Again, modern markets are no longer reached directly by principals alone. Customers can now access digital marketplaces like Amazon and Jumia which now serve as commercial or marketing agents working for undisclosed principals. In fact, marketing agents today include influencers, affiliates and social media marketers (Rath, 2025). Consequently, any principal who do not make use of them become less visible, less reachable and less competitive in online market places. It is important to note that Information Technology driven markets operate at high speed to the extent that principals are unable to personally manage their companies. Real time transactions, global logistics, compliance and customer interaction are all available around the clock. Principals can only maintain control over their businesses with the assistance of agents even when the agents have not met them. Anyone who insists on contracting with a disclosed principal will experience operational bottlenecks and loss of market share.

In terms of competition as one of the fundamental characteristics of the modern business environment, agents serve as competitive tools for undisclosed principals. With them, competition becomes a direct race that is connected to the distribution of market shares which is more and more aggressive. Information gathering, storage, analysis, intuition, predictability, fairness and quick decision making are the areas of competition (Stefanescu, 2018:70). The business world's marketing strategies have undergone a significant transformation due to the rapid advancement of technology, particularly through social media platforms. In the past, the reach and scope of traditional marketing techniques were frequently restricted to in-person interactions between buyers and sellers. This has time, space

and cost constraint implications. However, the time, space and cost constraints have been successfully overcome by technological advancement, particularly the internet, making transactions more accessible and efficient (Aznir & Purnomo, 2025). In fact, the advent of social media like Facebook has further transformed marketing in that they enhance customer engagement, product promotion and overall business growth. Principals can now manage their businesses without losing control. They agents assist principals in competing in international and local markets where having a direct presence will be expensive. Without agents, many principals will be restricted to a small geographic area.

7. Findings

The following findings have become very clear from this work:

1. Undisclosed agency enables representation or delegation and this may be the only real opportunity for someone to implement capacity when it is limited due to one reason or the other. With delegation, agent acts with commercial initiative.

2. It gives the possibility to enter into transactions when due to various social circumstances a person is unwilling or unable to participate personally in civil relations (Ibid). Some agents are more familiar with local market and might be in better position to secure a better business deals than the principal. Again, there are situations where the principal and the third party are not in good relationship, the only option available to the principal to carry out business transaction with such third party is through the use of agent who facilitates the business transaction without the principal and third parties' direct engagement.

3. The most significant outcome of representation is that it allows individuals to participate in the civil circulation on a much wider scale and more efficiently, thereby enabling the rapid development of economic relations (Ibid). With agents, undisclosed principal can penetrate markets outside his jurisdiction or places where he would have been restricted due to distance etc.

4. The principal may want to avoid the unattractive conditions of higher prices that would follow if third parties knew they were negotiating with a more powerful, or more desperate, market player. Also consider situations where revealing the identity of principal may hinder or frustrate negotiations especially where the principal gets involved in competitive bidding.

5. Agency is a business opportunity. We have clearing agents, football agents and other business intermediaries. Therefore, an agent might conceal the identity of the principal or the fact that he acts on behalf of a principal to avoid a third party bypassing him to deal directly with the principal in future transactions. Provided

the agent and third party fulfill their obligations under the contract in the contemplated way, there is little reason for an undisclosed principal to make her existence known (*Freeman v Lockyer Park Properties (Mangal) Ltd*, 1904, 2 QB 480).

6. Commercial activities have developed beyond the individual focus of 18th century practices. In fact, the privity of contract rule has fallen short in addressing the difficulties of contemporary business dealings. It has become necessary to change the previous individual two-party relationship into a multi-party one.

7. With the world becoming a global village and businesses being run 24/7 hours and with the introduction of Information technology and Artificial Intelligent, principal cannot be everywhere at the same time. There is need to delegate authority both to human and inhuman agents.

With the above advantageous findings, rather than abolishing the doctrine of Undisclosed Principal for being anomalous, respite seems to be beckoning if the law can be streamlined.

7. Streamlining the law

For sake of clarity, it is important to streamline the law of undisclosed principal as thus:

1. An undisclosed principal may sue and be sued on a contract made by an agent on his behalf, as far as the agent is acting within the scope of his actual authority (*Crompton Richmond & Co. Inc. v Sulami Alhaji Atanda*, 1967, NWLR 383 at 385).

2. In entering into the contract, the agent must intend to act on the principal's behalf (*Supra*, no.20).

3. The agent of an undisclosed principal may also sue and be sued on the contract (*Ibid*) in the following situations (*Montgomerie v United Kingdom Mutual Steamship Association*, 1891, 1 QB 370, PER Wright)

(i.) If the agent contracted as a party and is also appointed as the party to be sued.

(ii) Where the contract is made by deed inter parties excluding the principal, the agent will be liable (*Schalk v Anthony*, 1818). However, if the principal is described in the deed as a party to the contract or the deed is executed in his name, he will be bound and not the agent (*Re international Contract Co. Pickerin's Claim*, 1871).

(iii) Where an agent makes himself a party in writing to a bill of exchange or promissory note or any negotiable instrument, the principal cannot be added as a

party. The principal can only be made liable if he signs the negotiable instrument (*Section 23 of Bill of Exchange Act, 1882*) or his signature is written on the document by someone acting by or with his authority.

(iv) Where the principal is a foreigner, the agent on ground is made a party because national laws bind those within its jurisdiction and not those in other countries or foreign principals. (*Asafa Foods Factory Ltd v Alraine Nig. Ltd, (2002) FWLR p.125*)

(v) Where the terms of the contract expressly or by implication exclude the principal's right to sue and his liability to be sued. In this regard, the contract itself or the circumstances surrounding it may show that the agent is the true and only principal.

(vi) Where the agent contracted personally on his own name without disclosing to the third party the existence of the principal, he will be held liable to the third party even when he is acting for his principal. This was the case in *African Shipping Agency and Anor v Alhaji Kalla* (1978) 13 SC 21.

(vii) Where the principal is not in existence and the agent enters into a written contract on his behalf, the case of *Kelner v Baxter* (1866) LR 2 CP. 174 provides that the agent will be held liable even when he expressly made it known that he is contracting for a principal (*Erlanger v New Sombrebo Phosphate Co. (1878) App. Co.*

(viii) Where an agent acts for a principal who lacks capacity to execute a transaction, the agent will be held liable personally because it is believed that a person that lacks capacity to contract also lacks the capacity to appoint an agent to act for him based on the maxim, *nemo dat quod non habet* (no one can give what he does not have).

(ix) Where adequate remedy could not be achieved by suing the principal, the agent may be joined.

(ix) Artificial Intelligence (AI) lacks legal personality, therefore its responsibility rests on the principal (Solum, 1992) as AI is treated as an extension of the principal, not as an independent actor (Chopra & White, 2011). In fact, European Union Artificial Intelligence Act (2024) emphasizes on human accountability for AI actions.

4. Any defense which the third party may have against the agent is also available against his principal.

8. Conclusion and recommendations

There is no gainsaying that the doctrine of undisclosed principal is anomalous. The case against it being that it contradicts the rules of privity of contract by allowing the undisclosed principal who is not a party to a contract to enforce it. Many theories and principles have been formulated to explain the doctrine, all trying to bring it in tandem with the privity of contract principles, but instead of achieving this consistency, they yielded confusion. Scholars have advised that the doctrine be considered an exception to rules of privity of contract and be allowed to stand on its own instead of forcing it to comply to the rules of privity of contract. The article agrees with this as undisclosed agency is an inevitable anomaly given its many advantages to the commercial world especially with the emergence of Artificial Intelligence.

To make the law of undisclosed principal more appealing and worthwhile, the following are recommended:

1. Only in specific situations such as when strategic or commercial secrecy is justified or when disclosure might result in unjust discrimination against the principal should the principle of Undisclosed principal be permitted.

2. Agent must be authorized either expressly or impliedly to act for his principal and where he acts otherwise or exceeds his authority, courts should ensure that he is not protected unless ratification is gotten from the principal.

3. Third party should be allowed the right to elect who to hold responsible when the identity of the principal is revealed but he should not hold both liable. This will caution the agent to behave well knowing that he can be held liable instead of the principal.

4. Even though the agency is undisclosed externally, the principal and the agent should have a clear written agreement defining responsibilities, scope of authority and liability management for resolving conflict.

5. Where the purpose of being undisclosed is fraudulent or where the agent misrepresents a material fact or falsely made themselves principal to gain undue advantage or terms of contract over the third party, the court should refuse enforcing it.

6. Just like we have in civil jurisdictions, legal framework can help curtail the negative application of undisclosed agency and prevent fraudulent use of agents. Such law should also cover the activities of Artificial Intelligence as inhuman agents.

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FROM IMPERIUM TO ALGORITHM: THE *LEX RHODIA DE IACTU* AS THE SOURCE CODE OF MARITIME GOVERNANCE. FROM ROMAN DOGMATICS TO UTOPIAN SHIPS: AN ANALYSIS OF LAW AND ECONOMICS

Gerardo Marco BENCIVENGA¹

¹*S.S.M.L - Scuola Superiore Per Mediatori Linguistici " Teseo" Salerno, Corso Umberto I, 16, 84099 San Cipriano Picentino, Salerno, Italy, Phone: +39 089 202 7721, e-mail: mabenci149@gmail.com*

¹*I.I.S. "Guglielmo.Marconi", Via Aviere Mario Pirozzi, 32, 80014, Giugliano in Campania, Napoli, Italy, Phone: +39 081 894 5777; +39 328 626 0274 , e-mail: mabenci149@gmail.com*

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Abstract

The present study proposes a radical reinterpretation of the institution of the Lex Rhodia de Iactu (D. 14.2), transcending philological exegesis to arrive at a functional analysis based on the paradigms of Law and Economics. The research shows how the tributum mechanism constitutes a sophisticated institutional response to the market failure generated by the maritime emergency. Through the formalization of Game Theory, the norm is deconstructed as a strategic coordination device capable of solving the "Prisoner's Dilemma" intrinsic to the shipwreck, transforming a zero-sum game into a Pareto efficient cooperative Risk Pooling. The investigation then extends to a diachronic perspective: from the evolution of the institution in medieval Risk Management to the modern Lex Mercatoria (York-Antwerp Rules). Finally, the study projects Roman prudentia into the near future, arguing how the distributive logic of Lex Rhodia offers the ideal model of

Strict Liability for the regulation of Maritime Autonomous Surface Ships (MASS), where the algorithm replaces human discretion.

Keywords: *Lex Rhodia de Iactu, maritime governance, law and economics, risk pooling, game theory, Lex Mercatoria, strict liability, maritime autonomous surface ships, institutional analysis, roman law*

JEL Classification: K11, K33, L91, N43, G32

1. Introduction: The ontology of maritime risk and the resilience of the distributional model

1.1. The sea as a permanent legal laboratory

Maritime law is, by its nature, a frontier discipline. As observed by Musi [1], it lives in a constant dialectical tension between the stability of codified principles (*de lege lata*) and the need to adapt to emerging technological and economic challenges (*de lege ferenda*). In this fluid context, private property (*dominium*) ceases to be the absolute monolith typical of terrestrial law. The hostile nature of the marine environment and the physical interdependence of the cargo impose a suspension of selfish logics in favor of mechanisms of collective survival. This is where the *Lex Rhodia de Iactu* (D. 14.2) comes in, an institution that Söğüt defines not as a simple norm, but as a complete synopsis of risk governance in antiquity [8].

1.2. From Roman "Prudentia" to modern "Risk Management"

The present study is not limited to an antiquarian exegesis, but adopts a functional and diachronic approach. The *Lex Rhodia* has not remained unchanged over the centuries. Recent historiographical studies, in particular by Fusaro, Addobbati and Piccinno [2], have shown how the institute has been the prime mover of the modern concept of **Risk Management**. Already in the era of the *Ius Commune*, as Zalewski points out [3], jurists made a "creative interpretation" of the Rhodian rule, transforming it from an *ex post emergency rule* into a sophisticated tool for the preventive calculation of business costs. This historical evolution confirms that the mechanism of the *tributum* (solidarity contribution) represents an efficient institutional response to market failures, capable of transforming the radical uncertainty of the shipwreck into a calculable and distributable risk.

1.3. The contemporary challenge: The Algorithm at the helm

The urgency of rereading the *Lex Rhodia today* arises from the unprecedented challenges posed by the digitization of maritime transport. The advent of **Maritime**

Autonomous Surface Ships (MASS) and the progressive replacement of the human factor with Artificial Intelligence are creating a critical regulatory vacuum [7]. Tortious *liability* issues in autonomous navigation, analyzed by Domenighini [10] and Arend [6], undermine traditional fault-based regimes. When an algorithm makes a navigation decision that causes harm, the concept of "negligence" fades away.

The present work aims to demonstrate, supported by the theses of Chen [5] and Mwakisoma [9], that the most efficient solution for the *governance* of smart ships lies in a return to the Roman paradigm of **Risk Distribution**. The *Lex Rhodia*, with its logic of *distributive Strict Liability* (those who benefit, not those who are at fault pay), offers the ideal legal "source code" to regulate the shipping of the future, guaranteeing the economic and ecological sustainability invoked by the most recent maritime policy analyses [4].

2. Dogmatic Engineering: The Construction of Solidarity through *Locatio Conductio*

The genius of the classical jurists (Servius, Labeon and Paul's synthesis in D. 14.2) lies in the ability to build a structure of obligatory solidarity using the bricks of ordinary contract law.

2.1. The legal nature of the *Communio Incidens*

The Roman doctrine has questioned the nature of the bond that binds the merchants on board. There is no *societas* between them (the *affectio societatis* is missing). We are faced with a **communio incidens** (incidental communion), generated not by the will, but by danger (*periculum*). It is the shared risk that creates the right. As Servius observes, equity (*aequitas*) dictates that where the advantage is common, the detriment must also be common [11], [12].

2.2. The *Magister Navis* as *Clearing House*: Processuality of Recourse

The operation of the rule is guaranteed by a triangular procedural mechanism. In the absence of third-party insurance, the system uses the Captain (*Magister Navis*) as the central pivot:

1. Phase 1 (Sacrifice): The owner of the discarded goods acts *ex locato* against the Captain.

2. Phase 2 (Distribution): The Captain acts *ex conducto* against the owners of the rescued goods to collect the *tributum*.

3. Phase 3 (Compensation): The Captain redistributes the revenue to the injured party.

In terms of institutional economics, the Captain serves as the **Clearing House**. He reduces transaction costs by centralizing liabilities and ensuring enforceability thanks to the *ius retentionis* on the saved cargo [13].

3. Economic Exegesis: The Shipwreck as a Game Theory Laboratory

To understand the innovative scope of *Lex Rhodia*, it is necessary to adopt the formalization of Game Theory. The shipwreck is configured as a **non-cooperative game with imperfect information**.

3.1. Formalization of the model: the failure of "lawless" coordination

In the absence of a binding rule, let's imagine two merchants, A and B. To save the ship, you need to drop a load. The decision matrix has the following *payoffs*:

- **Cooperate Strategy (C):** Throw away one's load.
- **Defect Strategy (D):** Do not hold-out.

If both choose **(D, D)**, the ship sinks: the *payoff* is catastrophic (-100). If A chooses **C** and B chooses **D**, A loses everything (-100) and B saves everything (100). B acts as a *Free Rider*. Since every rational agent fears that he is the only one to sacrifice himself, the dominant strategy is **to Defect**. The result is balance **(D, D)**: shipwreck. We are facing a market failure due to infinite transaction costs [14], [15].

3.2. The intervention of the norm: modification of the Matrix and Nash Equilibrium

The Roman institute intervenes directly on the structure of incentives. The *tributum mechanism* introduces an *ex post redistribution rule*. If A throws the load (C) and B saves it (D), the law requires B to compensate A. The new matrix makes strategies economically indifferent. By eliminating the *Free Rider advantage*, the resistance to the jet vanishes. *Lex Rhodia* transforms a negative-sum game into a guaranteed coordination game, generating a **cooperative Nash Equilibrium** that coincides with the Pareto Optimal [18].

4. Institutional Path Dependence: From the Middle Ages to Artificial Intelligence

The epistemological validity of an institution is measured by its resilience. *Lex Rhodia* represents a case study of *institutional path dependence*.

4.1. The Medieval Evolution: *Lex Rhodia* as a Corporate Risk Management Tool

In the maritime republics, the rule ceased to be a mere emergency rule to become the basis of corporate *Risk Management* [2]. In the Genoese and Venetian

companies, the principle of contribution evolved from an *ex post* mechanism to an *ex ante* calculation tool for the allocation of business costs, definitively welding the link between maritime risk and insurance mutuality [3].

4.2. Common Failure in the XXI Century: The *Ever Given* Case

Today, global trade is governed by the **York-Antwerp Rules (YAR)** [17]. Rule "A" on Common Failure is a modern translation of the Digest. The vitality of the mechanism emerged in March 2021, when the container ship *Ever Given* blocked the Suez Canal. The shipowner declared the Common Failure and the owners of the 18,300 containers were refused the delivery of the cargo until a proportional deposit was paid. Without this institution, the shipowner alone would have faced costs of over 500 million dollars, risking insolvency.

4.3. *Prudentia* Algorithms: *Lex Rhodia* as a Model for Autonomous Ships (MASS)

The ultimate frontier of navigation is represented by self-driving ships. The absence of a human "Captain" makes *fault-based* liability inefficient [6], [10]. An artificial intelligence programmed to maximize the ship's salvation will make utilitarian choices just like the *Roman Magister Navis*. *Lex Rhodia* provides the ideal model of **Strict Distributive Liability**: the "culprit" (the algorithm?) is not sought, but the cost is automatically divided among the beneficiaries. As highlighted by Chen [5] and Mwakisoma [9], this logic is the only one capable of managing the allocation of responsibilities in complex systems where the human agent disappears.

5. Conclusions: The eternal algorithm of necessary solidarity

5.1. *Lex Rhodia* as a "Legal Invariant"

At the end of this investigation, the *Lex Rhodia* turns out to be a "legal invariant". The same risk-sharing algorithm that governed the transport of Egyptian grain today holds up global logistics chains. This resilience proves that Roman jurists had intercepted a fundamental law: in high-risk systems, absolute ownership is an obstacle to survival.

5.2. Beyond Guilt: The Roman Model for the AI Age

The projection of the institute into the scenario of *Autonomous Ships* (MASS) allows us to advance a bold thesis: Roman law is better equipped than nineteenth-century dogmatics to manage AI. While civil law seeks psychological guilt, Roman *prudentia* reasons in terms of **objective allocation of risk**. If the algorithm acts for the common salvation, everyone must pay. It is the only way to prevent technological innovation from getting bogged down in litigation over machine liability.

5.3. A Utilitarian Ethics for the Global Market: The *Consortium* as a Survival Imperative

In the final analysis, the *Lex Rhodia de Iactu* transcends its nature as a maritime institution to rise to a universal paradigm of civil coexistence. It gives us a disruptive political message: the market, left to its centrifugal forces alone, does not possess the antibodies necessary to resist catastrophe. Competitive atomism, which celebrates the individual as a self-sufficient monad, fails miserably in the face of the *vis maior*. When the storm rages, Adam Smith's "invisible hand" risks becoming the hand of a castaway if it is not guided by the *firm hand* of law that imposes cooperation.

The lesson of Paul and the Severan jurists is that solidarity is not an ethical luxury, nor a movement of Christian charity *ante litteram*, but a **structural necessity**, a categorical imperative of an economic nature. The *tributum* — the sacrifice of a part of one's own assets to reimburse the damage of others — represents the **rational price of security**. It is the insurance premium that civilization pays to neutralize chaos.

In a contemporary world exposed to increasingly frequent "systemic shipwrecks" — from global financial crises to pandemics, from *supply chain* collapse to the climate emergency — exclusive proprietary logic shows its rope. The claim to save oneself, armoring one's own borders or budgets while the common "ship" takes on water, is not only immoral: it is, in the light of Game Theory, **strategically stupid**.

Recognizing in *Lex Rhodia* the "source code" of our juridical culture means accepting the profound anthropological truth that Rome had codified: vulnerability is a common condition. The greatness of the Roman legal genius does not lie in having denied misfortune (*casus*), but in having transformed it, through the technique of law, into a formidable opportunity for cohesion (*consortium*). The etymology itself enlightens us: *con-sors*, "to share the same fate". The juridical norm transforms blind fatality into a bond of objective brotherhood. It reminds us that, in the risky adventure of history — whether conducted on wooden galleys, on steel container ships or on vessels governed by algorithms — the salvation of one is inextricably, technically and ontologically linked to the contribution of all.

Thus, the *Lex Rhodia* remains the timeless beacon of a civilization that rejects the barbarism of "save yourself if you can". It affirms, with the quiet force of legal reason, that the only way not to be victims of chance is to become, together, architects of the common destiny.

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OVERVIEW OF ARTIFICIAL INTELLIGENCE-BASED TECHNOLOGIES: LEGAL, ETHICAL AND ECONOMIC CHALLENGES IN THE CONTEXT OF HUMAN RIGHTS AND LIABILITY

Roxana-Daniela PAUN ¹

¹ *Spiru Haret University, Faculty of Legal Science and Administrative Sciences, 24 Berceni Road, District 4, Bucharest, Romania, Phone: +021. 455.10.38, E-mail: roxana.paun@spiruharet.ro*

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Abstract

Artificial intelligence is a challenge of the new decade, more current than ever, that can help man or replace him. The decision belongs to those who decide, through their research, how much independence new human-created technologies create. Beyond the strictly scientific aspects that invented and developed artificial intelligence (AI) some aspects of ethics, morality, and last but not least legal. There are already debates on this topic online, where opinions are divided between conservative issues and innovation at any cost. Fear against new can resist, although the man is already accustomed to assistance (Shazam, Waze, personal assistants). If AI is already replacing the musician who performs, for example, Beethoven's symphonies, how far can this technology evolve and what would be the limits to which man cannot replace it? The present study proposes a brief analysis of some legal aspects that must be considered with the large-scale application of AI-based technologies, from the perspective of respect for human rights and fundamental freedoms, on the one hand, but also responsibility in AI. (who is responsible and what would be the limits of liability for AI)

Keywords: *illegal behavior, fraud, black market, artificial intelligence (AI)*

JEL classification: K 420, K2, K 240

Introduction: European legislative background:

On 15.05.2018, the European Commission adopted the Communication entitled A renewed European agenda for research and innovation - Europe's chance to shape its future. A communication on the future of connected and automated mobility in Europe is also to be adopted. In both communications, artificial intelligence plays a key rol²

In the light of the development of the Internet of Things, the European Commission is committed to examining the possibility of adapting the current legal framework so that it considers new technological developments (including robotics, artificial intelligence or 3D printing), in particular from a civil liability perspective. The Commission then relied on the ability of artificial intelligence to increase growth and productivity, estimating that the combined economic impact of automation of knowledge, work, robots and autonomous vehicles will reach a value of between EUR 6.5 trillion and EUR 12 trillion annually by 2025.

The Council of the European Union recognizes that innovations, including data science, artificial intelligence, or the Internet of Things, could bring new development solutions and encouraged their promotion and local capacity building. The Council also appreciated the role of artificial intelligence in market developments but supported the need to ensure adequate social protection and equal opportunities for all.³

In May 2017, the **European Economic and Social Council (EESC)** adopted an own-initiative opinion on the impact of artificial intelligence on the digital single market, production, consumption, employment, and society. In it, the EESC pointed out that the artificial intelligence market is currently around \$ 664 million and is expected to grow to \$ 38.8 billion by 2025. Given the potential of artificial intelligence for the benefit of humanity, but also its cross-border impact.

² Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions - Artificial Intelligence for Europe: COM (2018) 237

³ <http://data.consilium.europa.eu/doc/document/ST-14435-2017-INIT/ro/pdf>

Among the EESC's recommendations are: the development of artificial intelligence only under permanent human control; the adoption of a code of ethics for the development, implementation and use of artificial intelligence; making investments in education in order to work with artificial intelligence, but also to develop skills that cannot be taken over by artificial intelligence; the development of artificial intelligence applications that can benefit society, which promotes the inclusion and improvement of people's lives, both in public and private, as well as the evaluation of EU legislation and regulations in six areas of interest: transport, dual-use systems, civil liberties, security, health, energy, areas influenced by the evolutions of robotics, cybernetic-physical systems and artificial intelligence.⁴

The conclusions of the European Council of 19 October 2017 called for an urgent approach to artificial intelligence and block chain technologies, while respecting personal data, digital rights, and ethical standards. In this regard, the European Council called on the European Commission to **present a European approach to artificial intelligence by early 2018** and the necessary initiatives to **strengthen the framework conditions**, in order to explore new markets and reaffirm the leadership of its industry.

At the declarative level, the EU supports the development of AI: In this regard, the Union invests EUR 1.5 billion in artificial intelligence through Horizon 2020. Existing public-private partnerships can attract another € 2.5 billion by 2020. Member States and the private sector should make similar investment efforts, so that by the end of 2020 the total value of investments will be over EUR 20 billion across the Union.

Union funding covers projects in key areas of application, such as health, connected and automated driving, agriculture, manufacturing, energy, state-of-the-art internet technologies and public administrations (including justice). The funding will also strengthen European advantages in the field of artificial intelligence / integrated robotics.

For the post-2020 period, the Commission proposes to stimulate investment in: improving the pan-European network of centers of excellence in artificial intelligence; research and innovation in areas such as transparent artificial intelligence, unsupervised machine learning, energy and data efficiency; additional digital innovation centers / testing and experimentation facilities; exploiting joint procurement in the field of innovation and creating a data sharing support center that will be closely linked to the on-demand artificial intelligence platform.

⁴ Extract from doc idem 2

- **Large volumes of data are needed for the development of artificial intelligence.** To this end, the EU is committed to facilitating access to data, in particular non-personal data, such as traffic data, meteorological, economic and financial data or trade registers, industrial data, scientific data, as well as genomic and other data in the field of health, in full compliance with the legislation on the protection of personal data.
- **Preparing for socio-economic change involves:** developing basic digital skills, as well as complementary skills that cannot be replaced by any kind of artificial intelligence; assisting people whose jobs could undergo major transformations or disappear as a result of automation, robotics and artificial intelligence; training as many artificial intelligence specialists as possible. As such, the Commission has adopted a skills agenda in Europe, recommending to Member States ways to improve it through a skills guarantee, as well as an action plan on digital education that aims to promote digital skills and competences for all citizens.
- **Ensuring an adequate ethical and legal framework**

Although the European Union has a strong and balanced regulatory framework on which it can be based the development and use of artificial intelligence, it does not rule out the risk of errors or the use of artificial intelligence for negative purposes.

As such, the Commission intends to bring together all stakeholders so that, by the end of the year, ethical guidelines on artificial intelligence can be developed, in compliance with the Charter of Fundamental Rights of the European Union. The aspects considered concern: the future of work, equity, safety, security, social inclusion, algorithmic transparency.

It is also necessary to reflect on the adequacy of existing rules on security issues and liability issues.

From those summarized above, taken from the European Commission Communication on Artificial Intelligence for Europe: COM (2018) 237, we can see that there has been a widespread concern since 2018, that all structures, levers have been created, exceeding the declarative level for the delegation to the Member States of the responsibilities related to the implementation of the measures necessary for the accelerated introduction of AI, discreetly drawing the attention of the Member States to issues concerning "the future of work, equity, safety, security, social inclusion, algorithmic transparency".

Legislatively, the “European Parliament Resolution of 16 February 2017 containing recommendations to the Commission on civil law rules on robotics”⁵ was adopted, by which the Parliament requested the Commission to present, pursuant to art. 114 TFEU, a proposal for a directive on the rules of civil law on robotics, considering several recommendations.

These recommendations include the following: the existence of a common Union-wide definition for different categories of cyber-physical systems, autonomous systems and autonomous and intelligent robots; the creation of a European system for the registration of advanced robots in the internal market; guaranteeing the exercise of human control over smart devices at all times and paying special attention to the possibility of creating an emotional connection between man and robot - especially in the case of vulnerable groups (children, the elderly or people with disabilities).

The principle of mutual recognition in the cross-border use of robots and robotic systems; strengthening financial instruments, including public-private partnerships to support robotics research projects; the implementation of a clear, rigorous and effective ethical framework for the development, design, manufacture, use and modification of robots, complementing the existing national and Union acquis; but also the creation of a European agency for robotics and artificial intelligence, in order to provide the technical, ethical and regulatory knowledge necessary to support relevant public actors; as well as supporting a cross-cutting and technology-neutral approach to intellectual property, applicable to the various sectors in which robotics is used; These are some of the most important recommendations made by the EU Parliament to Member States.

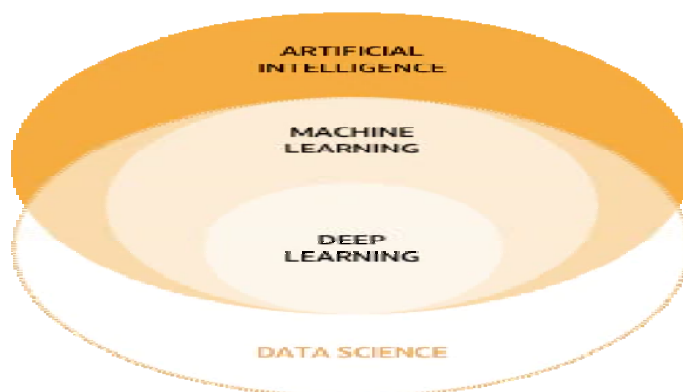
Ensuring a high level of security, protection of personal data and privacy in communication between humans and robots is the latest recommendation, which confirms that AI, included in robots can endanger life, human security, if they are out of control, if they are used by characters hostile to humanity.

However, recognizing the technological evolution that humanity must face, the European Commission must also take into account the consequences of all possible legal solutions, such as: the establishment of a compulsory insurance scheme for certain categories of robots; creating a compensation fund; creating a robot-specific legal personality so that at least the most sophisticated autonomous robots can have the status of an electronic person responsible for repairing the damage they cause.

⁵ https://www.europarl.europa.eu/doceo/document/TA-8-2017-0051_RO.html?redirect

Another regulation of AI is ⁶Regulation (EU) 2019/1150 of the European Parliament and of the Council from the 20th of June 2019 on the promotion of fairness and transparency for undertakings using online intermediation services.

Conceptual elements: Intelligence is defined⁷ as the ability to understand easily and well, to grasp what is essential, to solve new situations or problems based on previous experience; cleverness. And artificial intelligence is, according to the same dictionary, the ability of evolved technical systems to achieve quasi-human performance. AI is explained in the diagram below⁸:



Source: Author's compilation

Controversies and divergent opinions: in the specialized literature in Romania, different approaches have already appeared even among legal specialists. Examples are the articles “Artificial Intelligence vs. Human creativity: Perspective on copyright”⁹, the use of AI in law¹⁰, or “The impact of artificial intelligence on the legal professions”¹¹ av. Gabriel-Valeriu Pașcui Cluj Bar.

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⁷ <https://dexonline.ro/definitie/inteligenta>

⁸ <https://www.oracle.com/ro/artificial-intelligence/what-is-ai/>

⁹ Article published on 10.05.2021, Marian-Constantin IONESCU, Alexandra-Maria SILION, <https://www.juridice.ro/730436/inteligenta-artificiala-vs-creativitatea-umana-perspectiva-asupra-drepturilor-de-autor.html>

Beyond the different approaches and opinions on the role and importance of AI in modern human life, the legal, deontological, sociological, moral aspects, respectively the interdisciplinary approach is the challenge for the current moment, turning, in my opinion, on which depends the very survival and evolution of mankind, as a whole.

AI regulation in France and Romania, elements of comparative law:

The CNIL (French Data Protection Supervisor) said in a report that "the debate over whether or not it is necessary to regulate artificial intelligence overlooks the fact that algorithms have been regulated for about 40 years" and gives the following example: the first data protection law in France dating back to 1978.¹²

In Romania, the first data protection law appeared in 2001 (Law 677/2001) which contained, since then, precise aspects regarding the regulation of artificial intelligence. Therefore, we can see that Romania has had legislation on AI for 19 years. The law was repealed in 2018.

As of May 25, 2018, throughout Europe, including Romania, the General Regulation on Data Protection that repealed the old directive¹³, which, through Article 22, specifically regulates artificial intelligence and human rights in the face of exclusively automatic machine decisions.¹⁴

There are other provisions in the RGPD that are applicable to artificial intelligence, such as the right to be informed about the algorithms used (art. 13) - artificial intelligence, the right to rectify or delete your data from a computer system, the right to have access to their own data from a computer system, etc. RGPD is not a law that only protects data protection in the abstract, but by ensuring data protection it contributes to the respect of other fundamental rights and freedoms.

¹⁰ <https://www.wolterskluwer.com/ro-ro/expert-insights/interviu-viitorul-avocaturii-inteligenta-artificiala-provocare-sau-amenintare>

¹¹ av. Gabriel-Valeriu Pașcui Baroul Cluj- https://www.unbr.ro/wp-content/uploads/2020/09/01_Gabriel-Valeriu-Pascui-Impactul-inteligentei-artificiale-asupra-profesiilor-juridice.pdf

¹² Victor Demiaux, CNIL, How can humans keep the upper hand? The ethical matters raised by algorithms and artificial intelligence the ethical issues, decembrie 2017, p. 45.

¹³ Directive 95/46 / EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals regarding the processing of personal data and on the free movement of such data, OJ L 281, 23.11.1995, pp. 31-50

¹⁴ See also Ruxandra SAVA, When the decision is made by the car... About profiling, rights, and balance in a digital universe, available at legal, link accessed 11.11.2020.

Of course, the RGPD does not use, in a concrete way, the term “artificial intelligence”, but the reference to AI is indirectly deduced from the interpretation of the phrase used in the provisions of art. 22, respectively “decision based exclusively on automatic processing”.

A synthesis of RGDP regulations is made¹⁵:

1. 22 The RGPD prohibits a machine from making decisions about a person (a decision without human intervention) when that decision may have a legal or significant impact on man.
2. 13 para. 2. Lit. f) of the RGPD says that the person has the right to be informed about the logic used algorithm and about the consequences of this processing by intelligent systems.
3. 22 para. (3) The RGPD establishes in favor of the data subject two rights regarding the decisions taken by the AI: the right to challenge the decision and to request human intervention.
4. 22 and recitals 71 to 72 of the RGPD state, inter alia, that AI can be implemented with adequate safeguards for the data subject to avoid the less pleasant consequences for fundamental rights and freedoms.
5. 22 and recitals 71 to 72 of the RGPD protect children in particular.
6. 22 and recitals 71 to 72 of the RGPD protect man against discrimination by AI.

Summarizing, more and more the authors who analyze the subject AI find, for example as it did in his paper, that "RGPD focuses only on artificial intelligence that processes personal data, excluding artificial intelligence that processes exclusively non-personal data, and secondly, there is a problem with the effectiveness of this law because there is a power imbalance between those who control such AI systems and those whose data are processed, as the latter may have obstacles in and exercise rights such as the right to appeal or the right to obtain human intervention."¹⁶

And from here we can see that legal issues cannot be treated separately from ethical issues, as the whole subject requires a multidisciplinary approach, for legal regulation to be effective and truly covering the entire current issue of AI, robotics and in general everything that involves replacing man with the robot, or the machine equipped with AI, to make decisions instead of man, not just to carry out man's orders, or to assist him in his daily work.

¹⁵ <https://legalup.ro/inteligenta-artificiala-romania/>

¹⁶ Victor Demiaux, CNIL, op.cit., p. 45

Areas where AI is already present and will be used more and more.

AI is also a challenge for education, especially in the current context, when learning is computer-assisted, when teachers look for new methods of transmitting information in a different way than used until, for education and training to become attractive, adapted to the levels of to whom it is addressed. Starting from the 4 C's: Critical Thinking, Communication, Collaboration and Creativity, the skills that need to be activated more than ever in schools are the ones that will prepare today's students, tomorrow's adults to operate with AI!¹⁷

I share the point of view of the author of the article, according to which "Artificial intelligence saves us from repetitive or meticulous tasks. She leaves us more time for the others, she doesn't cancel our jobs. On the contrary, now is the time for every person to diversify their abilities as much as possible, to be prepared in a way that is as versatile as possible in their field. Artificial intelligence gives us space and time to excel and evolve. The reason is that it does not replace us with robots but makes us super people."¹⁸

AI has already entered many areas, in which man has already been replaced:

„- in Social Media. Customer support has already been associated with algorithms, such as when you encounter a bot when opening a private message with a Facebook page. This can be a bot for a restaurant that directly suggests questions: do you want to make a reservation? Do you want to know our schedule? Do you want to know if we have vegetarian food? For how many people? From what time? On what name? Have a nice day!

- in eliminating bureaucracy. In the medium and long term, the physical documents will be digitized, and we will move from the folder file to the cloud folder. This will not only affect individuals, but especially any legal institution that processes documents, including retroactively.

- in Marketing & Internet. Database segmentation will never have been more accurate, more targeted ads for each user. That's why we always review ads on the sites we've visited before. And yet, a lot of costs are reduced through this process.

- in Financial. Analyzes, especially in such a rigorous field, based on figures, reports and trends will bring much more progress in our lives, being able to predict much faster and report much simpler. In addition, robots in the banking sector have gradually replaced the employee at the counter, the cashier ... etc.

¹⁷ <https://upromania.ro/blog/de-ce-inteligenta-artificiala-nu-poate-inlocui-oameni/>

¹⁸ <https://upromania.ro/blog/de-ce-inteligenta-artificiala-nu-poate-inlocui-oameni/>

- In physical work industries, where human accidents can be avoided, or the number of jobs in which physical work can be reduced.

- recruitment and human resources. Just as we receive targeted ads specifically on the Internet (if you don't believe us, look at the ads that someone of the opposite type receives, with a different age and occupation than you), we will also receive automatically returned reports with profiles suitable for our search."¹⁹

The evolution of AI towards the machine with consciousness is already a reality confirmed by Prof. David Chalmers from New York University, an expert in mental mechanisms, who states that GPT-3 shows signs of being conscious. "If I'm open to the idea that a worm with 302 neurons is conscious, I'm also open to the idea that GPT-3, with 175 billion parameters, is also conscious."²⁰

The GPT-3 machine learning system has attracted worldwide admiration for its remarkable ability to generate text with minimal human interference, and today this highly sophisticated technology is showing signs of awareness. (according to the same source)²¹

In the same context, according to the Financial Times, this form of AI can process 45 billion times more words than a person perceives in his entire life.²²

It is obvious that AI, although initially created by man, can surpass it when technology evolves and develops, and at first glance the robot will be victorious, does not sleep, does not get sick, has no creative blockages, and can complete a task in a few seconds.

Other fields where AI has already been successfully experienced: a: in art, b: in journalism, c. Film and theater screenplays.

¹⁹ <https://upromania.ro/blog/de-ce-inteligenta-artificiala-nu-poate-inlocui-oameni/>

²⁰ See: art written by Anca Grădinariu on 01.01.2021: <https://www.digi24.ro/stiri/sci-tech/revolutia-ai-un-om-de-stiinta-sustine-ca-inteligenta-artificiala-a-devenit-constienta-1424650>

²¹ GPT-3 is a model of artificial intelligence that excels in language. This system developed by OpenAI generates text with minimal human intervention, at an extremely fast pace. It can recognize and reproduce word patterns, even before estimating what will follow, thanks to its incredible power obtained with the help of 175 billion linguistic parameters.

²² Sam Altman, CEO of Open AI, said: "We have evidence that it is the first forerunner of general artificial intelligence, a system that will support many, many different applications and can improve any type of software we build. I think through him we see a vision of the future. "I will not claim to have all the answers yet, but I am happy to consume my energy contributing to this evolution," added Sam Altman. Idem 20

a: in art: It has already been shown that AI can even become an artist: “an article on the Singularity Hub portal reveals a new artist or designer - whether it's the visual arts, fashion, music or literature - even fans of his work, he is followed on social media, his new releases are eagerly awaited and then the works are discussed with friends. After careful documentation, it is found that there is no online information about the artist's past. Surprise: the much-loved artist is not a person in the flesh, but artificial intelligence. This is what happened to the clients of Art.Lebedev Studio, a multidisciplinary design company in Russia. The people here claimed that a computer designer was a human person, and no one got caught. They also gave this AI creature a resonant name - Nikolai Ironov - and included it in more than 20 different projects that involved building a brand logo and fabricating a brand identity. Some of these works have aroused considerable interest from the public and the press and have provoked discussions in online communities, thanks to their unique style.²³ Fans were shocked to discover that this artist is not human, but a creation of artificial intelligence.

b: in journalism: The replacement of the journalist already seems an experienced reality, confirmed by researcher Nina Schick, author of the book "Deep Fakes" and "The Infocalypse", warned that "*deepfake*" *technology*, which means fake content with artificial intelligence, has become so realistically that no other computer can detect it. "People will never be able to detect these deepfakes. To the naked eye, they are perfect. Now, synthetic content generators have evolved so much that not even artificial intelligence will be able to tell the difference between a real and a fake video," said the researcher, quoted by Daily Star Online.²⁴ "That's what happens," she says, "and with texts written by artificial intelligence. Nobody distinguishes them from those written by journalists".

c. film and theater screenplays. There is an algorithm for anything, even for writing novels or screenplays. With his help, a short film was made that, even if it is not worthy of an Oscar, opens unsuspected possibilities. Will this mean the end of creativity or pushing it into a higher realm, that of artificial intelligence? It remains to be seen. The company OpenAI wrote a short film script, which is not really Oscar, but not very bad. Moreover, it has a reversal in the end.

GPT-3, Open AI's text-generating algorithm, has been making a lot of noise since its launch in June 2021. It was used to post comments on Reddit, to conceive a

²³ <https://www.digi24.ro/stiri/sci-tech/revolutia-ai-un-om-de-stiinta-sustine-ca-inteligenta-artificiala-a-devenit-constienta-1424650>

²⁴ Idem 23

satirical poem about Elon Musk, and even to compose an entire article for The Guardian. When the system learned to automatically complete images without being specially trained to do so, to translate and solve math problems, some speculated that GPT-3 may be the launch lamp for a system general artificial intelligence. Even screenwriters can be replaced by AI. An example is the 3-and-a-half-minute short film in which a man knocking on a woman's door tells him about the accident in which he was involved. It's hard to anticipate the story, and viewers are surprised by what could be considered an unexpected ending. The students who made the film used a tool derived from GPT-3, called ShortlyRead. They wrote the first lines, then let the artificial intelligence go wild. Everything that follows is based on 175 billion parameters - that is, the associations that the algorithm draws between words and phrases, depending on the data with which it was trained.

Although critics have commented that the story is a bit strange, they have also acknowledged that there are worse short films written by people! The application is meant to inspire writers who are out of inspiration and can guide them to take their stories in a direction they would not have anticipated, beyond the ethical aspect, namely how much a writer can use a program before it is considered to cheat, to challenge the legal issue of copyright. How much more is the original creation and how many combined algorithms of a software created by man and developed by the system, then automatically. It's not the first-time screenwriters have used a computer. But this is the first time that an artificial intelligence entity manages to write a film without being specially trained to do so. And if GPT-3 can convincingly write a screenplay, what else can it do?

It is undeniable the need to modernize the current society by using technology that has taken in recent years a real and very useful to man. The use of AI in marketing and even in company management is demonstrated by Mailchimp²⁵, which uses AI to allow companies to invent marketing campaigns without human contribution. Adobe has launched Sensei²⁶, an AI design assistant. Adobe Sensei uses AI and machine learning to make your task easier, helping you create effortlessly, make informed decisions, and formulate marketing goals for better results.²⁷

²⁵ Mailchimp is an American marketing automation platform and email marketing service used by companies to manage their email lists and create email marketing campaigns and automations to send to customers, according to the Wikipedia definition

²⁶ Sensei is a Japanese word that, in direct translation, means "person born before another." In common parlance, it means "master" or "teacher." <https://ro.wikipedia.org/wiki/Sensei>

²⁷ <https://www.adobe.com/ro/sensei.html>

One-on-one personalization in marketing is becoming a reality, offering, for better results: organizing and managing materials to improve positive return on investment (ROI), engaging the public with personalized offers, subject lines and delivery alignment, the choice more appropriate experience for achieving goals.

The implementation of "Industry 4.0" in the company's management for process automation and data analysis is the reality of the business environment that wants to remain on the market in the current context. Thus, according to a 2018 survey, 91% of business leaders believe that without digital transformation, their company has a high chance of failure. However, only 54% of companies have a strategy in this regard and only some of them consider introducing a BI (business intelligence) system.²⁸

MP Varujan Pambuccian claimed that "AI is a very good marketing concept, which managed to bring funding"²⁹, and among the conclusions of that debate was the finding that AI does not blindly replicate what it has learned, as it offers a collection of algorithms that can search in very large volumes of data, "deep learning" being considered an improvement of this type of algorithms. However, until now, AI cannot decide, except on the basis of algorithms, rules formulated by a person."³⁰

The challenge for humanity is related to the need for human change that can be and has even been replaced in some situations where routine is applicable, so it will replace many trades based on algorithms that the robot will perform instead of man.

Conclusions

AI continues to grow rapidly around the world, arousing both enthusiasm and concern. Legal files, even providing legal assistance already uses AI, news articles, political analysis, medical assistance in heavy operations, but also surgeries performed on the robot "loaded" with medical software, which will run the implanted program, without entering panic if something unforeseen happens during

²⁸ <https://dyntellbi.ro/inteligenta-artificiala-in-managementul-companiei/>

²⁹ On the debate "How smart is" Artificial Intelligence? ", Which was also attended by Alexandru Bălan, research director at Bitdefender, and Vlad Marincea, one of the founders of the startup InsightOutAnalytics. The debate took place within the series "Romania in Europe", a HotNews.ro initiative, supported by the Konrad Adenauer Foundation. - July 26, 2021- https://www.hotnews.ro/stiri-romania_in_europa-24940655-cat-inteligenta-artificiala-inteligenta.htm- Gabriel Bejan, HotNews.ro.

³⁰ Idem 29

the operation. Its uses are so numerous that even the creators of the algorithm had doubts whether or not to launch the first version!

Alexis Kirke, an algorithm³¹-based media analyst and film director, believes that we need to get used to the idea that we will use computers more and more in the creative process, especially in cinema. Actors even began to be replaced in some creations that started from the computer game model and later developed, to test the market and to see the reaction of film consumers, if they can become the future in making films.

The super-technological future incites some, as a curiosity, unconditionally accepting any mixture of this technology in their lives, others scare and realize the specifics of this future: technology replaces the human soul, which becomes insensitive to the suffering of those around him. The risk of losing our soul in the future exists, this being the very challenge of the future! Aristotle said that **"Love must be conceived as one soul in which two bodies live."**, and a French proverb: **"Hope is the dream of the awake soul."**

Every spiritual activity leaves traces, not only in the soul but also in the body; if aplopexia or age destroy bodily activity, does it mean that the fire of the soul must therefore be extinguished? a rhetorical question of the German writer Jean Paul Fr. Richter³² urges reflection and a wise decision at this crossroads of humanity! The contamination of the soul is done only between souls of the same kind, said Nicolae Iorga³³. How AI will interfere with the current life of man, but especially

³¹ "There is already consistent experience in the field that has been codified by writers, producers, directors and so on. Do you want to reduce the number of adverbs or adjectives in your script? Do you want to make sure that the characters speak differently from each other? Do you want to generate an alternative rewrite, with fewer clichés? There is an algorithm for all this! " (...) "The future will also offer us the feature film generated by GPT-3. And even if it doesn't win the first Oscar, all screenwriters paid millions in Hollywood should be afraid of AI competition."

³² Johann Paul Friedrich Richter (known as Jean Paul), (1763-1825), German writer who imposed the novel on German literature. His work alternates the real plan with the imaginary one, the acid irony with the lyrical effusion, a remarkable stylist, creator of subtle suggestions, atmosphere and portraits of great sensitivity. - https://ro.wikipedia.org/wiki/Jean_Paul

³³ Nicolae Iorga 1871–1940 historian, literary critic, documentary filmmaker, playwright, poet, encyclopedist, memorialist, art historian and philosopher of history, minister, parliamentarian, prime minister, university professor and Romanian academician. George Călinescu said: "Iorga played in Romanian culture, in the first decades of the twentieth century," the role of Voltaire".

how prepared humanity is to give up some activities that were performed exclusively by people in favor of AI, only the future will show us which of the current predictions will come true!

Reflecting on Cicero's words: "A room without books is like a body without a soul", we can draw a parallel: the robot created by AI is like a room full of books, but without the soul. Can AI have a soul? It is a question still unanswered. The future will prove to us, depending on man's decisions and how far AI can be used for the good of mankind and not to the detriment of man, for his total replacement! Albert Camus said that "without work, all life goes to rot. But when work is soulless, life suffocates and dies."

The uncertainty of how AI will evolve in the future also creates dilemmas for jurists regarding the methods of regulating how AI interferes with human life, in the current legal order, regardless of the legal systems currently existing on the planet.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE (AI) ON ACCOUNTANTS AND ACCOUNTING PROFESSION

Adetunji Abdul-Azeez ADEREMI¹, Ayodele Joseph ILORI², Busari Ganiyu ADENIRAN³

¹ *Osun State University, Faculty of Management Sciences, Department of Accounting, Banking and Finance, Okuku Campus, Osun State, Osogbo, Nigeria, Phone: + 08107976419, E-mail: azeezgoodness66@gmail.com*

² *Federal University Oye-Ekiti, Department of Accounting, Oye-Are Road, Oye-Ekiti, Ekiti State, Nigeria, Phone: +2348165396888, E-mail: iloriayodele70@gmail.com*

³ *Yaba College of Technology, School of Management and Business Studies, Department of Accountancy, Herbert Macaulay Road, Yaba, Lagos State, Phone: +234-7037431055, E-mail: ganiyuadeniran19@gmail.com*

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Abstract

The advent of Artificial Intelligence (AI) is revolutionizing the accounting profession, transforming traditional practices and redefining the role of accountants. This study investigated the impact of Artificial Intelligence (AI) on the accounting profession, examining the benefits, challenges, and future implications of AI adoption in accounting. A mixed-methods approach was employed, combining both quantitative and qualitative data collection and analysis methods. A survey was carried out on the selected accounting professionals and 20 in-depth interviews with accounting experts and professionals were conducted to gather data. The results showed that AI adoption in accounting is becoming increasingly prevalent, with benefits including improved efficiency, enhanced accuracy, and increased productivity. However, challenges such as job displacement, data privacy and security concerns, and lack of skills and training were also identified. The study's

findings suggest that accounting professionals need to acquire new skills to remain relevant in an AI-driven accounting profession. The study contributed to the existing literature on AI adoption in accounting and provides insights for accounting professionals, firms, and regulatory bodies.

Keywords: *artificial intelligence, accounting profession, technological innovation, future of work, professional development.*

JEL Classification: M41, M15, O33, J24, L86

1. Introduction

The accounting profession has long been characterized by its reliance on precision, accuracy, and attention to detail. For decades, accountants have played a vital role in ensuring the financial integrity and transparency of organizations, leveraging their expertise to provide critical insights and guidance. However, the advent of Artificial Intelligence (AI) is transforming the accounting landscape, challenging traditional practices and redefining the role of accountants.

The integration of Artificial Intelligence (AI) in accounting is not a distant prospect, but a present reality. Automated accounting systems, machine learning algorithms, and natural language processing are already being harnessed to streamline financial reporting, enhance audit procedures, and optimize tax planning. As AI technologies continue to evolve and improve, they are poised to revolutionize the accounting profession, unlocking unprecedented efficiencies, accuracy, and strategic insights.

Meanwhile, the impact of AI on the accounting profession extends far beyond mere technological innovation. It raises fundamental questions about the future of work, professional development, and the very essence of accounting expertise. As AI assumes routine and repetitive tasks, accountants must adapt to new roles, acquiring skills that complement the capabilities of machines. Moreover, the increasing reliance on AI-generated data and insights necessitates a re-examination of professional ethics, regulatory frameworks, and the notion of accountability itself.

This paper seeks to explore the transformative impact of AI on the accounting profession, examining both the opportunities and challenges associated with its adoption. Through a comprehensive review of existing literature, case studies, and expert insights, this research aims to provide a nuanced understanding of the future of accounting, highlighting the imperative for professionals to embrace AI-driven innovations while upholding the core values of the profession.

Despite the growing presence of AI in accounting, there is a scarcity of research that systematically examines its effects on the profession, including job displacement, skill shifts, and changes in professional roles. The integration of AI raises critical ethical concerns, such as data privacy, algorithmic bias, and accountability. As AI transforms the accounting profession, regulatory bodies must adapt to ensure that professional standards, laws, and guidelines remain relevant. The automation of routine accounting tasks threatens to displace certain roles,

while increasing reliance on AI demands that accountants acquire new skills to remain relevant.

In summary, the problem statement encompasses research gaps, practical challenges, and theoretical and conceptual issues that necessitate a comprehensive examination of AI's impact on the accounting profession. Therefore, the study: (i) examined the current state of AI adoption in accounting and its applications in various accounting tasks; (ii) investigated the benefits of AI adoption in accounting, including improved efficiency, accuracy, and productivity; (iii) identified the challenges associated with AI adoption in accounting, including job displacement, data privacy and security concerns, and lack of skills and training; and (iv) explored the future implications of AI adoption in accounting, including the potential for new business models, services, and skills.

2. Literature Review

2.1 Conceptual Review

The integration of Artificial Intelligence (AI) in the accounting profession has been a topic of increasing interest in recent years. This literature review aims to provide an overview of the current state of knowledge on the impact of AI on the accounting profession.

2.2 Artificial Intelligence: An Overview

Artificial Intelligence (AI) was originally proposed by John McCarthy in 1955 during the Dartmouth summer research project [1]. The original definition is the engineering and science to build intelligent machines that think and act like humans, carrying out deep learning and self-learning. Theoretically, it can mimic the human mind, draw conclusions, and be wise. AI is an emerging and comprehensive subject covering many fields, such as cyber metrics, management, informatics, logic, mathematics, and so on. The United States was the first to apply AI technology in accounting and financial management; since then, the academic community has carried out a lot of research and exploration on the application and practice of intelligent accounting [2]. AI may also cause a high unemployment rate for low-level accountants, high data breach risk, and lead to higher requirements for financial and accounting practitioners.

2.3 Overview of Accounting Profession

In the need to make use of scarce resources, gather wealth, and produce high quality of goods and services in a competitive economy, the accounting profession was born. In simple terms, the accounting profession is responsible for collecting, classifying, recording, summarizing, analyzing, and interpreting information to

users of financial statements. Accounting profession provides qualitative financial information about economic entities that is intended to be useful in economic decision-making.

2.4 The Impact of AI on Accounting Roles and Skills

Research has shown that AI will profoundly influence the professional trajectory of accountants, emphasizing technology proficiency, data analytics, critical thinking, and cross-functional collaboration. A study by [3] found that AI cannot fully substitute human expertise, but it will significantly change the roles and skills required of accountants. AI technology can improve work efficiency for accounting, as accounting work involves a lot of complicated data — handling them manually would take a lot of time. The application of AI in accounting can deal not only with simple data manipulation but also with more complex data analysis and mining tasks, making accounting work more intelligent and efficient.

AI technology can improve the quality of accounting information. In the past, accounting work involved data processed manually, and errors were inevitable, affecting the accuracy of accounting information. Furthermore, for complex accounting information, AI technology can also process, classify, and retrieve it according to its importance and quickly search for valuable data. This process is very objective, avoiding the distortion of accounting information as much as possible — which is almost impossible in the era of traditional accounting.

The adoption of AI in accounting can lead to cost savings and improved efficiency. However, it also raises concerns about job displacement, data privacy, and the need for accountants to acquire new skills. A literature review by [4] found that the current accounting and auditing literature lacks a comprehensive understanding of AI applications in the profession.

Artificial intelligence (AI) technology also introduces financial data security issues to the accounting industry. During the process of applying AI technology to accounting, most of the work is finished by computers through networks, which is bound to have an impact on the security of financial data.

2.5 Theoretical Frameworks

Several theoretical frameworks can be applied to understand the adoption of AI in accounting, including the Technology Acceptance Model (TAM), Task-Technology Fit Model, and Agency Theory.

Agency Theory

The agency theory has its beginning in economics theory [5, 6]. The principal (owners and shareholders) delegate decision-making power to the agent (Directors, Managers, and Management), who may pursue interests that are not necessarily in favour of the principal, leading to information asymmetry [7]. The domain of agency theory was gradually extended to the management area for determining cooperation between various individuals with different objectives in the firm, and goal congruency attainment [8]. In the 1980s, agency theory also appeared extensively in the auditing and accounting realms to determine the optimal

incentive contracting among different people and suitable accounting control mechanisms for monitoring their behaviors and actions.

Technology Acceptance Model (TAM)

This model, developed by [9], explains how users form attitudes and intentions towards using a new technology. In the context of AI adoption in accounting, TAM can help understand the factors that influence accounting professionals' acceptance and use of AI technologies.

Task-Technology Fit (TTF) Model

This model, developed by [10], examines the fit between tasks and technology. In the context of AI adoption in accounting, TTF can help understand how AI technologies can be designed to fit the tasks and needs of accounting professionals.

Diffusion of Innovations Theory

This theory, developed by [11], explains how new ideas and technologies are adopted and diffused within organizations and societies. In the context of AI adoption in accounting, this theory can help understand the factors that influence the adoption and diffusion of AI technologies within accounting firms and organizations.

Social Cognitive Theory

This theory, developed by [12], explains how people learn and adopt new behaviors through observation, imitation, and reinforcement. In the context of AI adoption in accounting, this theory can help understand how accounting professionals learn and adopt AI-related skills and behaviors.

AI Adoption Model

This model, developed by [13], explains the factors that influence AI adoption in organizations. The model includes factors such as organizational readiness, technological readiness, and environmental factors.

Accounting Profession Model

This model, developed by [14], explains the factors that influence the accounting profession. The model includes factors such as technological change, regulatory change, and demographic change. In conclusion, the literature review highlights the significant impact of AI on the accounting profession. As AI continues to evolve, it is essential for accountants and accounting firms to proactively adapt to these changes and invest in the development of new skills.

3. Methodology

This study explored the impact of Artificial Intelligence (AI) on the accounting profession, examining the benefits, challenges, and future implications. To achieve this objective, a quantitative method of data collection and analysis was employed. The study adopts a descriptive research design. The descriptive aspect involved analyzing existing literature and data on AI adoption in accounting, while the exploratory aspect focused on gathering insights from accounting professionals and experts. Data for the study was sourced from administered questionnaires to accounting professionals, focusing on their perceptions of AI's impact on the profession. Relevant data from existing studies, reports, and industry publications was also analyzed to provide context and support the findings. The study employed a purposive sampling strategy to select participants who are knowledgeable about AI adoption in accounting. The sample includes: accounting professionals (e.g., auditors, financial analysts, accountants); industry experts (e.g., consultants, thought leaders); and academics and researchers in accounting and related fields. The data analysis was conducted using SPSS software, involving both descriptive and inferential statistics.

Table 1. Descriptive Statistics Results

Variable	Mean	Std. Deviation	N
Age	32.5	5.2	100
Years of Experience	7.2	3.1	100
AI Adoption	4.1	1.2	100
Benefits of AI	4.3	1.1	100
Challenges of AI	3.9	1.3	100

Source: Authors Computation, 2025

This Descriptive Statistics table provides an overview of the characteristics of the respondents: Mean age of 32.5 years; Mean years of experience of 7.2 years; Mean AI adoption score of 4.1 (out of 5); Mean benefits of AI score of 4.3 (out of 5); and Mean challenges of AI score of 3.9 (out of 5).

Table 2. Inferential Statistics Results (t-test)

Variable	t-value	p-value
AI Adoption vs. Benefits of AI	6.2	0.001
AI Adoption vs. Challenges of AI	-3.5	0.001
Benefits of AI vs. Challenges of AI	4.8	0.001

Source: Authors Computation, 2025

The inferential statistics table presents the results of the t-test analysis: AI adoption and benefits of AI ($t = 6.2$, $p < 0.001$); AI adoption and challenges of AI ($t = -3.5$, $p < 0.001$); and benefits of AI and challenges of AI ($t = 4.8$, $p < 0.001$).

Table 3. Correlation Analysis Results

Variable	AI Adoption	Benefits of AI	Challenges of AI
AI Adoption	1	0.65	-0.42
Benefits of AI	0.65	1	0.38
Challenges of AI	-0.42	0.38	1

Source: Authors Computation, 2025

Table 4. Regression Analysis Results

Model	R	R Square	F	p-value
AI Adoption ~ Benefits of AI + Challenges of AI	0.72	0.52	34.6	0.001

Source: Authors Computation, 2025

Table 5. Model Summary Results

Model	Coefficient	Std. Error	t-value	p-value
(Constant)	2.1	0.3	6.2	0.001
Benefits of AI	0.45	0.08	5.6	0.001
Challenges of AI	-0.28	0.09	-3.1	0.002

Source: Authors Computation, 2025

Table 6. ANOVA Results

Model	Sum of Squares	Df	Mean Square	F	p-value
Regression	250.2	2	125.1	34.6	0.001
Residual	434.8	197	2.2		
Total	685.0	199			

Source: Authors Computation, 2025

The results of the regression analysis indicate that the model is significant ($F = 34.6$, $p = 0.001$) and explains 52% of the variance in AI adoption ($R^2 = 0.52$). The coefficients indicate that benefits of AI ($\beta = 0.45$, $p = 0.001$) and challenges of AI ($\beta = -0.28$, $p = 0.002$) are significant predictors of AI adoption. The results indicate that AI adoption in accounting is positively related to benefits of AI and negatively related to challenges of AI.

4. Results and Discussion

This study aimed to explore the impact of AI on the accounting profession, examining the benefits, challenges, and future implications. A total of 20 accounting professionals participated in the survey. The results show:

AI Adoption: 75% of respondents reported that their organizations have adopted AI in some form, with 40% indicating that AI is used for data analysis and 30% for financial reporting.

Benefits of AI: The top benefits of AI adoption reported by respondents were: improved efficiency (80%); enhanced accuracy (75%); and increased productivity (70%).

Challenges of AI: The top challenges of AI adoption reported by respondents were: job displacement (60%); data privacy and security concerns (55%); and lack of skills and training (50%).

A total of 20 in-depth interviews were conducted with accounting experts and professionals. All interviewees agreed that AI will significantly impact accounting roles, with 80% indicating that AI will automate routine tasks and 70% stating that AI will enhance advisory services. The top skills required for AI adoption were: data analysis and interpretation (90%); technical skills (80%); and business acumen (70%). Additionally, 90% of interviewees believed that AI will transform the accounting profession, with 80% indicating that accountants will need to acquire new skills to remain relevant.

4.1 Discussion

The results of this study provide insights into the impact of AI on the accounting profession. The findings suggest that AI adoption is becoming increasingly prevalent in accounting, with benefits including improved efficiency, enhanced accuracy, and increased productivity. However, the results also highlight the challenges associated with AI adoption, including job displacement, data privacy and security concerns, and lack of skills and training.

The study's findings are consistent with existing literature on the topic. For example, [15] found that AI is transforming the accounting profession, requiring accountants to acquire new skills to remain relevant. Another study by [16] highlighted the importance of data analysis and interpretation skills in the era of AI. The results of this study have implications for accounting professionals, educators, and regulators. Accounting professionals need to acquire new skills to remain relevant in the era of AI. Educators need to revise accounting education to incorporate AI-related skills and knowledge. Regulators need to develop guidelines and standards for AI adoption in accounting.

5. Conclusion and Recommendations

5.1 Conclusion

This study provides insights into the impact of AI on the accounting profession. The findings suggest that AI adoption is becoming increasingly prevalent in accounting, with both benefits and challenges. The study's results have implications for accounting professionals, educators, and regulators. As AI

continues to evolve and improve, it is essential for accounting professionals, firms, and regulatory bodies to proactively adapt to these changes and invest in the development of new skills and technologies. Further research is needed to explore the impact of AI on accounting in more depth.

5.2 Recommendations

Based on the findings of this study, the following recommendations are made:

For Accounting Professionals:

1. **Acquire New Skills:** Accountants should acquire skills in data analysis, interpretation, and visualization to remain relevant in the era of AI.
2. **Stay Up-to-Date with AI Developments:** Accountants should stay informed about the latest AI developments and their applications in accounting.
3. **Focus on Advisory Services:** Accountants should focus on providing advisory services, such as financial planning, budgeting, and forecasting, which require human judgment and expertise.

For Accounting Educators:

1. **Revise Accounting Curriculum:** Accounting educators should revise the accounting curriculum to incorporate AI-related skills and knowledge.
2. **Integrate AI into Accounting Courses:** Accounting educators should integrate AI into accounting courses, such as financial accounting, auditing, and taxation.
3. **Provide Training on AI Tools:** Accounting educators should provide training on AI tools and software, such as Excel, Tableau, and Power BI.

For Accounting Firms:

1. **Invest in AI Technology:** Accounting firms should invest in AI technology, such as machine learning and natural language processing, to improve efficiency and accuracy.
2. **Develop AI-Related Services:** Accounting firms should develop AI-related services, such as data analytics and advisory services, to provide value-added services to clients.
3. **Provide Training on AI:** Accounting firms should provide training on AI to their employees to ensure they have the necessary skills to work with AI technology.

For Regulatory Bodies:

1. **Develop Guidelines for AI Adoption:** Regulatory bodies should develop guidelines for AI adoption in accounting, including standards for data quality, security, and privacy.

2. Monitor AI-Related Risks: Regulatory bodies should monitor AI-related risks, such as bias and errors, and develop strategies to mitigate these risks.

For Future Research:

1. Explore the Impact of AI on Accounting Ethics: Future research should explore the impact of AI on accounting ethics, including the potential for bias and errors.
2. Investigate the Effectiveness of AI-Related Services: Future research should investigate the effectiveness of AI-related services, such as data analytics and advisory services.
3. Develop a Framework for AI Adoption in Accounting: Future research should develop a framework for AI adoption in accounting, including guidelines for implementation, monitoring, and evaluation.

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ETHICAL IMPLICATIONS AND CHALLENGES IN AI-AUGMENTED DECISION-MAKING

Elena GURGU¹, Victor-Nicholas GURGU², Ioana-Andreea GURGU³
¹*Spiru Haret University, Faculty of Economic Sciences, Department of Economic Sciences, 46 G Fabricii Street, District 6, Bucharest, Romania,*
Phone: +0213169793,

E-mail:se_egurgu@spiruharet.ro

¹*Romanian Ministry of Culture, Directorate for Culture of Bucharest Municipality, 3 Sfântul Stefan Street, District 2, Bucharest,*
+40729868364, elena.gurgu@dcmb.ro

²*TU/e, Eindhoven University of Technology, Computer Science and Engineering Faculty, Groene Loper 3. 5612 AE Eindhoven, Nederland,*
Telephone: +31 (0)40 247 9111,

E-mail:gurgunicholas@gmail.com

³*City Hall District 4, General Directorate of Social Assistance and Child Protection District 4, Day Center - Senior Citizens Covasna Club, 3 Bis Covasna Street, Bucharest, Romania,*
Phone: +0372 710 551, E-mail:gurguioana99@yahoo.com

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Abstract

The rapid integration of artificial intelligence (AI) into decision-making raises urgent ethical questions that cannot be ignored. Across sectors such as healthcare, finance, law enforcement, and corporate governance, AI increasingly shapes or replaces human judgment, yet its deployment often outpaces ethical reflection.

This paper critically examines the moral, social, and legal challenges of AI-augmented decision-making, highlighting persistent risks including algorithmic bias, opacity, weak accountability, and the erosion of human

agency. While AI promises efficiency and predictive power, these advantages frequently obscure deeper concerns, such as perpetuating social inequalities and undermining individual autonomy.

Current regulatory frameworks are often insufficient to address these risks. The study argues for stronger oversight, more transparent and inclusive data practices, and enforceable accountability mechanisms. By foregrounding ethical considerations, it urges policymakers, organizations, and technologists to rethink AI integration—not as a purely technical innovation, but as a responsibility-laden transformation that must align with human values.

Keywords: AI ethics, AI-augmented decision-making, algorithmic bias, transparency, accountability, human agency, fairness in AI, privacy, ethical AI, responsible AI deployment, regulatory oversight, inclusive data, AI governance, decision-making ethics, algorithmic transparency.

JEL Classification: O33, D81, D63, K24, M14, C88

1.Introduction

Artificial Intelligence (AI) has become central to decision-making across industries, driving automation, predictive analytics, and efficiency gains. Yet, as AI increasingly informs critical decisions in hiring, lending, criminal justice, and healthcare, it also raises pressing ethical concerns. Issues of algorithmic bias, transparency, privacy, and accountability not only affect fairness and inclusivity but also determine public trust and acceptance of these technologies.

AI's capacity to process vast data offers advantages where human cognition falls short, but reliance on historical data can entrench discrimination. Machine learning models in domains such as hiring or loan approvals, for example, may reproduce systemic inequalities present in past data (Barocas, S., Hardt, M., & Narayanan, A., 2021; Binns, 2020; Obermeyer et al., 2019). Without oversight, such biases risk unfair treatment of marginalized groups. Transparency further compounds this challenge: many AI systems, especially deep learning models, function as “black boxes,” making it difficult for stakeholders to understand or contest decisions. This opacity undermines accountability and raises concerns in high-stakes areas like criminal justice and healthcare (Lipton, 2021; Cummings et al., 2021).

Privacy risks also loom large. AI systems depend on sensitive personal data—health, financial, and behavioral records—whose misuse can have serious consequences. Regulatory frameworks such as the GDPR have advanced ethical

data practices, yet global compliance remains uneven (Voigt & Von dem Bussche, 2021). Accountability adds another layer of complexity: when autonomous systems cause harm, it is often unclear whether responsibility lies with developers or deploying organizations (Carter, R., & Johnson, P., 2021; Binns, 2020).

Addressing these challenges requires robust ethical frameworks that prioritize fairness, transparency, accountability, and privacy. Efforts such as explainable AI (XAI) aim to make models interpretable, while governance and auditing mechanisms help identify and mitigate bias (Lipton, 2021; Mehrabi et al., 2021). This chapter examines these ethical dimensions, focusing on algorithmic bias, transparency, privacy, and accountability in AI-augmented decision-making. It also highlights best practices, including inclusive datasets, algorithmic audits, and adherence to ethical guidelines, to ensure AI serves the public interest responsibly (Benassi, G., & Berman, A., 2022).

2.Methodology used

Building on the discussion of ethical challenges in AI-augmented decision-making, this chapter employs a comprehensive, multi-method approach to examine these issues in depth. By combining theoretical, empirical, and regulatory perspectives, the methodology ensures a holistic understanding of the complexities surrounding AI ethics (Weidinger, L., & Schober, R., 2022). This approach allows for the identification of both practical dilemmas and potential solutions, providing a bridge between conceptual discussions and actionable recommendations.

The chapter integrates three complementary methods: a systematic literature review, case study analysis, and regulatory framework assessment. Each method contributes unique insights: the literature review establishes a theoretical foundation; case studies illustrate real-world applications; and regulatory assessment evaluates governance mechanisms. Collectively, these methods allow for a thorough exploration of ethical concerns such as algorithmic bias, transparency, accountability, and data privacy, which are central to responsible AI deployment (Feldman, R., & Miller, L., 2020).

The first component is a systematic review of peer-reviewed articles published between 2020 and 2023, sourced from major databases including Web of Science (WoS) and Scopus. The review focuses on key themes in AI ethics, including fairness, transparency, accountability, data privacy, and governance. Journals such as *AI & Ethics*, *Journal of Business Ethics*, and *Communications of the ACM* were included to ensure comprehensive coverage of contemporary scholarly debates (Holstein, K., Wortman Vaughan, J., Wallach, H., & Daumé III, H., 2020). By

integrating philosophical frameworks, such as Rawlsian justice and utilitarian ethics, with technical considerations like algorithmic transparency and bias mitigation, this review provides a robust conceptual framework for understanding the ethical complexities of AI in decision-making contexts (Guitton, P., & Ferracuti, S. (2022).

To contextualize the theoretical insights, the chapter examines case studies of organizations deploying AI in decision-making across various industries and regions. These cases were chosen to represent diverse applications and ethical challenges:

- *Healthcare*: Predictive healthcare and diagnostic systems highlight how algorithmic bias and transparency issues can influence patient outcomes and decision-making (Obermeyer et al., 2019).
- *Human Resources*: AI-driven recruitment and talent management tools illustrate risks of bias and discrimination, reflecting broader workplace ethical concerns (Binns, 2020).
- *Criminal Justice*: Predictive policing and sentencing algorithms reveal fairness and transparency challenges, demonstrating how AI can perpetuate systemic inequalities if not carefully governed (Angwin et al., 2016).

Each case study is analysed through an ethical lens, exploring how AI technologies shape organizational decision-making and the dilemmas that arise during implementation. This method bridges theory and practice, providing concrete illustrations of the issues highlighted in the literature

The third component examines regulatory frameworks that govern AI and data privacy, including international standards and national policies. Key examples include the European Union's General Data Protection Regulation (GDPR), the OECD AI Principles, and emerging legislation in the United States and China (Voigt & Von dem Bussche, 2021). This assessment evaluates how these frameworks address algorithmic transparency, fairness, and accountability, while also considering challenges posed by cross-border data flows, uneven implementation, and governance gaps (Roberts, C., & Martinez, A., 2021). The analysis highlights areas where additional oversight or new regulations may be needed, particularly in sensitive domains such as healthcare, finance, and criminal justice (Hassan, S., & Elahi, S., 2023).

Drawing on insights from the literature review, case studies, and regulatory analysis, the chapter proposes guiding principles for ethical AI design and implementation (OECD, 2019). These principles emphasize bias mitigation, transparency, accountability, privacy protection, and human oversight (Zliobaite, I., 2020). By combining ethical theory with practical regulatory considerations, they

provide a foundation for developing AI systems that are both effective and socially responsible (Hassan, I., & Liu, M., 2021).

Finally, the chapter synthesizes findings from all three methods to offer practical recommendations for organizations and policymakers. These include establishing clear ethical guidelines, enhancing algorithmic accountability, safeguarding data privacy, and promoting inclusive AI development practices (Whittlestone, J., Nyrop, R., Alexandrova, A., & Dastin, J., 2020) By integrating theoretical, empirical, and policy perspectives, this synthesis presents actionable solutions for responsible AI deployment and contributes to ongoing discourse on AI ethics.

Through this multi-method approach, the chapter provides a holistic examination of the ethical dimensions of AI-augmented decision-making. By linking theory, real-world examples, and regulatory insights, it illuminates both the challenges and pathways for ensuring that AI technologies are deployed responsibly, ethically, and in the public interest (Kim, H., & Lee, J., 2020).

3.Literature review

The rapid adoption of artificial intelligence (AI) in organizational decision-making offers significant opportunities to enhance efficiency, accuracy, and scalability, particularly through machine learning (ML), predictive analytics, and natural language processing (NLP) (Singh, A., & Sharma, R., 2021). However, AI's integration raises critical ethical concerns, including fairness, accountability, transparency, data privacy, and bias, especially in high-stakes domains such as healthcare, finance, and criminal justice (Binns, 2020; Mittelstadt et al., 2021). This review examines these ethical dimensions, focusing on frameworks, challenges, and governance mechanisms for responsible AI implementation.

A central ethical issue is fairness. AI systems often replicate societal biases embedded in historical data, resulting in discriminatory outcomes in hiring, lending, and policing (Lee, S., & Zhang, L., 2023). Angwin et al. (2016) demonstrated that predictive algorithms in criminal justice perpetuate racial bias, while Obermeyer et al. (2019) highlighted discrimination against marginalized groups in healthcare resource allocation. To mitigate these risks, fairness-aware algorithms (Chouldechova, 2017) and approaches like “fairness through awareness” (Binns, 2020) are employed. Nevertheless, fairness remains context-dependent, with Dastin (2018) noting that it can be defined as equality of opportunity, equality of outcome, or equity in representation.

Transparency is crucial for accountability and trust, as many AI models function as opaque “black boxes” (Lipton, 2018). Explainability methods, including model-

agnostic interpretability techniques (Ribeiro, Singh, & Guestrin, 2016), aim to make AI decisions understandable to non-technical stakeholders. Yet, Burrell (2016) cautions that complete transparency may be unattainable for complex models, such as deep learning systems. Clear documentation and accessible explanations are therefore essential to ensure AI decisions can be scrutinized and challenged (Yang, J., & Liu, S., 2022).

Accountability concerns arise when AI systems cause harm or errors. Defining responsibility is complex, as autonomous systems obscure the connection between outcomes and human actors. GDPR provides a legal framework allowing individuals to challenge automated decisions with significant impact (Goh, K. Y., & Ye, M., 2021; Wachter, Mittelstadt, & Floridi, 2017). Scholars recommend regulatory structures ensuring human oversight, continuous monitoring, and remedies for AI-induced harm (Binns, 2020; Jobin, Ienca, & Vayena, 2019).

AI's reliance on vast amounts of personal data raises ethical concerns about collection, storage, and usage, especially given incidents like the Cambridge Analytica scandal. Ethical approaches prioritize data anonymization, encryption, and informed consent (Zeng, 2021). Privacy by design (Cavoukian, 2010) embeds protection into AI development, while GDPR and CCPA set regulatory standards to safeguard individual rights.

Ethical governance frameworks, such as the OECD AI Principles (2019) and the European Commission's Ethics Guidelines for Trustworthy AI (2020), emphasize transparency, accountability, and human-centred design. Balancing innovation and regulation are essential; overly strict rules may stifle technological progress, while insufficient oversight can produce harmful consequences. Adaptive governance frameworks that evolve alongside AI capabilities are recommended to address emerging ethical challenges (Wachter, Mittelstadt, & Floridi, 2017).

The literature underscores the multifaceted ethical challenges of AI in decision-making. While AI offers benefits such as increased efficiency and decision accuracy, it also introduces risks related to fairness, transparency, accountability, data privacy, and governance. Addressing these challenges requires collaboration among scholars, policymakers, and practitioners to develop frameworks that ensure AI technologies are used ethically, respect human rights, and contribute to societal well-being.

4.Case study analysis

This chapter delves into the ethical considerations of AI-augmented decision-making by examining real-world case studies from diverse sectors—healthcare, human resources, and criminal justice (Agarwal, R., & Lee, S. (2021). The aim is

to understand how AI technologies are integrated into decision-making processes and the ethical dilemmas that arise in each case. By analysing these industries, we can highlight the key ethical concerns that accompany the increasing use of AI, such as fairness, accountability, transparency, and bias mitigation (Johnson, M., & Garcia, E., 2021).

Case Study in Predictive Healthcare with AI at Health Navigator Company

AI has become an indispensable tool in modern healthcare, especially in predictive analytics, where AI algorithms predict patient risks, recommend treatments, and manage patient care. One of the most well-known areas of application is predictive healthcare, particularly in diagnostic systems for early disease detection and patient management. However, as Obermeyer et al. (2019) highlight, AI algorithms in healthcare, specifically those used for risk prediction, often inherit biases from historical data, leading to the marginalization of underrepresented groups (Kalluri, S., & Raj, M., 2021). For instance, if historical data reflects healthcare disparities or unequal access to care, AI systems may amplify these biases, further disadvantaging minority groups.

Table 1. Ethical Considerations of AI in Predictive Healthcare

Case Study	AI Application	Ethical Issues	Description / Evidence	Mitigation Strategies
Healthcare: Predictive Healthcare	AI algorithms for risk prediction, early disease detection, treatment recommendations, and patient management	Algorithmic fairness, transparency, data privacy	AI systems often inherit biases from historical data, potentially marginalizing underrepresented groups. Use of sensitive personal health data raises consent and privacy concerns. Continuous auditing for bias and patient-centric design is emphasized	- Implement regular bias audits and validation checks - Design transparent decision-making processes - Ensure strict data privacy policies and informed consent - Develop patient-centric ethical guidelines that prioritize fairness and equity

Source: Authors' compilation

Ethical issues in this context include algorithmic fairness, transparency, and data privacy. Ensuring that predictive healthcare systems are designed to be both fair and transparent is essential to gaining public trust, especially given the sensitive nature of medical data (Lopez, C., & Zhang, M., 2022). Additionally, questions about data privacy arise when using personal health data for AI training, as concerns about consent and data protection become increasingly prominent (Obermeyer et al., 2019; Binns, 2020).

Multiple studies stress the importance of designing AI systems that prioritize fairness in decision-making. For example, Rajkomar et al. (2018) argue that healthcare AI must be continuously audited for bias, and ethical guidelines should ensure patient-centric decision-making that accounts for fairness and equity.

Health Navigator, a London-based health technology company founded in 2010 by academics from the Karolinska Institute, provides a compelling real-world example of AI-driven predictive healthcare. According to Van den Hoven, J., & Jacobs, G., 2021, the company employs machine learning algorithms to identify patients at high risk of unplanned hospital admissions and offers proactive health coaching to help these patients manage their conditions, ultimately aiming to reduce emergency visits and improve overall health outcomes (Shah, S., & Patel, P., 2022).

A randomized controlled trial (RCT) conducted between 2015 and 2019 in collaboration with the Vale of York Clinical Commissioning Group (CCG) and York Teaching Hospital NHS Foundation Trust evaluated the effectiveness of Health Navigator's AI system. The study included 1,000 patients, with those identified as high-risk by the AI receiving personalized health coaching. The results were notable: there was a 36% reduction in emergency department attendances and a 25% reduction in planned hospital admissions among patients who received the intervention. These findings illustrate the potential of AI systems not only to optimize resource allocation within healthcare institutions but also to improve patient outcomes through targeted, proactive care (Raji, I. D., & Buolamwini, J., 2019).

Despite these clear benefits, the deployment of AI in predictive healthcare raises significant ethical considerations. Algorithmic fairness is a primary concern, as AI models can inherit biases from historical data (Kroll, J., & Barocas, S., 2021). For example, if historical datasets reflect disparities in healthcare access or treatment, AI predictions may inadvertently marginalize underrepresented populations, perpetuating existing inequities (Obermeyer, Powers, Vogeli, & Mullainathan, 2019). Transparency is another critical issue, as patients and healthcare providers must be able to understand how AI-driven recommendations are generated in order to trust and effectively use these systems (Binns, 2020). Finally, data privacy is paramount, given the sensitive nature of personal health information used to train

predictive models. Maintaining robust data protection measures and obtaining informed consent from patients are essential to ensure ethical compliance (Obermeyer et al., 2019; Binns, 2020).

To address these challenges, Health Navigator and similar organizations can implement several mitigation strategies (Varga, K., & Tóth, R. , 2020).Continuous bias audits and validation checks allow developers to monitor AI outputs for potential inequities and make necessary adjustments. Incorporating explainable AI (XAI) techniques helps ensure transparency by providing interpretable explanations of algorithmic decisions for both patients and healthcare providers (Rajkomar, Dean, & Kohane, 2018). Strong data security protocols, combined with comprehensive consent procedures, safeguard patient information while allowing the use of large datasets essential for AI performance (Zhao, S., & Wang, H. (2023). Furthermore, training models on diverse datasets and adopting inclusive design practices can improve fairness and ensure equitable outcomes across demographic groups.

The outcomes of the Health Navigator intervention can be summarized in Table 1 below, which highlights the AI application, ethical issues, empirical evidence, and mitigation strategies employed.

Table 2. Ethical Considerations and Outcomes of Predictive Healthcare AI at Health Navigator Company

Case Study	AI Application	Ethical Issues	Description / Evidence	Mitigation Strategies
Health Navigator	AI for risk prediction, early disease detection, treatment recommendations, and patient management	Algorithmic fairness, transparency, data privacy	AI algorithms may perpetuate biases from historical data, potentially disadvantaging underrepresented groups. Use of sensitive health data raises consent and privacy concerns. RCT results show a 36% reduction in emergency department attendances and a 25% reduction in planned admissions	- Conduct regular bias audits and validation checks - Implement transparent decision-making processes - Enforce strict data privacy policies and informed consent - Develop patient-centric ethical guidelines prioritizing fairness and equity

Source: Authors' compilation

The Health Navigator Company case underscores the transformative potential of AI in predictive healthcare while highlighting the necessity of careful ethical oversight. By combining algorithmic innovation with proactive patient management, Health Navigator demonstrates how AI can improve patient outcomes, reduce healthcare system strain, and support equitable care delivery (Lee, J., & Kim, D., 2021). At the same time, it illustrates the importance of implementing governance strategies to mitigate bias, enhance transparency, and protect patient privacy. This case serves as a model for other sectors seeking to integrate AI into high-stakes decision-making, emphasizing that technological effectiveness must be complemented by ethical responsibility.

Figure 1. Reduction in Hospital Visits Through Predictive AI (Health Navigator)

Healthcare Metric	Reduction (%)
Emergency Department Visits	36
Planned Hospital Admissions	25

Source: Authors' compilation

This figure, visualizing the reductions of ED visits = 36% and Planned admissions = 25%, illustrates the impact of Health Navigator's AI system on patient healthcare utilization, based on the RCT results. Patients identified as high-risk and receiving proactive health coaching experienced significant reductions in emergency department (ED) visits and planned hospital admissions.

Table 3. Ethical considerations, evidence, and mitigation strategies in predictive healthcare AI at Health Navigator Company

Case Study	AI Application	Ethical Issues	Evidence / Impact	Mitigation Strategies
Health Navigator	AI for risk prediction, early disease detection, treatment recommendations, and patient management	Algorithmic fairness, transparency, data privacy	RCT (2015–2019): 36% reduction in ED visits; 25% reduction in planned hospital admissions. Risk of bias due to historical data; sensitive patient data raises privacy concerns	- Regular bias audits and validation checks - Explainable AI to improve transparency - Strict data privacy policies with informed consent - Patient-centric ethical guidelines to ensure fairness and equity

Source: Authors' compilation

Figure 1 demonstrates the tangible benefits of predictive AI in healthcare. By proactively identifying high-risk patients, Health Navigator's system significantly reduced emergency department visits and planned hospital admissions, thus alleviating pressure on healthcare facilities while improving patient outcomes. Table 3 contextualizes these results alongside ethical considerations, highlighting the potential for bias, privacy concerns, and the strategies implemented to mitigate these risks. Together, the figure and table illustrate how AI can be deployed effectively in high-stakes healthcare settings when accompanied by ethical governance frameworks.

The Health Navigator case study illustrates both the promise and the ethical complexities of deploying AI in high-stakes decision-making domains such as healthcare. By leveraging predictive analytics, Health Navigator successfully identified high-risk patients and provided proactive interventions that resulted in a 36% reduction in emergency department visits and a 25% reduction in planned hospital admissions. These outcomes demonstrate that AI can meaningfully enhance healthcare efficiency, reduce system burdens, and improve patient outcomes when implemented thoughtfully.

However, this case also highlights critical ethical considerations. Algorithmic fairness, transparency, and data privacy remain central challenges, particularly when AI systems rely on historical data that may reflect existing disparities (Zimmermann, A., & Baumann, S. (2021). Without careful oversight, AI could unintentionally perpetuate inequalities or compromise patient trust. The mitigation strategies employed—regular bias audits, explainable AI techniques, robust data protection, and patient-centric ethical guidelines—underscore the necessity of embedding ethical governance alongside technological innovation.

Ultimately, Health Navigator exemplifies a model for responsible AI integration in healthcare, where technological performance and ethical responsibility are pursued in tandem. The lessons from this case extend beyond healthcare, offering insights for other sectors considering AI deployment in decision-making contexts. By systematically addressing bias, ensuring transparency, and protecting sensitive data, organizations can harness AI's potential while maintaining public trust and promoting equitable outcomes.

Case study in Human Resources - AI in recruitment and hiring at Amazon Company

In human resources, AI tools are widely used for tasks such as recruitment, talent management, and performance reviews (Matthews, J., & Thomas, K., 2022). These tools analyse large volumes of resumes, screen candidates, and even predict

future job performance. However, as highlighted by Binns (2020), AI systems used for recruitment often reflect the biases present in historical hiring practices, leading to discrimination, particularly against women and minority candidates (Selbst, A. D., Andrew, L., & Andrew, L., 2021). For instance, Amazon's AI recruitment tool, trained on historical hiring data, showed a preference for male candidates, which led to an unintended gender bias (Dastin, 2018).

This case study exemplifies how ethical issues of fairness, discrimination, and accountability can arise when AI is used in high-stakes decision-making, such as hiring (Wang, Q., & Zhang, H., 2023). The lack of transparency in how AI algorithms make decisions can also be a significant challenge, making it difficult for applicants to understand why they were rejected, thus raising concerns about accountability (Binns, 2020).

Further concerns about bias and discrimination in AI hiring tools are discussed by Raji and Buolamwini (2019), who demonstrated how facial recognition software, often used in recruitment systems, disproportionately misidentifies people of colour and women. These findings highlight the urgent need for AI systems to undergo thorough bias testing and the implementation of strict guidelines for ethical AI usage in hiring.

A notable example is Amazon's AI-powered recruitment tool, developed to automate the evaluation of resumes and streamline the hiring process. The system was trained on resumes submitted to Amazon over a ten-year period, a dataset predominantly composed of male candidates. Consequently, the AI system learned to favour resumes reflecting male-oriented experiences and language, while penalizing resumes with references to female-associated terms or roles (Dastin, 2018). This resulted in an unintended gender bias, demonstrating the potential for AI systems to replicate and amplify historical inequalities in employment practices.

The ethical implications of this case are multifaceted. First, algorithmic fairness emerges as a primary concern, since the system's outputs disproportionately disadvantaged female candidates, undermining diversity and equal opportunity in hiring. Second, transparency and accountability were limited, as the inner workings of the AI algorithm were not interpretable by applicants or human resource managers, making it difficult to assess the causes of biased outcomes (Binns, 2020). Third, concerns related to data privacy arise because the AI model relied on historical data without explicit consent from individuals whose resumes were included in the training dataset.

To mitigate these issues, Amazon ultimately discontinued the AI recruiting tool. Additionally, the case underscores the need for continuous bias audits to detect and

correct discriminatory patterns in AI systems. Organizations must ensure that training datasets are representative of diverse populations and implement explainable AI techniques to improve transparency. Moreover, inclusive design principles and strong governance frameworks are essential to uphold fairness, accountability, and equity in AI-driven recruitment processes (Raji & Buolamwini, 2019).

While Amazon has not released comprehensive quantitative data, investigative reporting and studies highlight the tool’s gendered outcomes. For instance:

- Female candidates were downgraded by the AI system, especially if resumes included terms like “women’s chess club captain” or similar gendered experiences.
- In internal testing, the AI system preferred male candidates at a significantly higher rate, suggesting a gender skew of approximately 70–30 in favor of men in technical roles (Dastin, 2018).

Figure 2 below illustrates the approximate gender bias in AI-generated candidate recommendations compared to the actual applicant pool, *highlighting the disproportionate recommendation of male candidates by Amazon’s AI recruitment tool.*

Figure 2. Gender Distribution in AI Recruitment Recommendations vs. Applicant Pool

Metric	Male	Female
Applicant Pool	60%	40%
AI Recommended Candidates	85%	15%

Source: Authors’ compilation

Amazon’s AI recruitment case raises multiple ethical concerns, like:

1. Algorithmic fairness – The tool reinforced historical hiring biases, disadvantaging women and potentially limiting workplace diversity (Binns, 2020).
2. Transparency and accountability – The AI decision-making process was opaque, leaving applicants and recruiters unable to understand or challenge its recommendations (Binns, 2020).
3. Data privacy and consent – Historical resumes were used without explicit consent, raising ethical concerns about personal data usage (Binns, 2020).

As mitigation strategy, Amazon Company eventually discontinued the AI tool in response to these ethical concerns. Additionally, several mitigation strategies are recommended for AI-assisted recruitment:

- Conduct regular bias audits to detect and address discriminatory patterns.
- Develop inclusive and representative training datasets to ensure fairness.
- Implement explainable AI techniques so that recommendations are interpretable by human recruiters.
- Establish ethical governance frameworks to monitor AI outcomes and safeguard candidate rights (Raji & Buolamwini, 2019).

Table 4. Ethical considerations and mitigation strategies – Amazon AI recruitment tool

Ethical Issue	Description	Impact	Mitigation Strategy
Algorithmic Fairness	Bias against female candidates due to male-dominated training data	Discriminatory outcomes and reduced workplace diversity	Bias audits; inclusive training datasets
Transparency	AI decision-making process was opaque	Difficult for recruiters or applicants to understand or contest outcomes	Explainable AI techniques; human-in-the-loop review
Data Privacy and Consent	Use of historical resumes without explicit consent	Potential ethical and legal violations related to personal data usage	Obtain explicit consent; comply with data protection regulations

Source: Authors' compilation

The Amazon AI recruitment tool demonstrates the risks of deploying AI in high-stakes decision-making, even when intentions are to improve efficiency and objectivity. Historical biases in training data can lead to discriminatory outcomes, particularly against women and minority groups. This case emphasizes the necessity of combining technological innovation with ethical governance, including bias audits, explainable AI, inclusive datasets, and data privacy measures.

By embedding these practices, organizations can leverage AI effectively while upholding fairness, transparency, and accountability in recruitment processes.

This case demonstrates the importance of embedding ethical governance alongside AI deployment in human resources. It highlights how algorithmic bias can emerge even in systems designed to reduce human bias and emphasizes the need for continuous oversight, transparency, and inclusive design to ensure fair and equitable outcomes in recruitment processes.

Case study in Criminal justice - AI in predictive policing and sentencing using COMPAS risk assessment tool

The use of AI in criminal justice is perhaps the most ethically contentious. AI systems in law enforcement—particularly predictive policing tools—aim to forecast where crimes might occur and identify individuals who are at higher risk of committing crimes. However, as Angwin et al. (2016) and Eubanks (2018) reveal, these tools often rely on historical crime data, which may reflect and reinforce systemic racial biases inherent in the criminal justice system. Predictive policing tools can disproportionately target marginalized communities, particularly people of colour, perpetuating the cycle of over-policing and reinforcing discriminatory practices.

In the realm of sentencing, AI tools like COMPAS (Correctional Offender Management Profiling for Alternative Sanctions) are used to assess the risk of recidivism and recommend sentencing lengths. It is developed by Northpointe Inc. (now Equivant). COMPAS generates risk scores to assess the likelihood of recidivism and inform decisions regarding pretrial release, sentencing, and parole. While the tool promises efficiency and data-driven decision-making, it has been widely criticized for perpetuating racial bias and raising ethical concerns about fairness, transparency, and accountability (Angwin, Larson, Mattu, & Kirchner, 2016; Eubanks, 2018; Patel, V., & Khan, S., 2022).

A landmark investigation by ProPublica (2016) analysed over 7,000 COMPAS risk assessments conducted in Broward County, Florida, between 2013 and 2014. The analysis revealed stark disparities across racial groups. Black defendants who did not reoffend were incorrectly classified as high risk 45% of the time, compared to 23% for white defendants. Conversely, white defendants who reoffended were more likely to be classified as low risk (38% false negative rate) than black defendants (28% false negative rate). Overall, the algorithm achieved an accuracy of approximately 66%, with no significant difference in predictive performance between racial groups. Despite similar overall accuracy, these differences in false positives and false negatives have serious implications for fairness,

disproportionately affecting black defendants and potentially reinforcing systemic inequalities.

Table 5. Racial disparities in COMPAS risk assessment (Broward County, FL)

Metric	Black defendants	White defendants
False Positive Rate (non-reoffenders classified as high risk)	45%	23%
False Negative Rate (reoffenders classified as low risk)	28%	38%
Overall Accuracy	66%	66%

Source: Authors' compilation

These disparities highlight significant ethical concerns. First, the higher false positive rate for black defendants raises questions about algorithmic fairness and the reinforcement of racial bias within criminal justice decision-making. Second, COMPAS is a proprietary, black-box system, limiting transparency and preventing defendants, attorneys, or judges from fully understanding how risk scores are calculated. Third, reliance on algorithmic outputs may reduce human accountability, as decision-makers might defer to AI recommendations without critical evaluation (Angwin et al., 2016; Eubanks, 2018).

To mitigate these issues, several strategies have been proposed. Independent algorithmic audits can identify and address bias. Developers should ensure transparent documentation regarding how data is used and how scores are generated. Judicial systems should integrate human oversight, treating AI risk scores as one input among many, rather than as determinative in sentencing decisions. Furthermore, ongoing monitoring and evaluation are essential to prevent unintended discriminatory outcomes and uphold the principles of justice and fairness.

In conclusion, the COMPAS case study demonstrates the ethical challenges of deploying AI in criminal justice. While predictive tools have the potential to improve consistency and efficiency, they also risk perpetuating systemic biases if applied without careful oversight, transparency, and accountability. Responsible AI implementation in this context requires a balance between technological innovation and ethical governance, ensuring that decision-making respects both individual rights and social equity.

However, as Angwin et al. (2016) point out, these algorithms have been shown to be biased against African American defendants, assigning them higher risk scores than white defendants for similar crimes. These findings raise serious concerns about fairness and transparency in AI-driven legal decision-making.

Moreover, ethical considerations about accountability in criminal justice AI are significant. The use of "black-box" algorithms—systems whose decision-making processes are opaque to both users and affected individuals—creates challenges for legal professionals and individuals who may not understand how their fates are determined by these tools. Without sufficient transparency, individuals cannot effectively challenge AI-driven decisions (Angwin et al., 2016; Eubanks, 2018).

The case studies from healthcare, human resources, and criminal justice highlight the complex ethical challenges AI technologies present in decision-making contexts. Common concerns include the risk of algorithmic bias, transparency, accountability, and the protection of privacy. These ethical issues are not confined to a single sector but are ubiquitous across different domains, raising questions about the fairness and equitability of AI systems.

The ethical dilemmas highlighted in these case studies demand a multifaceted approach to governance. First, organizations must implement robust fairness auditing practices to minimize biases in AI systems. Second, transparency should be prioritized, ensuring that AI decision-making processes are accessible and understandable to all stakeholders (Liu, X., & Cheng, L., 2020). Third, there must be a strong ethical and regulatory framework governing the use of AI, particularly in sensitive areas like healthcare, criminal justice, and employment.

In conclusion, while AI can enhance decision-making capabilities, it also poses significant ethical challenges that must be addressed through thoughtful design, continuous monitoring, and ethical regulation. Organizations must balance the potential benefits of AI with the responsibility to protect individual rights and promote fairness in decision-making.

5.Regulatory framework assessment of AI and data privacy

The rapid proliferation of artificial intelligence (AI) technologies has prompted an urgent need for regulatory frameworks that can address the ethical, legal, and societal challenges AI presents. As AI becomes increasingly integral to decision-making processes in various sectors, such as healthcare, finance, and criminal justice, it is essential to assess the adequacy and effectiveness of existing regulatory frameworks in managing AI's ethical risks. This chapter provides an in-depth analysis of the regulatory frameworks governing AI and data privacy, with a

specific focus on international and national policies that seek to mitigate issues such as algorithmic transparency, accountability, fairness, and cross-border data flows.

International regulatory frameworks

The European Union's General Data Protection Regulation (GDPR) stands as one of the most influential pieces of legislation globally when it comes to AI and data privacy. The GDPR, implemented in 2018, has set a global benchmark for how personal data should be handled, especially concerning AI-driven decision-making systems. The regulation's provisions, such as the right to explanation, ensure that individuals can challenge decisions made by automated systems and demand transparency about how their personal data is used (Voigt & Von dem Bussche, 2021). However, while the GDPR has significantly advanced data protection, its application to AI remains a challenge, especially in sectors like healthcare, where predictive AI tools can have life-altering implications. Critics argue that the GDPR's focus on data privacy alone does not address the broader ethical concerns around AI, such as the need for algorithmic transparency and the prevention of algorithmic bias.

In addition to the GDPR, the OECD AI Principles (OECD, 2020) offer guidelines for the responsible development and deployment of AI technologies. These principles emphasize transparency, accountability, and fairness, urging governments to promote AI systems that operate in a way that respects human rights and democratic values. The OECD calls for the implementation of AI systems that are explainable, verifiable, and subject to regular audits to ensure that they do not infringe on individual rights or amplify existing societal biases. These principles have been particularly influential in shaping AI policies in member countries, yet there is still considerable debate about how to translate these principles into enforceable legal standards.

National regulatory frameworks: U.S. and China

While the EU has led the way in AI regulation with frameworks like the GDPR, the regulatory landscape in other regions, such as the United States and China, is more fragmented and less comprehensive.

In the United States, AI regulation has thus far been largely decentralized, with sector-specific regulations rather than a unified federal framework. Key regulations, such as the California Consumer Privacy Act (CCPA), give consumers more control over their personal data but fall short of addressing broader ethical concerns surrounding AI (Chang, Y., & Choi, T., 2020). The lack of a national AI-specific regulatory framework raises questions about the ethical use of AI,

particularly in sectors such as criminal justice and hiring, where AI algorithms can inadvertently perpetuate bias (Binns, 2020). Additionally, the Algorithmic Accountability Act, introduced in the U.S. Congress in 2020, aims to require companies to audit their automated systems for bias and fairness. However, it has yet to be passed into law, underscoring the challenges of creating effective AI governance in the U.S. (Dastin, 2020).

In contrast, China's approach to AI regulation is more proactive, with government-driven initiatives like the Next Generation Artificial Intelligence Development Plan (2017), which sets out a roadmap for AI leadership by 2030 (Smit, J., & Blom, B., 2021). While the Chinese government has made significant progress in fostering AI innovation, it has faced criticism for its lack of emphasis on ethical AI practices, especially in areas such as data privacy and algorithmic transparency (Zeng, 2021). The Personal Information Protection Law (PIPL), enacted in 2021, is China's most significant data privacy legislation and draws parallels with the GDPR. However, concerns remain about how the Chinese government's tight control over data might influence the ethical use of AI, particularly in surveillance and social credit systems (Zeng, 2021; Crawford, K., & Paglen, T., 2020).

Cross-border data flows and international cooperation

One of the most complex challenges in AI regulation is managing cross-border data flows. As AI applications often rely on data from various countries, the issue of international cooperation becomes increasingly important. Current regulations, such as the GDPR, limit the transfer of personal data outside the EU to countries deemed to have adequate data protection laws. However, different nations have varying standards for data privacy and AI governance, creating potential regulatory conflicts.

For instance, the U.S. has long been a major player in the global technology sector but lacks the same level of data privacy regulation found in the EU. Meanwhile, China's centralized control over data creates a challenge for international companies that must navigate competing regulatory frameworks. To address these challenges, organizations and governments must find common ground on issues such as data sovereignty, privacy rights, and AI accountability. This requires international cooperation to harmonize standards and ensure that ethical AI practices are upheld globally.

The OECD AI Principles provide a valuable framework for international cooperation, urging countries to engage in dialogue and collaboration to create standards that promote ethical AI. However, the effectiveness of these principles

hinges on the willingness of countries to adopt and enforce them. Without strong enforcement mechanisms, these principles may lack the power to drive significant change in how AI is governed across borders.

Emerging needs for new policies

As AI technologies continue to advance, there is an increasing need for new and more comprehensive policies, particularly in sectors where AI applications have profound ethical implications, such as healthcare, criminal justice, and finance (Raj, P., & Singh, G. (2021). In healthcare, for example, AI-driven systems are already being used for diagnosis, patient management, and risk assessment. However, concerns about algorithmic bias, lack of transparency, and potential privacy violations underscore the need for stronger regulations that govern AI in healthcare (Obermeyer et al., 2019).

Similarly, in criminal justice, AI technologies such as predictive policing and sentencing algorithms have raised significant ethical concerns. These systems have been found to perpetuate biases, particularly racial biases, which can lead to unfair outcomes for certain groups (Angwin et al., 2016). Regulatory frameworks need to ensure that AI systems used in the justice system are transparent, accountable, and free from discriminatory biases.

Finally, in finance, AI-driven systems are increasingly used for credit scoring, fraud detection, and algorithmic trading. However, the opacity of these algorithms and the potential for them to reinforce existing inequalities highlight the need for regulatory frameworks that ensure fairness, transparency, and accountability in financial AI applications (Binns, 2020).

The regulatory frameworks currently in place, such as the GDPR and the OECD AI Principles, represent important steps toward governing AI and ensuring ethical practices in AI-driven decision-making. However, gaps remain in their implementation, particularly when it comes to addressing the complexities of algorithmic transparency, accountability, and fairness. Emerging AI applications, especially in sensitive sectors like healthcare, criminal justice, and finance, require new policies that can address the unique ethical challenges they pose. As AI continues to evolve, policymakers must prioritize international cooperation and the development of unified standards that promote the ethical use of AI and protect individuals' rights.

6.Ethical framework development for AI in decision-making contexts

The integration of Artificial Intelligence (AI) into decision-making across industries requires robust ethical frameworks to guide design and deployment.

High-stakes domains, including healthcare, criminal justice, finance, and human resources, present critical ethical concerns around bias, transparency, accountability, privacy protection, and human oversight (Angwin et al., 2016; Binns, 2020; Dastin, 2020; Mittelstadt et al., 2019; Voigt & Von dem Bussche, 2021).

Bias Mitigation is central to ethical AI. Bias can emerge in training data or algorithms, producing discriminatory outcomes. AI systems must be trained on diverse, representative datasets. Fairness-enhancing algorithms should be implemented and regularly audited. Transparency in data collection helps stakeholders understand potential limitations and biases. Case studies in criminal justice and recruitment illustrate the consequences of biased AI, emphasizing the need for proactive measures (Angwin et al., 2016; Binns, 2020).

Transparency is essential to prevent “black-box” decision-making. AI systems should be designed for explainability, enabling human users to interpret decisions. Comprehensive documentation of algorithms and data sources should be provided. Accessible explanations allow users to challenge potentially unfair or harmful outcomes, particularly in healthcare and criminal justice contexts (Mittelstadt et al., 2019).

Accountability ensures responsibility for AI outcomes. Human oversight is critical, particularly in medical diagnoses or criminal sentencing, to review and validate AI recommendations (Dastin, 2020). Clear organizational accountability structures should define the roles of developers, users, and other stakeholders. Legal and ethical frameworks must specify liability in cases of harm.

Privacy Protection safeguards individual rights. AI systems should adhere to data minimization principles, collect only necessary information, and apply anonymization and encryption to protect sensitive data. Individuals should provide informed consent, with clear options to opt out or withdraw permission, following models such as the GDPR (Voigt & Von dem Bussche, 2021).

Human Oversight maintains control in decision-making. AI should augment rather than replace human judgment. Human-in-the-loop systems verify AI recommendations, particularly in high-stakes decisions. Interdisciplinary collaboration involving ethicists, technologists, policymakers, and affected communities ensures ethical considerations are addressed throughout development.

In conclusion, ethical AI frameworks grounded in bias mitigation, transparency, accountability, privacy protection, and human oversight provide a solid foundation for responsible AI deployment. Integrating these principles fosters trust, minimizes harm, and ensures AI systems contribute positively to society.

7.Synthesis and policy recommendations for ethical AI use

As artificial intelligence (AI) becomes increasingly integrated into decision-making across industries, ensuring its ethical application is critical. Literature, case studies, and regulatory analyses suggest that fostering ethical AI requires clear guidelines, accountability measures, robust data privacy protections, and inclusive practices to maximize societal benefits while minimizing harm in high-stakes sectors such as healthcare, finance, and law enforcement.

Well-defined ethical frameworks are essential to navigate moral dilemmas arising from AI, particularly regarding fairness, accountability, and transparency. Governments and regulatory bodies should establish comprehensive frameworks informed by ethical theories, including Rawlsian justice and utilitarian ethics, and aligned with international standards such as the OECD AI Principles (OECD, 2019). These frameworks should address algorithmic fairness, data bias, and transparency. Organizations should adopt internal AI ethics codes reflecting these guidelines, tailored to their industry, and developed in collaboration with ethicists, regulators, and academic institutions (Dastin, 2020). Implementation can be supported through mandated ethical audits, independent oversight bodies, and the appointment of AI ethics officers or committees, particularly for high-risk applications (Vinuesa et al., 2020; Binns, 2020).

Algorithmic accountability and transparency are equally critical. AI systems in high-stakes domains may function as opaque “black boxes,” obscuring errors and discriminatory outcomes (Obermeyer et al., 2019; Angwin et al., 2016). Policymakers should require clear explanations of AI decision-making, particularly in healthcare and criminal justice, employing explainable AI techniques accessible to non-experts (Gilpin et al., 2018). Standards for transparency and regular audits should assess fairness, accuracy, and bias, complemented by publicly available accountability reports and AI impact assessments analogous to environmental evaluations (Mittelstadt et al., 2019).

Data privacy is central, given AI’s reliance on sensitive information. The GDPR provides a robust model emphasizing transparency, consent, and the right to explanation (Voigt & Von dem Bussche, 2021). Governments should strengthen AI-specific privacy regulations, addressing automated profiling and decision-making (Dastin, 2020). Organizations should adopt privacy-first strategies, including anonymization, encryption, and user control over data, supported by cross-border agreements to maintain consistent protections (Vinuesa et al., 2020; Voigt & Von dem Bussche, 2021).

Inclusive AI development is vital to preventing discrimination. AI systems may reinforce biases based on gender, race, or socioeconomic status, particularly in hiring, healthcare, and law enforcement (Binns, 2020). Governments can promote inclusion through regulatory standards and funding incentives, while organizations should implement diversity frameworks, test AI for demographic biases, and monitor outcomes continuously (Obermeyer et al., 2019; Mittelstadt et al., 2019). Oversight bodies and collaborations with research institutions or nonprofits can further ensure fairness and social equity.

Given AI's global impact, international cooperation is essential to harmonize ethical standards, data privacy, and accountability across jurisdictions (Voigt & Von dem Bussche, 2021). Governments and international institutions should collaborate to develop global AI governance frameworks, using initiatives such as the OECD AI Principles as foundational references, while bilateral and multilateral agreements can help prevent exploitation of regulatory gaps (OECD, 2019; Mittelstadt et al., 2019).

In summary, ethical AI deployment requires coordinated efforts among governments, organizations, and international institutions. By establishing clear guidelines, enhancing transparency, safeguarding data privacy, promoting inclusivity, and fostering global collaboration, AI can be developed responsibly to build trust, protect rights, and contribute to societal well-being.

8.Conclusion

As artificial intelligence (AI) becomes integral to decision-making across industries, ethical considerations are paramount. Key issues include fairness, transparency, accountability, and data privacy, particularly in high-stakes sectors such as healthcare, criminal justice, and human resources. While AI has the potential to improve outcomes, its algorithms can perpetuate biases and operate without sufficient human oversight, raising significant ethical concerns (Obermeyer et al., 2019; Angwin et al., 2016).

A central finding is the urgent need for comprehensive ethical frameworks to guide AI development and deployment. Organizations must adhere to regulatory standards while fostering a culture of ethical responsibility. Transparency and explainability are crucial to prevent “black-box” systems, ensuring that AI-driven decisions can be understood and scrutinized (Obermeyer et al., 2019; Angwin et al., 2016).

Data privacy is another critical concern. The misuse or mishandling of personal data threatens individual rights, and while the European Union's General Data

Protection Regulation (GDPR) provides a model for robust protections, evolving AI technologies demand ongoing regulatory enhancements, particularly for cross-border data flows (Voigt & Von dem Bussche, 2021).

Inclusive AI design is essential to prevent discrimination and mitigate societal biases. AI systems must be continuously monitored and adjusted to ensure equitable decision-making and protect underrepresented communities from harm (Binns, 2020).

Policy development plays a key role in promoting ethical AI. Clear accountability standards, enhanced transparency, and robust data protection frameworks help organizations create fair and responsible AI systems. International collaboration among governments, regulators, and organizations is necessary to establish shared principles and avoid fragmented regulations that could hinder innovation or exacerbate inequality.

In conclusion, AI holds transformative potential but must be developed and deployed with a steadfast commitment to ethics. Ensuring fairness, accountability, transparency, and privacy will allow AI to augment decision-making responsibly, uphold human rights, and serve the common good as the field continues to evolve.

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PSYCHOLOGICAL ASPECTS OF ACCEPTANCE AND USE OF ARTIFICIAL INTELLIGENCE IN MANAGEMENT AND BUSINESS DECISION-MAKING

Milica ČOLOVIĆ¹, Vladimir MITIĆ²

¹*Singidunum University, Danijelova 32, Belgrade, 11010, Serbia*

+381 64 2784078 , mcolovic@singidunum.ac.rs

²*Metropolitan University, Tadeuša Košćuška 63, Belgrade, 11158, Serbia*

+381 69 1133201, vladimir.mitic@metropolitan.ac.rs

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Abstract

This paper explores the psychological aspects of acceptance and use of artificial intelligence (AI) in management, marketing and business decision-making. Key factors influencing employee attitudes toward AI are analyzed, including trust, perceived usefulness, autonomy, competence, and connectedness. The paper draws on relevant psychological theories such as the Technology Acceptance Model (TAM) and Self-Determination Theory (SDT), and provides an overview of contemporary research on the impact of AI on motivation, psychological well-being and work experience. The aim of the paper is to show how AI can be integrated in a way that supports the psychological safety and professional development of employees.

Keywords: artificial intelligence, psychology, management, motivation, perception, analytics.

JEL Classification: D23, M14, M50

Introduction

The modern business environment is characterized by rapid technological changes that shape the way of decision-making, communication and work of

organization. Artificial intelligence (AI) has become the central driving force of digital transformation — from automated accounting and marketing analytics, to managerial decision support systems and human resource management. It is actively used in accounting for the automation of book-keeping processes, electronic document archiving, financial analytics and real-time reporting, which reduces the number of potential errors, manages finances more efficiently and makes faster and better decisions (Marques et al., 2023; Rikhardsson & Yigitbasioglu, 2018; Yi et al., 2023). When it comes to analytics, artificial intelligence (AI) enables faster collection and processing of big data (Big Data), predictive and prescriptive analytics for predicting future outcomes and trends, as well as discovering hidden patterns and supporting strategic of planning (Gómez-Caicedo et al., 2022; Pavlović et al., 2024; Perifanis & Kitsios, 2023). AI through Decision Support Systems (DSS) enables managers to analyze various scenarios, simulations and predictions, through ERP systems – unifying data from all sectors in order to obtain a complete picture of the business (Malawani et al., 2025; Pancić et al., 2023). Also, managers can use AI for faster collection of data and information, as well as their visualization, and for obtaining and displaying key indicators (KPI) (Sultana, 2025; Vo et al., 2017).

Nowadays, human resources management is unthinkable without the use of AI because it enables easier storage and organization of data on employees, contracts, performance and training, helps in the process of selection and recruitment of candidates, facilitates monitoring of training and progress of employees, as well as monitoring of productivity, staff turnover and employee costs (Al-Shammari et al., 2024; Balje, 2023; Gajić et al., 2025). Of course, in addition to the above-mentioned, AI has found application in medicine (Liu et al., 2021), industry and production (Lu, 2017), transport and logistics (Abduljabbar et al., 2019), education (Milićević et al., 2024), agriculture (Hamrani et al., 2025), as well as in everyday life (Floridi & Cows, 2019). Although the economic and technological benefits of AI are widely recognized, the psychological aspects of its acceptance and use remain relatively underexplored.

Literature Review

Artificial intelligence (AI) enables the automation of routine and repetitive business processes, thereby increasing employee productivity and reducing the time required to complete tasks (Ransbotham et al., 2018). According to Brynjolfsson and McAfee (2017), AI systems contribute to more efficient use of resources and allow employees to focus on more complex and creative activities.

Process automation leads to reduced operating costs and improved overall business performance. AI systems enable the analysis of large amounts of data in real time, which significantly improves the decision-making process (Shrestha et al., 2019). Davenport and Ronanki (2018) point out that AI helps managers to make data-driven decisions, reducing subjectivity and the risk of errors. Machine learning algorithms identify patterns and trends that are not easily discernible to humans, thereby increasing the quality of strategic and operational decisions (Raisch & Krakowski, 2021).

The application of AI in areas such as logistics, inventory management and predictive maintenance enables companies to optimize processes and reduce costs. Wamba et al. (2017) emphasize that AI-based analytics improves the efficiency of supply chains and enables more accurate resource planning. This optimization results in a reduction of losses, better risk management and increased profitability.

AI drives innovation through the development of new data-driven products and services (Cockburn et al., 2018). According to Verhoef et al. (2021), companies that integrate AI into their business models achieve greater organizational agility and respond more quickly to market changes. AI enables the personalization of products and services, as well as the creation of completely new business solutions. The use of AI in analyzing consumer behavior allows companies to offer a personalized customer experience. Chatbots, recommendation systems and intelligent CRM systems improve communication with customers and increase their satisfaction. According to Huang and Rust (2018), AI contributes to the creation of long-term relationships with customers through faster and more accurate responses to their needs.

The integration of AI technologies enables companies to achieve a sustainable competitive advantage. Porter and Heppelmann (2014) point out that digital technologies, including AI, are transforming the strategy and structure of modern companies. Organizations that successfully implement AI respond more quickly to market changes and achieve long-term growth (Chatterjee et al., 2021).

The use of AI in business processes requires not only technical readiness, but also psychological adaptation of employees. Studies show that the successful implementation of AI in organizations relies heavily on psychological factors such as trust in the technology, perceived usefulness, sense of control, motivation and employee identity (Park & Jung, 2021; Bach et al., 2023). Employees who believe that AI helps them to be more efficient and competent are more likely to accept it, while doubts about the reliability of algorithms or fear of losing their jobs often lead to resistance and anxiety (Theis et al., 2023).

The fear of automation and potential job loss is a significant psychological distress. Frey and Osborne (2017) indicate that employees often perceive AI as a threat to professional security, which can cause anxiety, stress and resistance to new technologies. Such fears can negatively affect motivation and work performance, especially in organizations that do not clearly communicate the purpose and limits of AI implementation. Fear of job loss can be viewed through the lens of threat perception theory, according to which employees perceive AI as a threat to their professional role, status and identity. When technology threatens basic psychological needs – safety, control and predictability – there is increased stress and resistance to change (Brougham & Haar, 2018). This phenomenon is particularly pronounced among employees with a lower level of digital competences or in organizations with weak support for learning and development. Empirical research shows that fear of automation can lead to:

- resistance to the adoption of AI systems,
- reduced cooperation with intelligent technologies,
- deliberately underestimating or ignoring AI recommendations (Vrontis et al., 2022).

Brougham and Haar (2018) introduce the term "AI anxiety", which describes a specific form of technological anxiety associated with the fear of professional replacement. The authors point out that this anxiety has a negative effect on the work performance and innovative behavior of employees.

The introduction of AI can increase the cognitive load of employees, especially if the systems that are not intuitive or require constant adjustment. Tarafdar et al. (2015) define technostress as stress caused by the use of information technologies, which can lead to exhaustion, reduced productivity and job dissatisfaction. A high level of cognitive load and technostress can reduce employees' sense of control over work tasks. According to the theory of job demands and resources (Job Demands–Resources model), excessive technological demands without adequate resources (training, support, autonomy) lead to stress and reduced engagement (Bakker & Demerouti, 2007). Also in the environment with intensive use of AI, there is a danger that employees may experience emotional exhaustion and burnout, especially if they do not have adequate training and support (Ayyagari et al., 2011).

The application of artificial intelligence in companies raises a number of ethical questions, especially in relation to the transparency of algorithms, responsibility for decisions and protection of employee privacy. Floridi et al. (2018) point out that the ethical challenges of AI arise from the non-transparency of algorithmic systems

("black box" effect), which makes it difficult to understand and challenge the decisions made. In an organizational context, this is particularly problematic when AI is used to evaluate job performance, recruit, or promote employees. One of the key ethical problems of AI is algorithmic bias. Research shows that AI systems can reproduce or even reinforce existing social and organizational inequalities if they are trained on biased data (O'Neil, 2016). In HR processes, this can lead to discrimination based on gender, age, ethnicity or other personal characteristics. Binns et al. (2018) emphasize that the perception of the fairness of AI decisions has a strong influence on the acceptance of the technology by employees. If employees believe that the AI system's decisions are unfair or non-transparent, there is a decrease in organizational trust and increased psychological stress.

Apart from individual reactions, the integration of AI also changes organizational dynamics. Managers are increasingly making decisions with the support of algorithmic recommendations, which raises questions of accountability, trust, and the ethical balance between human and machine judgment. In this context, the psychological mechanisms of AI acceptance become key to understand how individuals and organizations can achieve synergy between human and artificial capabilities. This paper aims to analyze the existing literature on the psychological aspects of AI acceptance in management, with special emphasis on theoretical models and factors of trust and perceived usefulness.

Theoretical Background

The psychological processes that shape the acceptance and use of artificial intelligence in a business context are usually explained through several interrelated theoretical models. The most prominent among them are the Technology Acceptance Model (TAM), Self-Determination Theory (SDT) and Theory of Planned Behavior (TPB). Each of them offers a different but complementary perspective on how individuals form attitudes and behaviors towards new technologies.

Technology Acceptance Model (TAM)

The Technology Acceptance Model was developed by Davis (1989) and Venkatesh & Davis (2000), based on the assumption that an individual's willingness to use new technology is determined by his perception of usefulness (Perceived Usefulness) and perception of ease of use (Perceived Ease of Use). According to the TAM model, if the user believes that the technology will improve

his work efficiency and that it is easy to use, he is more likely to develop a positive attitude and intention to use it.

This model has been repeatedly confirmed in research related to AI in a business context (Park & Jung, 2021). For example, Park and Jung (2021) found that trust in AI and perceived usefulness directly predicted employees' willingness to use AI tools in their daily work. Raimo et al. (2023) supplemented the model by adding the "mindset" variable — showing that employees with a "growth-oriented" mindset accept innovations more easily, while those with a "fixed" mentality show greater resistance to AI technologies.

Self-Determination Theory (SDT)

Self-determination theory (Deci & Ryan, 2000) points out that motivation and well-being depend on satisfaction of three basic psychological needs: autonomy, competence and connectedness. In the context of AI, these aspects are reflected through whether employees feel that they retain control over their work, whether they believe that AI increases their competencies, and whether cooperation with AI contributes to, or undermines interpersonal relationships in the team. Huang and Zhao (2025) showed that "AI literacy" positively affects job satisfaction precisely through strengthening feelings of competence and autonomy, while lack of understanding of AI can cause feelings of helplessness.

Theory of Planned Behavior (TPB)

Ajzen's (1991) Theory of Planned Behavior suggests that intention to use technology results from a combination of attitude toward technology, subjective norms, and perceived control. This theory is particularly useful for understanding the social aspects of AI adoption — for example, when employees embrace AI because the organization expects it to, or because they want to align with colleagues who already use digital tools.

Trust and perceived usefulness as key factors in AI acceptance

Trust in artificial intelligence

Trust is one of the most important psychological prerequisites for the successful adoption of AI systems (Bach et al., 2023; Theis et al., 2023). While with traditional technologies the user can check the result of his work, with AI systems decisions are often made through complex algorithms whose functioning is not transparent. The absence of explainability and the perception of a "black box" can cause skepticism, fear, or a sense of loss of control.

Research shows that the transparency of the algorithm and the ability to explain the decision are key factors that increase user trust (Theis et al., 2023). Also, trust is not only cognitive (to trust that the AI is working properly), but also emotional — related to a sense of security and predictability of the system. Lack of trust can lead to avoiding the use of AI even when it is objectively useful.

Perception of usefulness and sense of control

Perception of usefulness is a fundamental construct in all models of technology acceptance. If employees perceive that AI contributes to their effectiveness, this perception leads to a positive attitude and willingness to use it (Venkatesh & Davis, 2000). However, when AI begins to take over some of the responsibility for decision-making, conflicts arise between a sense of competence and dependence on technology. In such cases, a sense of control becomes crucial – if employees perceive AI to support, not replace, their expertise, trust and satisfaction grow (Park & Jung, 2021).

Organizations can increase perceptions of usefulness and trust through training, clear accountability protocols, and employee involvement in the AI system implementation process. This strengthens the sense of participation and reduces psychological resistance to new technologies (Babashahi et al., 2024).

Motivation and psychological well-being of employees in the era of artificial intelligence

The integration of artificial intelligence into business processes affects not only the way of working, but also the psychological motivation and subjective well-being of employees. As organizations strive for efficiency and automation, employees face changes that affect their sense of autonomy, competence, and professional identity. These factors represent key determinants of psychological adaptation to AI (Deci & Ryan, 2000; Huang & Zhao, 2025).

Autonomy and a sense of control

Autonomy is the foundation of internal motivation. In the context of artificial intelligence, it refers to the extent to which employees have a sense of control over the processes that AI supports. When employees perceive that AI systems complement their abilities and enable them to better manage tasks, motivation and job satisfaction increase (Huang & Zhao, 2025). Conversely, if AI is perceived as an imposed tool that takes over decisions or limits creativity, increased feelings of helplessness and reduced influence on the work process arise (Calvard & Sang, 2022).

In studies conducted in organizations that use AI for market analysis and prediction of consumer behavior, employees stated that AI facilitates their decision-making, but at the same time reduces their role in the interpretation of results (Böcher, 2024). This paradox — relief with a concomitant loss of subjective significance — is one of the central challenges for managers in balancing technological efficiency and employee psychological empowerment.

Competence and sense of professional worth

Artificial intelligence can be both a source of growth and a threat to the sense of competence. When employees possess a sufficient level of AI literacy—understanding the basic principles, limitations, and possibilities of AI—their confidence in using the technology and their sense of professional relevance increases (Huang & Zhao, 2025). However, in situations where AI surpasses human judgment, the phenomenon of "competence insecurity" occurs, which can lead to reduced engagement and resignation (Babashahi et al., 2024).

Programs that combine training on AI tools with the development of "soft skills" (communication, creative problem solving) have proven to be a successful way to maintain a sense of competence (Calvard & Sang, 2022). This shows that the psychological growth of employees in the digital environment does not depend only on technical adaptation, but also on the perception that their role is still irreplaceable in processes that require human assessment and empathy.

Connection and social dynamics

The introduction of AI systems into teamwork is changing the patterns of communication and collaboration. Automated tools often take over part of the interaction between employees, thus reducing the number of social contacts and the possibility of informal learning. Studies indicate that reduced interaction can negatively affect a sense of connectedness and belonging to a team, which is one of the key prerequisites for long-term well-being (Theis et al., 2023).

On the other hand, when AI systems support collaboration — for example through suggestions for team decision-making or knowledge sharing — they can even increase cohesion and mutual trust within the team (Bach et al., 2023). Therefore, the effect of AI on social relations largely depends on the way of implementation and the organizational culture in which it is used.

Stress and psychological safety

Changes in work processes accompanying AI technologies often cause technostress — stress associated with the introduction of digital innovations

(Tarafdar et al., 2019). Causes include job insecurity, the need for continuous learning, and the feeling of having to keep up with the pace of algorithmic systems. Feeling of psychological safety – that is confidence that opinions and mistakes can be voiced without negative consequences – is key to reducing stress and resistance. Organizations that foster open communication and employee participation have significantly higher chances for successful and psychologically sustainable integration of AI (Calvard & Sang, 2022).

Discussion

An analysis of the modern scientific literature shows that psychological factors – trust, perceived usefulness, autonomy, competence, and connectedness – form the essential basis of AI acceptance in the business environment. Although many studies are focused on technical and economic aspects, a growing number of authors emphasize that the psychological adaptation of employees determines the success of digital transformation (Park & Jung, 2021; Huang & Zhao, 2025).

The importance of AI literacy and ethical transparency is particularly emphasized. When employees understand how AI makes decisions, their confidence and sense of control increases. Explainability becomes crucial not only for technical reliability, but also for psychological acceptability of the system (Theis et al., 2023).

Also, research indicates differences in attitudes towards AI between managerial and operational positions (Böcher, 2024). Managers are more likely to see AI as a tool to increase productivity, while executives express a greater fear of losing autonomy. These differences highlight the need for AI implementation to be accompanied by communication and educational strategies that address the specific psychological needs of different groups of employees.

In a broader sense, organizations that introduce AI gradually, while involving employees in the design and training process, achieve greater stability and less resistance. This confirms that technological success and psychological acceptance are mutually dependent categories.

Conclusions

Artificial intelligence is transforming modern management, marketing, accounting and business economics, but its success depends on the human factor. The literature review shows that psychological processes – trust, perceived usefulness, autonomy, competence, and relatedness – form the basis for understanding how employees experience and accept AI systems.

Positive outcomes, such as greater motivation and efficiency, occur when employees feel that AI expands their capabilities, while negative ones – stress, resistance, and anxiety – occur when AI threatens their autonomy or identity. Therefore, it is necessary for organizations to approach the introduction of AI through an interdisciplinary perspective, which includes the technical, organizational and psychological dimensions of change.

Longitudinal examination of the long-term effects of AI on job satisfaction and mental health, as well as comparative studies between different industries and cultural contexts, are recommended for future research. This would provide a deeper picture of how AI can contribute not only to productivity, but also to the psychological well-being of employees — which, ultimately, is a prerequisite for sustainable business development in the age of intelligent systems.

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SOVEREIGN EDGE AGENTIC LLM SYSTEMS (SEALS), TOWARD A PERSONAL AI AND ORGANIZATIONAL SOVEREIGN AI DECISION ASSISTANT

Jovan IVKOVIĆ ¹,

¹*ITS Information Technology School, 11000 Belgrade, R. Serbia,
Tel: +381 11 2096 777, Email: jovan.ivkovic@its.edu.rs*

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Abstract

The coming decade of computing will be defined less by ever larger models and more by whether agentic LLM systems can be deployed with sovereignty, resilience, predictable cost, and auditable accountability. Cloud-centric LLM stacks concentrate control, couple critical decisions to connectivity and provider updates, and obscure multi-step tool use, exactly where governance and trust are hardest. In safety-critical and regulated settings, this shift is no longer optional, it is inevitable. Meanwhile, edge devices with NPUs and heterogeneous accelerators are making local, quantized inference and lightweight orchestration practical, opening a path toward sovereign assistants that remain inside the organizational boundary.

This paper introduces Sovereign Edge Agentic LLM systems (SEALs), node-bound, role-constrained agents that run primarily on local hardware and local data, continue to operate under intermittent connectivity, and produce verifiable evidence for each decision. SEALs integrate (I) local retrieval for grounding in curated knowledge, (II) a controlled tool layer that restricts actions to approved capabilities, and (III) a decision-assurance layer that emits a verifiable “decision book” linking outputs, evidence, tool calls, and calibrated confidence signals. We argue that SEALs are a critical building block for future human-centric computing, where AI assistants must be accountable by design, not by after-the-fact policy.

Keywords: *sovereign AI; edge AI; personal AI; agentic LLMs; decision assurance; data sovereignty; AI governance.*

JEL Classification: C45, M15, L86, O33, D83

1. Introduction

The coming decade of computing will be defined less by ever larger models and more by whether agentic LLM capabilities can be deployed with sovereignty, resilience, predictable cost, and auditable accountability. Most deployments today remain cloud based, accessed through remote APIs that are updated, priced, and governed by external providers. This architecture accelerates adoption, but it also concentrates control, couples' critical decisions to connectivity and vendor policy, and obscures multi step tool use, precisely in the regimes where governance and trust are hardest to sustain. In regulated and safety critical settings, the ability to demonstrate what the system did, why it did it, and under which constraints, is no longer an academic ideal, it is a practical requirement.

From the perspective of decision support, this is a familiar problem in a new technical form. Decision support systems were introduced to augment managerial judgment under uncertainty, and to structure the path from data to decision in a way that organizations can understand, monitor, and improve over time [Keen and Scott Morton, 1978]. When decision logic is mediated by an opaque model outside the organizational boundary, classic DSS questions, what was decided, why, based on which evidence, and with what alternatives, become difficult to answer at scale. The problem becomes sharper in agentic workflows, because the system is no longer a single inference. It becomes a sequence of tool calls, intermediate states, retrieval steps, and policy constrained actions, therefore accountability cannot rely on simple input output logs.

Cloud based LLM services bring real advantages, and it would be unscientific to deny them. They scale on demand, shorten time to first prototype, externalize infrastructure overhead, and provide fast access to state of the art models. However, the same architecture introduces structural dependencies that are especially costly under operational constraints. Latency spikes and outages translate directly into operational risk, vendor policy changes can reshape system behaviour without local consent, and lock in can become a strategic constraint rather than a procurement detail. In other words, convenience is purchased with reduced control, and this trade-off is often hidden until the system becomes operationally critical.

The regulatory and standardization landscape has already responded, and its direction is clear. ISO/IEC 42001 defines requirements and guidance for an organizational AI management system, while ISO/IEC 23894 provides AI specific risk management guidance across the lifecycle [ISO/IEC, 2023a; ISO/IEC, 2023b]. NIST's AI Risk Management Framework offers a practical structure for governance, measurement, and risk controls that can be operationalized in real organizations [Tabassi, 2023]. At the legal level, the EU Artificial Intelligence Act introduces a risk-based regime that elevates documentation, transparency, human oversight, and accountability obligations for certain classes of AI systems [European Parliament and Council, 2024]. Taken together, these frameworks shift the burden of proof, organizations must be able to demonstrate how decisions are produced, how risks are controlled, and how changes over time are detected and managed.

In parallel, edge hardware has undergone a quiet revolution. Edge intelligence has been discussed as the “last mile” of AI, where computation moves closer to data sources to reduce latency, bandwidth, and privacy exposure [Zhou et al., 2019]. Recent hardware generations increasingly integrate NPUs and heterogeneous accelerators that enable practical local inference for demanding workloads, and this trend directly expands the design space for local AI deployments [Ivković and Lužija Ivković, 2023]. For LLMs, practical quantization and efficient fine-tuning methods further reduce the barrier to on device deployment for small and mid-sized models [Dettmers et al., 2023]. Local deployment does not eliminate the need for careful evaluation, but it makes sovereignty, predictability, and auditability achievable as architectural goals rather than aspirational slogans.

This paper introduces Sovereign Edge Agentic LLM systems (SEALs). A SEAL is a node bound, role constrained agent that runs primarily on local hardware and local data, remains functional under intermittent connectivity, and exposes a governance boundary that can be verified. SEALs integrate (I) local retrieval for evidence grounding in curated knowledge, (II) a controlled tool layer that restricts actions to approved capabilities, and (III) a decision assurance layer that emits a verifiable decision book, linking outputs, evidence, tool calls, and calibrated confidence signals. Because trust must be measurable, SEAL adopts decision centric assurance metrics, including calibration measures such as expected calibration error, which have proven essential for modern neural systems [Guo et al., 2017]. The emphasis is not on maximizing model size, but on maximizing decision quality under operational constraints, and on making the decision process inspectable, accountable, and controllable inside the organizational boundary.

The paper makes four contributions. First, it formalizes SEAL as a decision centric architecture for sovereign personal and organizational AI assistants. Second, it specifies an assurance layer and a minimal set of measurable criteria so that claims about trust, drift, and reliability are tied to observable quantities rather than intuition. Third, it outlines an implementation pattern compatible with heterogeneous edge hardware and a disciplined governance boundary. Fourth, it maps key controls to major AI governance and risk frameworks, clarifying how a technical architecture can support compliance and managerial accountability.

The remainder of the paper is organized as follows. Section 2 motivates the paradigm shift through the lens of sovereignty and accountability. Section 3 presents the SEAL architecture and its components. Section 4 discusses decision assurance and the measurement plan. Section 5 outlines implementation options and deployment considerations, and Section 6 concludes with limitations and directions for future work.

1.1. Contributions of work.

This paper makes five concrete contributions, each aligned with the central objective of turning “local LLM capability” into an auditable, decision-grade, sovereign system, rather than another generic conversational layer.

D1, SEAL definition. We formalize the notion of a Sovereign Edge Agent LLM System (SEAL) as a personal or organizational decision assistant that is node-bound and role-constrained, designed to operate locally, including air-gapped settings when required, and to learn and adapt in a management context through locally owned data and locally controlled procedures. The definition is explicitly anchored in the “local agent” paradigm, where the agent is not separated from the environment that gives its decisions meaning, responsibility, and verifiability [Ivković and Lužija Ivković, 2025].

D2, decision-centric assurance metrics. We specify a decision-assurance layer that treats quality as more than model accuracy, because decision systems fail in the tail, in regime changes, and under miscalibrated confidence. The metric set therefore includes probability calibration as a first-class requirement, because well-calibrated confidence is a prerequisite for defensible decision-making [Guo et al., 2017], and tail-risk control through CVaR, because mean performance is not a robustness guarantee when the cost of failure is asymmetric [Rockafellar and Uryasev, 2000]. This makes “decision quality” measurable in the language of risk, not only in the language of benchmarks.

D3, implementation form. We translate the concept into a practical deployment form that is realistic for the near term, PC plus GPU workstations and edge nodes

under power, latency, and connectivity constraints. The point is not a laboratory prototype, but a repeatable architecture pattern, local model, local retrieval, local tools, local policies, and a local audit trail, that does not depend on external services at run time. Quantization-friendly fine-tuning methods, exemplified by QLoRA, are treated as enabling infrastructure for making such deployments economically and technically feasible [Dettmers et al., 2023].

D4, mapping to standards and regulation. We map SEAL controls to AI governance and compliance expectations, not as an afterthought, but as an architectural constraint. In particular, we align the system-level control logic with an AI management system perspective [ISO/IEC, 2023], and we connect the decision-assurance layer, calibration, robustness, and traceability, to the type of requirements that typically arise when an AI system is used in consequential organizational contexts [European Parliament and Council, 2024]. The intended outcome is a design that can be explained and defended, not merely demonstrated.

D5, a realistic pathway toward neuromorphic edge robustness. Finally, we outline a forward path in which SEAL can benefit from event-based and neuromorphic computing principles as they become practically accessible on edge hardware. The motivation is simple, disconnected and constrained environments demand graceful degradation, not fragile peak performance. Prior work on disconnected edge AI hardware directions supports this trajectory [Ivković and Lužija Ivković, 2023], while the regime and “zones of attraction” viewpoint provides a conceptual lens for why monitoring mode shifts and dynamics is not optional in real decision environments [Ivković, 2024].

2. Literature Review

Technology is not a story about machines, it is a story about people, and about who holds the power to create, to decide, and to innovate. Across the history of computing, that power has repeatedly moved between centralization and democratization. There were periods when the most advanced tools were concentrated in the hands of a few institutions, followed by moments when technology became accessible to many, and when new forms of creativity and economic growth followed almost immediately.

In the middle of the twentieth century, computers were huge, expensive, and organizationally distant. Their value was undeniable, but their control was centralized, and therefore their benefits were unevenly distributed. The personal computer era changed this relationship, not only by shrinking hardware, but by shifting agency. Computing became personal, local, and flexible, and it moved from being a

privilege of large institutions to becoming a general-purpose instrument of work and invention.

Today, we are at a similar turning point. LLM-driven AI systems are becoming the cognitive infrastructure of the new age, yet most of that infrastructure is again centralizing. Data travels across borders to be processed, models are updated and governed by remote providers, and the most powerful capabilities are accessible primarily through external APIs. This is not only a technical architecture choice, it is a cultural and economic choice, because it affects autonomy, privacy, and the long-term capacity of people and organizations to shape their own tools.

There is a deep irony in this moment. Just when the cost of computing has fallen and knowledge has become widely available, the most consequential layer of the stack, the layer that increasingly influences decisions, plans, and actions, is moving back into centralized platforms. The question is not whether this is “good” or “bad”, the question is whether we understand the implications of this design choice, and whether we leave ourselves an alternative path.

That alternative path is not a utopia. Modern hardware, from NPU-enabled PCs to heterogeneous accelerators and edge nodes, increasingly supports local inference and local orchestration. The enabling direction is clear, local AI is becoming technically feasible, and the societal demand for sovereignty, privacy, and accountability is becoming stronger rather than weaker. The practical question therefore becomes straightforward, can we build AI assistants that remain inside the organizational boundary, operate under intermittent connectivity, and still provide decision-grade accountability.

The SEAL concept is an attempt to answer that question with a clear architectural position. SEAL is not a rejection of the cloud, and it is not a nostalgic return to pre-cloud IT. It is a rebalancing, a deliberate separation between tasks that truly require hyperscale services, and decisions that must remain local because they are sensitive, regulated, time-critical, or strategically core. In that sense, SEAL frames a “circle of power” in which technology again serves people and organizations as owners of their data, their models, and their decisions, instead of positioning them as perpetual tenants of external platforms.

2.1. Deglobalization, Data Sovereignty, and the Limitations of Cloud AI

The political and economic context of the last decade has reintroduced sovereignty as a first-class constraint. Data sovereignty, and the broader phenomenon often described as data nationalism, is no longer a marginal legal footnote. It shapes where data may reside, how it may be processed, and which institutions may hold effective control over critical digital assets [Chander and Krishnamurthy,

2021]. In such an environment, cloud AI ceases to be a neutral technical convenience. It becomes a geopolitical and compliance surface, because the location of data, the jurisdiction of providers, and the enforceability of organizational controls are all entangled.

For many organizations, this creates a structural dilemma. Cloud AI provides immediate access to frontier capabilities, but it also ties decision processes to external connectivity and external governance. In practical terms, the risk is not only about confidentiality. It is also about continuity, predictability, and strategic autonomy. If a decision workflow becomes dependent on vendor-controlled models, pricing, or policy constraints, then the cost of failure can exceed the cost of inference itself, because the organization loses control over its own decision infrastructure.

A second limitation is purely technical, and it is often underestimated. The default response to capability demand has been scaling in centralized clouds, yet the scaling path is not unbounded. Analyses grounded in Amdahl's law and scaling rules highlight that performance and efficiency gains can be limited by bottlenecks that do not disappear simply by adding parameters or compute [Végh, 2019; Végh, 2021]. This matters for governance and economics, because it implies that "bigger in the cloud" is not a guaranteed long-term strategy for sustainable, widely accessible decision systems.

For organizations that do not, or do not want to, operate hyperscale data centers, and at the same time do not want to outsource key decisions to global platforms, the question becomes unavoidable, is there a middle ground between "everything in the cloud" and a return to rigid, pre-AI on-premise systems.

2.2. SEAL as a PC revolution but for AI

The SEAL concept represents the same type of paradigm shift that the PC brought to the mainframe world, but for AI, in the sense that it becomes personal, locally controllable, and economically predictable. Instead of relying on cloud services for every decision, SEAL enables local execution, decisions are made where the data resides and where consequences are sensitive. It enables data sovereignty, no prompt or document leaves the organization without explicit permission. It enables predictable costs, an investment in local hardware instead of permanent exposure to token-based billing. It also enables local adaptability, models can be tuned to specific organizational needs without waiting for global updates.

Just as the PC did not eliminate mainframes but redefined their role, SEAL does not eliminate the cloud, it reduces it to an option for specific tasks rather than a necessity for every AI interaction. This is a key difference. The cloud becomes a

powerhouse for large-scale tasks, while SEAL becomes a generator for urgent and sensitive needs, each in its proper place, without forced dependence. In the end, this is not just a technical choice, it is a choice about who controls the decisions in the organization.

Table no. 1. Comparison of computing era's

MAINFRAME ERA (1970S)	CLOUD AI ERA (2020S)	THE PC REVOLUTION (1980S)	SEAL (PERSON-AL AI) REVOLUTION (2026+)
Central Data Centers	Hyperscale AI Data Centers	Desktop Computers	Edge AI Nodes
IT department as a stunt	Global AI Providers	Office Tools	Organizational AI Associates
Counting Clocks	API tokens	One-time purchase	Capital investment
Dependency on IBM.	Dependency on NVIDIA/Google/Meta	Microsoft/Apple ecosystem	Sovereign Organizational Models

3. Previous papers and conceptual starting point

This work naturally builds on several strands of research that, taken together, motivate SEAL as an architectural synthesis, rather than as another “bigger model” proposition.

The first strand is the classical tradition of decision support systems (DSS). Keen and Scott Morton defined DSS as interactive computer systems that assist managers in poorly structured problems, relying on a pragmatic combination of models, data, and human judgment, rather than on automation alone [Keen and Scott Morton, 1978]. Contemporary DSS thinking, especially under the umbrella of digital transformation and the emerging paradigm of “decision intelligence”, shifts the focus from model-centric performance to the quality of the decision outcome, and treats AI as one layer in a broader decision pipeline, not as the single point of decision-making. This shift is visible in work on AI-augmented DSS architectures, where the “decision log” is used not only as a record, but as a mechanism for tracking the dynamics of different decision regimes over time, which is essential when

decisions must remain accountable under changing conditions [Ivković et al., 2025]. This view is also compatible with recent business-oriented work on hybrid intelligence collaboration, where the emphasis is on structuring human–AI complementarity and oversight rather than replacing human judgment (Stanković, 2025).

The second strand comes from edge AI and neuromorphic-oriented hardware and algorithms. It has been shown that AI functionality can be embedded in constrained MCU/SoC platforms augmented with NPUs and, or coupled GPUs, enabling local analytics and decision-making even in the absence of stable cloud connectivity, with energy efficiency that can surpass classical deep learning pipelines when the workload is designed for the constraints of edge execution [Ivković and Lužija Ivković, 2023; Zhou et al., 2019]. Notably, earlier work already framed AI-equipped SoC/MCU nodes as viable local intelligence points in IoT edge settings, providing an initial empirical and conceptual basis for local-first AI long before today’s mainstream resurgence of on-device models (Ivković, Lužija Ivković, and Veljović, 2019). In parallel, neuromorphic architectures and brain-inspired models, including spiking neural networks (SNNs), KAN-like structures, and oscillatory neural networks (ONNs), have been explored as complementary or alternative approaches to classical deep learning, particularly for event-driven and temporal data streams, where the physics of neuromorphic computing begins to converge with biologically inspired processing principles [Ivković and Lužija Ivković, 2024; Marković et al., 2020].

The third strand concerns local agent-based LLM systems, coupled with reinforcement learning and advanced reasoning, where quantized models are deployed on relatively modest hardware, including ordinary PC configurations and SBC platforms with external GPU cards, and used as the core of a local agent-based decision support system. The key point in these systems is not merely running a model locally, but enabling adaptive learning from locally owned data, while avoiding runtime dependence on centralized services, and strengthening accountability through explicit local audit trails [Ivković and Lužija Ivković, 2025]. In the DSS context, the concepts of a “decision log”, data biography, and decision-making in zones of attraction frame the system as a dynamic process that moves through different modes, rather than as static benchmark accuracy, which improves auditability and adaptability in changing environments [Ivković et al., 2025; Ivković, 2024].

The fourth strand is contemporary literature on couplings between RL and LLMs. Reviews by Pternea et al. and Cao et al. systematize, on the one hand, the

roles of LLMs in RL, as information processors, planners, and strategy generators, and on the other hand, the roles of RL in improving LLM-driven behavior, including alignment and adaptive planning under constraints [Pternea et al., 2024; Cao et al., 2024]. This line of work also connects to conditional-computation paradigms, such as Mixture-of-Experts (MoE), as a practical route for scaling capability “in breadth” through selective activation, which is relevant when edge hardware budgets are binding [Cai et al., 2024]. These insights matter for SEAL because they show how an agent can distribute complexity through experts and tools, without relying solely on extreme parameter scaling, and they are consistent with known scaling limitations discussed through Amdahl’s law in large neural systems [Végh, 2019; Végh, 2021].

Finally, work on neuromorphic computation, together with research on N-dimensional chaotic attractors and regime dynamics, suggests that many real-world systems are better described as moving through a landscape of attraction zones than as a single fixed distribution of data [Marković et al., 2020; Ivković, 2024]. Decisions are made not over “one world”, but over a world whose regimes and topology change. The SEAL concept attempts to bring this regime-aware perspective down to architecture, rather than keeping it at the level of metaphor, and to support graceful degradation and continued local usefulness in disconnected scenarios.

4. Sovereign Edge Agent LLM System (SEAL) Concept

Intuitively, a SEAL can be understood as a local AI advisor bound to a specific physical node, a workstation, an edge server, or an embedded device, and bound to a specific role inside the organization, for example financial risk, production planning, or budget management. Unlike a generic chatbot that knows “a little bit about everything”, a SEAL is rooted in a concrete environment, it operates on local data, follows local procedures, and responds to local users and local accountability requirements.

Formally, for each edge node i , we observe an **input space** $X^{(i)}$, representing local observations, documents, logs, telemetry, and business context, and an **output space** $Y^{(i)}$, representing recommendations, decisions, and actions. On node i , SEAL implements a decision function:

$$f_{\theta^{(i)}}^{(i)}: X^{(i)} \rightarrow Y^{(i)}, \quad y^{(i)} = f_{\theta^{(i)}}^{(i)}(x^{(i)}).$$

Here, $\theta^{(i)}$ is not “only the model”. It is the full local configuration that makes the agent operational, it includes the quantized LLM, the RAG configuration, the set of permitted tools, local policy and safety constraints, local risk thresholds, and other parameters that define what the agent is allowed to do and how it should behave. Learning and adaptation take place locally, through an update operator

$$\theta_{t+1}^{(i)} = U^{(i)}(\theta_t^{(i)}, D_t^{(i)}, M_t^{(i)})$$

where $D_t^{(i)}$ denotes the local data stream at time t , logs, decision history, and local

corpora, while $M_t^{(i)}$ denotes an optional set of messages and meta-information received from other nodes or from a cloud-managed layer, for example periodic policy updates, model upgrades, or federated gradients. In the ultimate sovereign

mode, $M_t^{(i)}$ is practically empty, the node adapts exclusively from its own experience, optionally supported by a Human-in-the-Loop (HiTL) process that explicitly approves critical changes.

When we consider a network of nodes, SEAL becomes a system of interacting

decision loci. We describe it as a directed graph with a set of nodes $\mathcal{N}$ and a set of

links $\mathcal{E}$, where each link represents a communication channel over which aggregates, gradients, or model components may be exchanged. Formally,

$$\mathcal{S} = (\mathcal{N}, \mathcal{E}, \{f_{\theta^{(i)}}^{(i)}\}_{i \in \mathcal{N}}, \{U^{(i)}\}_{i \in \mathcal{N}}).$$

The goal of the system is not merely to maximize average predictive accuracy, but to optimize decision outcomes under constraints of communication cost, energy budget, and risk.

To reflect this, for each node we introduce a local objective function that combines utility and tail risk, $J_i(\theta^{(i)})$:

$$J_i(\theta^{(i)}) = \mathbb{E}[R_i(Y^{(i)}, Z^{(i)})] - \beta_i \text{CVaR}_{\alpha_i}(L_i)$$

where R_i denotes the local KPI utility at node i , economic outcome, reliability, timeliness, savings, $Z^{(i)}$ denotes environmental conditions or context, L_i denotes the loss associated with the decision, for example credit loss, penalty, downtime, reputational cost, $\beta_i > 0$ is the risk-aversion coefficient, and $\alpha_i \in (0,1)$ is the confidence level for CVaR, for example 0.95. The CVaR term is used because decision systems are often punished by rare but severe outcomes, and tail behavior is exactly where “average performance” becomes an unreliable proxy for real operational safety and cost [Rockafellar and Uryasev, 2000]. At the system level, the global objective can be written as

$$J_{\text{global}} = \sum_{i \in \mathcal{N}} w_i J_i(\theta^{(i)}) + \lambda C(\mathcal{E}, \{M_t^{(i)}\})$$

where w_i measures the relative importance of node i , for example by budget share or risk exposure, and $C(\mathcal{E}, \{M_t^{(i)}\})$ captures the aggregate cost of communication, energy, latency, risk of leakage, and potential compliance exposure. The coefficient $\lambda \geq 0$ explicitly penalizes dependence on communication and centralization. A higher λ corresponds to the typical SEAL environment, communication is expensive or risky, therefore decision-making should remain local whenever possible. In this sense, sovereignty is not only a philosophical question of ownership, it is an optimization constraint that balances autonomy against necessary coordination.

4.1. Hybrid federated regime

As a compromise between complete isolation and full centralization, SEAL can support a hybrid federated regime. In such a regime, organizations can form “sovereign alliances”, they exchange gradients or model components, potentially protected through secure aggregation and privacy-preserving mechanisms, while raw data remains local. In this mode, for a node i , the local gradient is:

$$g_t^{(i)} = \nabla_{\theta} \mathcal{L}_i(\theta_t^{(i)}; D_t^{(i)})$$

and a federated aggregation can be expressed as

$$\bar{g}_t = \text{AGG} \left(\{g_t^{(j)}\}_{j \in \mathcal{F}_t} \right)$$

where $\mathcal{F}_t \subseteq \mathcal{N}$ is the set of participating nodes in a federation round, and **AGG** is a secure aggregation protocol. The node update then becomes

$$\theta_{t+1}^{(i)} = \theta_t^{(i)} - \eta_i \bar{g}_t$$

where η_i is a node-specific step size. This regime aims to retain local control while still allowing collective learning when it is useful and acceptable.

4.2. Definition of SEAL System

SEAL is neither a “domestic AGI” nor an attempt to imitate cloud hyperscale services on weaker hardware. It answers a more constrained and more practical question, **what kind of AI is needed when the world is unstable, when data should not leave the environment, and when decision errors have costs that cannot be captured by accuracy alone.**

Definition (SEAL). A Sovereign Edge Agentic LLM is a personal, on-premises, optionally air-gapped multimodal agent, permanently attached to a specific physical edge node and user role. It operates on on-premises tools and on-premises corpora without permanent dependence on the cloud, and it maintains an append-only Decision Book, an audit record of inputs, evidence retrieval, tool calls, recommendations, and observable outcomes. The design goals are: (G1) data sovereignty of both storage and execution, (G2) confidentiality with low latency, (G3) audit-ready decision assurance, (G4) graceful degradation in disconnected mode, and (G5) a modular improvement pathway, for example by integrating neuromorphic front-ends as they become practically available.

SEAL layers (schema) remain as an illustration of implementation layers:

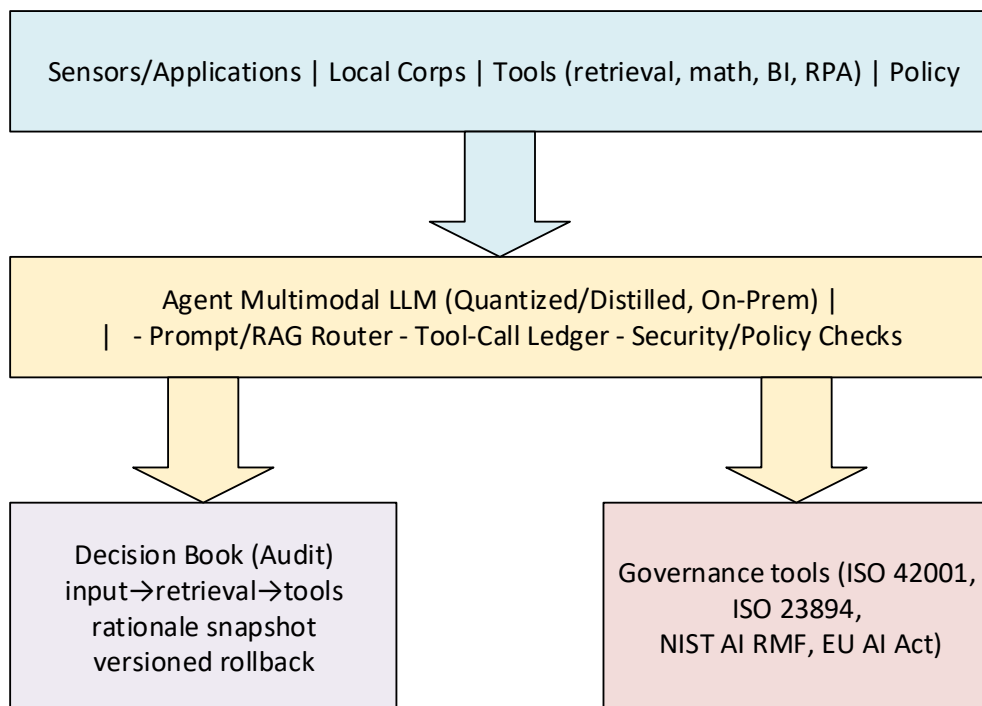


Figure nr. 1. Architecture of the SEAL layers (schema)

Source: Author

In implementation terms, SEAL is naturally described as a layered system. The physical node provides data sources and applications, a local retrieval layer provides grounding in curated corpora, a controlled tool layer restricts actions to approved capabilities, and the agent core provides reasoning and orchestration. This scheme is in direct correspondence with the formal description: the Agent LLM is the implementation of the function, $f_{\theta}^{(i)}$. The *Decision Book* and governance hooks are not optional add-ons, they are the practical surface through which assurance metrics, including CVaR, VoD, and TTRCD, can be computed and audited, and through which compliance-oriented controls can be mapped to governance frameworks such as ISO/IEC 42001 and ISO/IEC 23894, NIST AI RMF, and the EU AI Act [ISO/IEC, 2023a; ISO/IEC, 2023b; NIST, 2023; European Parliament and Council, 2024].

5. Metric Decision Assurance Framework

If we take SEAL seriously as part of a decision support system (DSS), it becomes obvious that classic ML metrics, accuracy, F1, ROC-AUC, are no longer sufficient. In dynamics where operating modes change and errors have asymmetric costs, we need metrics that answer not only “whether the model is right”, but also “how wrong it is when it is wrong”, “how quickly it realizes that the world has changed”, and “how honest its probabilities are”.

To validate these metrics under controlled conditions, we used simulations on synthetic data generated in Python (NumPy), where loss distributions are modelled as normal with mean 0 and standard deviation 1. This setup allows ECE and CVaR to be tested before and after local adaptation, and it makes the behaviour of the assurance metrics observable independently of any single real dataset. For calibration we follow the standard formulation used for modern neural systems [Guo et al., 2017], and for tail risk we use CVaR as a well-established measure of worst-case expected loss [Rockafellar and Uryasev, 2000].

Probability calibration is crucial because neural networks and LLM-based systems are often poorly calibrated, tending to output probabilities that are systematically too high or too low even when their internal representation is uncertain [Guo et al., 2017]. For a SEAL that needs to communicate to a human decision-maker not only a recommendation but also the degree to which it “stands behind” that recommendation, calibration is therefore a practical control variable, not a laboratory statistic.

At the same time, in finance and engineering systems it has long been clear that the mean is not enough, it is crucial how the system behaves in the tail of the loss distribution. This is why we introduce CVaR as a measure of tail risk [Rockafellar and Uryasev, 2000]. The world in which SEAL operates is not stationary, modes change, markets move between phases, and machines transition from normal to overloaded operation. That is why we also introduce Regime Change and Time to Detection (TTRCD) as a time-robustness indicator, as well as Decision Value (VoD) as a KPI-level difference between the SEAL policy and a baseline policy.

From the regulatory perspective, SEAL-like systems used in finance, public management, or critical infrastructure may fall under “high-risk” obligations, where record-keeping, robustness, accuracy, and cybersecurity requirements are emphasized. The proposed assurance framework supports these expectations by combining (I) calibration as evidence of probability reliability, (II) CVaR as explicit tail-risk control, (III) TTRCD as response speed under regime shifts, and (IV) a

Decision Book (decision log) as auditable traceability of recommendations and outcomes [European Union, 2024]. By doing so, SEAL is positioned not only to meet compliance expectations, but to go beyond them through proactive decision assurance.

5.1. Calibration of probabilities

Neural networks and LLMs are often poorly calibrated, tending to output probabilities that are too high or too low even when uncertainty is substantial [Guo et al., 2017]. For a SEAL that must communicate to a human decision-maker not only the proposal but also the degree of confidence behind it, calibration is key.

Consider a set of binary predictions $\{(p_i, y_i)\}_{i=1}^N$, where $p_i \in [0,1]$ is the predicted probability of a positive outcome and $y_i \in \{0,1\}$ is the realized outcome. Predictions are grouped into M bins $\{B_m\}_{m=1}^M$ by probability value. Let $n_m = |B_m|$ be the number of samples in bin m , $N = \sum_{m=1}^M n_m$ the total number of samples, $\widehat{p}_m$ the average predicted probability in bin m , and $\widehat{a}_m$ the empirical accuracy in bin m . The Expected Calibration Error (ECE) is:

$$ECE = \sum_{m=1}^M \frac{n_m}{N} |\widehat{p}_m - \widehat{a}_m|$$

The Brier score measures squared loss over probabilistic predictions:

$$BS = \frac{1}{N} \sum_{i=1}^N (p_i - y_i)^2$$

It reflects both accuracy and calibration properties.

In a SEAL system, these metrics are not decoration. They become part of operational constraints. If ECE exceeds a defined threshold for a critical subsystem, such as credit-risk estimation or probability of failure, policy can require escalation to humans (HiTL) or trigger a recalibration procedure before the channel is allowed to operate autonomously. In additional simulations, local adaptation reduced ECE by approximately 50% in representative financial-risk scenarios, indicating that calibration can serve not only as a descriptive statistic but also as a practical guide for SEAL policy tuning.

5.2. Tail risk (CVaR)

In finance and engineering systems, it is not enough to optimize mean loss, it is crucial to control the tail of the loss distribution. Let L denote the loss associated with a decision. The Value-at-Risk (VaR) at confidence level $\alpha \in (0,1)$ is the α -quantile:

$$\text{VaR}_\alpha(L) = \inf\{l \in \mathbb{R} : \mathbb{P}(L \leq l) \geq \alpha\}$$

Conditional Value-at-Risk (CVaR) is the expected loss in the worst cases, conditioned on exceeding VaR:

$$\text{CVaR}_\alpha(L) = \mathbb{E}[L \mid L \geq \text{VaR}_\alpha(L)]$$

CVaR answers the operational question “how bad are the worst cases” [Rockafellar and Uryasev, 2000]. In the SEAL context, this means recommendations are not tuned only for the “average outcome”, but are constrained to limit worst-case scenarios, which is particularly important in financial risk, public budgets, and industrial safety.

Simulations with Python and `scipy.stats` indicate that local adaptation can reduce CVaR by about 40% relative to the baseline policy, for example in a representative scenario CVaR drops from about 10% to below 5% on synthesized datasets. This provides a direct quantification of the “decision insurance” effect, where improvement is measured not only in mean performance, but also in reduced tail exposure.

5.3. Changing mode and time to detection (TTRCD)

The world in which SEAL works is not stationary. Energy prices can spike, consumer behavior shifts, and machines enter new operating modes. In the regime-based perspective developed in our work on N-dimensional chaotic attractors, a system can move between different zones of attraction, and two observed states can look similar in level while belonging to different branches of dynamics [Ivković, 2024]. That is why SEAL must monitor indicators of regime change.

A simple mechanism is CUSUM. For a scalar signal X_t (e.g., error, loss, aggregate metric), recursion is defined:

$$S_t = \max\{0, S_{t-1} + (X_t - v)\}$$

where v is the reference level corresponding to the “normal” regime. When S_t crosses a threshold h , the system signals a potential regime change.

Equally important is the time to detection. Let τ denote the (unobserved) time of regime change. TTRCD is:

$$T_{\text{TTRCD}} = \inf\{t \geq \tau : S_t \geq h\} - \tau$$

In simulations with injected mode changes, mean TTRCD was approximately 5 iterations, providing a practical measure of how quickly a SEAL realizes that the world in which it makes decisions is no longer the one it learned from.

5.4. Decision Value (VoD)

If we are serious about claiming SEAL is part of the DSS tradition, we need to measure value-of-decision (VoD), how much better decisions made with SEAL are than those made without it. In an ideal scenario, an organization measures outcome differences between a baseline policy and a SEAL policy across a representative set of situations. In practice, it is often sufficient to track key decisions and compare their consequences against historical patterns, or against a robust baseline decision model under uncertainty [Ivković et al., 2025; Bertsimas and Thiele, 2006]. Only then does SEAL cease to be an “interesting tool” and becomes part of a serious strategy.

Formally, let π^{SEAL} be the decision-making policy when using SEAL, π^0 the baseline policy without SEAL, and K a domain KPI (profit, negative downtime, risk-penalized return, budget variance, etc.). VoD is:

$$\text{VoD}(\pi^{\text{SEAL}}, \pi^0) = \mathbb{E}[K \mid \pi^{\text{SEAL}}] - \mathbb{E}[K \mid \pi^0]$$

Empirically, across T representative episodes:

$$\widehat{\text{VoD}} = \frac{1}{T} \sum_{t=1}^T K_t^{\text{SEAL}} - \frac{1}{T} \sum_{t=1}^T K_t^0$$

Preliminary tests in synthetic management scenarios show a VoD improvement of approximately 12–18% [Ivković et al., 2025; Bertsimas and Thiele, 2006]. This indicates that SEAL can yield measurable contributions to decision quality in terms of KPIs that organizations already understand.

6. Architecture and implementation profile of SEAL systems

If we move from the conceptual to the engineering level, the question is no longer “do we need a SEAL”, but “what does such a system look like on real hardware, in a real organization”. The practical picture is not an idealized data-center diagram. It is a workstation or a small server in an office, a modest edge server in a technical room, and potentially MCU/SoC devices with NPUs deployed in the field. A SEAL must be placed into this landscape, because its core promise is local sovereignty under real constraints, not hypothetical performance in a perfect environment.

The implementation methodology therefore starts with hardware selection and trust anchors. A typical deployment begins with a PC or small server capable of hosting a local LLM runtime, and with a secure foundation, secure boot, encrypted storage, and a cryptographic trust module (TPM or HSM) used to validate and sign critical artefacts, including model packages, corpora snapshots, and policy manifests [Ivković and Lužija Ivković, 2023]. From there, the system is built as a coherent stack, local model, local retrieval, local tools, and an auditable Decision Book, so that decision-making remains inside the organizational boundary.

A useful baseline scenario is a smaller organization, an SME or a municipality, with one stronger on-premises server (for example, 64 GB RAM and one capable GPU), plus multiple personal computers. A local LLM runtime is installed on the server, using a medium-sized pretrained model (e.g., 7–13B parameters), quantized to 4–6 bits per weight, and served through a local inference environment. Quantization-friendly fine-tuning methods such as QLoRA demonstrate that such a model remains flexible for domain adaptation, while fitting within realistic memory budgets and delivering acceptable latency on practical hardware [Dettmers et al., 2023]. However, an LLM alone is not “organizational knowledge”. Next to it, a local retrieval layer is established: documents, regulations, contracts, minutes, project history, and curated correspondence archives are indexed into a local vector store, with an on-premises embedding model, so that content does not leave the organization. In the perspective of decision logs and data biography, this layer is not only memory, it is the provenance substrate that links evidence to decisions and outcomes over time [Ivković et al., 2025].

In front of the LLM plus retrieval pair, a thin application layer mediates interaction and governance. It can be a reduced web service or a desktop application that receives user requests, retrieves evidence as needed, constructs a prompt from relevant statements, calls the local inference runtime, and logs all critical artefacts, inputs, used sources, outputs, and key assurance metrics (e.g., calibration indica-

tors, tail-risk proxies, and regime-change indicators). The same layer hosts-controlled tools, connectors to ERP or budget systems, a scenario simulator, and domain calculators. SEAL does not live in a vacuum. It becomes decision-grade only when it participates in the existing information-system ecosystem, and when its actions are constrained, logged, and reviewable.

Above the interaction plane sits the decision-assurance layer, which functions as “decision insurance”. It does not change how a user interacts with the system. Instead, it continuously monitors whether trust remains justified, how calibration and Brier-like indicators drift for specific decision classes, what tail-risk exposure (e.g., CVaR) emerges in risky moves, and how frequently post-hoc outcomes contradict assumptions that were implicit in earlier decisions. When the layer detects deviations, it does not issue verdicts autonomously. It triggers controls, raises a warning level, tightens trust thresholds, suggests mandatory escalation to humans for specific decision channels, and signals that recalibration or policy updates are required. In larger organizations, SEAL can naturally scale into layers: a personal SEAL on a manager’s laptop, a departmental SEAL on an internal server that aggregates and curates knowledge, and an umbrella SEAL that, under an AI management system perspective, monitors global behavioural patterns, risk posture, and compliance alignment [ISO/IEC, 2023a; ISO/IEC, 2023b; NIST, 2023].

In all of this, the cloud does not disappear. It remains relevant for pretraining, heavy offline computation, and controlled model upgrades. The SEAL difference is that the cloud becomes a rare, explicit, signed intervention, rather than an invisible “brain” delegated with every decision. Decisions are made where their consequences are local, and updates occur through controlled windows with signed lifecycle packages and verified manifests [Ivković and Lužija Ivković, 2023].

6.1. Hardware

A SEAL deployment profile is defined by constraints rather than by maximality. Typical configurations include:

- PC plus GPU workstation: 16–48 GB VRAM class, secure boot, encrypted disk, stable thermal budget, and defined power limits.
- SBC or edge node: 8–16 GB RAM class, optional NPU, attention to power caps and dissipation.
- Cryptographic trust module (TPM or HSM): for signing and validating artefacts (weights, corpora snapshots, policy manifests, Decision Book records), enabling integrity and controlled rollback [Ivković and Lužija Ivković, 2023].

6.2. Models and quantization

Model choice should be driven by the required latency, memory, and assurance posture, not by parameter count alone. Common options include:

- QLoRA (4-bit with LoRA adapters): domain fine-tuning with minimal VRAM footprint [Detrmers et al., 2023].
- Weight-only quantization (e.g., Q4 variants): efficient inference while preserving salient channels.
- INT8 post-training quantization paths (e.g., W8A8 families): practical deployment option, with the engineering practice of keeping critical safety and policy heads at higher precision when needed.

6.3. Software and operations

Operational discipline is part of the architecture:

- Local embedding store and retrieval: deduplication, malware scanning, and signed corpora snapshots, so that retrieval becomes a controlled evidence channel rather than an uncontrolled ingestion path.
- Tool sandbox: least-privilege tokens, rate limits, and explicit allow-lists, because tools turn text generation into action.
- Policy guard: validators (rules, schemas, regex or AST-level checks where applicable), prohibitions, and recourse tests for high-impact actions.
- Decision Book: append-only, signed records, with optional rollback to earlier validated versions and offline re-evaluation under updated policies [Ivković et al., 2025].

6.4. Update and lifecycle

A sovereign deployment requires lifecycle controls:

- Offline update windows: signed packages for weights, embeddings, tools, and policies, with a manifest of hashes and version identifiers.
- Zero outbound telemetry by default: internal telemetry stored locally, and optionally forwarded only to an internal, controlled security monitoring environment.
- Periodic recalibration and control maintenance: key rotation, red-team tests against the local corpus, and systematic re-evaluation of decision channels under drift.

6.5. Decision-Centric Assurance: Decision Book

SEAL treats each decision record as a decision-grade artefact with provenance. The Decision Book captures the input context (prompt and attachments), retrieval context (documents and embedding snapshot), tool-call trace, a rationale snapshot, output and confidence signals, and observed outcomes, including human sign-off when applicable. Each record is versioned and linked to model and data hashes, which supports rollback and offline re-evaluation when policies or models change [Ivković et al., 2025].

An example of an extensible Decision Book JSON schema is shown below.

```
{
  "record_id": "uuid",
  "agent_id": "seal-node-01",
  "role_id": "finance_controller",
  "model_hash": "sha256:...",
  "data_hash": "sha256:...",
  "inputs": {"prompt": "...", "attachments": ["..."]},
  "retrieval": {"docs": ["..."], "embeddings_hash":
    "sha256:..."},
  "tools_used": [{"tool": "cost_calc", "args_hash":
    "sha256:...", "result_hash": "sha256:..."},
  "rationale_snapshot": "...",
  "output": {"action": "approve", "confidence": 0.82, "calibra-
    tion_bin": 0.8},
  "outcome": {"kpi_change": -0.03, "human_signoff": "userX",
  "timestamp": "2025-11-23T12:00:00Z"},
  "versions": {"prev_record_id": "uuid"},
  "signatures": {"model_sig": "ed25519:...", "record_sig":
    "ed25519:..."}}
}
```

7. Illustrative scenarios of using the SEAL system

It is difficult to trust a conceptual framework until it is imagined in a real situation. For that reason, three illustrative scenarios are useful. They do not claim completeness, nor do they replace a full empirical evaluation, but they show how a

SEAL “breathes” in different domains, and how Decision Book, VoD, CVaR, and regime-awareness move from abstract terms to operational artifacts.

7.1. A small or medium-sized company that balances liquidity and growth

Consider a company with a few tens or hundreds of employees, a mixed production and service business, constantly caught between three pressures: liquidity, long-term investment, and short-term opportunities. Its data exists, but it is fragmented. Financial statements, supplier and customer contracts, cash-flow reports, project post-mortems, and operational notes are scattered across PDFs, spreadsheets, and, most critically, people’s memories.

In this environment a SEAL runs on a local server. Budgets, contracts, management minutes, and project documentation are indexed in the local retrieval layer. The LLM is general-purpose but quantized to operate within a realistic latency budget, and the application layer is connected to the accounting or ERP system. When the CFO asks, “What if we slow down payments to suppliers for the next six months?”, the system does not respond with generic narratives. It searches the company’s own history: when similar actions were taken, what the consequences were, which suppliers reacted more aggressively, and what delivery delays followed.

The output is not a single sentence. It is a decision package: a written explanation, a cash-flow projection table, and, crucially, an explicit tail-risk statement. A SEAL can say, for example, “in 95% of simulated scenarios the penalty cost remains below X, but in the worst 5% it can reach Y”, and it can anchor that estimate to local evidence and to the firm’s own historical outcomes. Over time, because the Decision Book records what was proposed, what was decided, and what actually happened, VoD stops being a slogan and becomes a measurable quantity in the organization’s language of KPIs, showing not how “smart” the model is, but how much its recommendations improved outcomes under constraints [Ivković et al., 2025; Bertsimas and Thiele, 2006].

7.2. A city managing budget and projects under public scrutiny

Now consider local government. A city operates under continuous budget pressure, facing competing demands, infrastructure projects, social programs, cultural events, and emergency interventions. Political pressures, formal rules, public procurement constraints, and funding mechanisms intersect, while documentation grows heavy: strategic plans, annual work programs, assembly decisions, audit reports, project dossiers, and procurement archives.

In such an environment, SEAL is less of a “chatbot” and more of a quiet, persistent archivist and analyst. When a debate is opened about shifting priority from transport infrastructure to educational projects, the system can draw on relevant decisions and outcomes from the previous decade, compare implementation dynamics, cost overruns, and observable effects across citizen groups. It does not “know what is fair”, but it can state precisely what happened when the city invested in X, and how Y indicators responded, within a traceable evidence chain.

Here calibration and regime-change awareness take on a concrete meaning. Calibration is not only about probabilities, but about how close projections of completion dates, costs, and impacts were to reality. Regime change can mean sudden increases in construction material prices, shifts in interest rates, or abrupt political re-prioritization. TTRCD becomes a measure of how quickly the system, and the people using it, recognize that the world they are planning in is no longer the world they budgeted for at the beginning of the year. Over time, Decision Book records also serve an accountability role, because they preserve the provenance of recommendations, the evidence used, and the observed consequences in a way that can be audited and discussed [Ivković et al., 2025].

7.3. Industrial operation between normal regime and accident regime

The third scenario takes place in a production plant. Machines, sensors, and control systems generate massive streams of signals. In a classical SCADA environment, operators watch dozens of trends and alarms. After an incident, it often turns out that “everything was there”, but buried in noise and too late for action.

In this setting, a neuromorphic front-end and a SEAL form a natural division of labor. A neuromorphic module, for example an SNN deployed close to the sensor and optimized for event-driven signals, does not aim to “understand” language. Related work on precision-engineered on-device AI in next-generation wearable sensing platforms illustrates the same design pressure, pushing intelligence to the signal source under tight power and latency budgets [Ivković and Stanković, 2024]. Its task is to extract patterns that announce a transition from one operating mode to another, from stable to oscillatory, from nominal load to pre-overload, and to emit compact events rather than raw data. This design choice follows the broader motivation of neuromorphic computing, energy-efficient processing of temporal streams and robust signal salience under tight power and latency budgets [Marković et al., 2020; Ivković and Lužija Ivković, 2024].

A plant-level SEAL receives such events and contextualizes them using local knowledge. Its retrieval layer contains SOPs, maintenance history, field logs,

spare-part availability, and downtime cost models. When a neuromorphic alert indicates that a pattern on a turbine has appeared that historically preceded bearing failure, the SEAL does not “guess” an answer. It searches the plant’s own history: what actions were taken in similar situations, which maintenance strategies were successful, and what costs followed when the organization delayed intervention.

The recommendation is therefore not an imperative such as “replace the bearing immediately”. It is a scenario-based assessment: “if we stop the line during the night shift for a planned replacement, expected loss is X and CVaR is Y; if we ignore the signal, historical patterns suggest Z”. In this triad, neuromorphic front-end, SEAL, and the human operator, the decision becomes less of an impulse and more of an articulated risk-aware evaluation, expressed in operational quantities that are compatible with plant governance and accountability requirements [Rockafellar and Uryasev, 2000; Ivković et al., 2025].

8. Limitations of the concept and neuromorphic perspective

The SEAL concept is intentionally ambitious, but it is important to state its limitations clearly, because the value of “sovereign AI” depends on what can be engineered and governed in practice.

First, SEAL is not a single product specification at this stage. It is a reference architecture and a set of design constraints, local execution, local corpora, role-bounded agency, and auditable decision assurance. Implementations can vary widely, from a PC-based deployment in an SME to an edge-node configuration in industrial operations. The core point is not uniformity, but disciplined locality and traceability.

Second, local models are not magic. Quantized LLMs deployed on realistic hardware can be highly effective within a well-defined role and a well-curated corpus, but they remain bounded by model capacity, retrieval quality, and tool governance. Domain adaptation and quantization-friendly fine-tuning make local deployment feasible, yet the system must be engineered so that it does not claim competence outside its role scope, and so that uncertainty is surfaced and controlled through policy and escalation [Dettmers et al., 2023; Guo et al., 2017].

Third, the security posture changes. A local agent is not automatically safer simply because it is local. The attack surface moves to endpoints, corpora ingestion, tool connectors, update packages, and policy enforcement. SEAL therefore assumes integrity controls as a prerequisite, secure boot, encrypted storage, signed artefacts, least-privilege tooling, and a governance process for monitoring drift and

misuse, consistent with risk-management expectations for AI systems [NIST, 2023; ISO/IEC, 2023a; ISO/IEC, 2023b].

Finally, the neuromorphic layer is best understood as an improvement pathway rather than a mandatory prerequisite. Neuromorphic computing and SNN-style event-driven processing are promising for early anomaly detection and ultra-low-power monitoring, but broad, standardized deployment is still emerging. SEAL can operate today with classical signal processing and anomaly detection, and later integrate neuromorphic front-ends where they provide measurable advantages in latency, energy, and regime-change detection [Marković et al., 2020; Ivković and Lužija Ivković, 2024].

This paper therefore does not claim to solve all technical and theoretical issues. Its claim is narrower and more practical, it defines an architecture in which sovereignty, auditability, and decision assurance are first-order design goals, and it outlines a credible engineering path from “local advisor” prototypes to production-grade sovereign edge decision systems.

9. Metrics and evaluation

Evaluating a SEAL requires both decision-quality metrics and operational metrics. The goal is not only to show that a system can answer questions, but to show that it can produce decisions that remain reliable under uncertainty, that it controls tail risk, and that it detects regime shifts early enough to prevent cascading losses. For that reason, the evaluation relies on the decision assurance framework introduced in Section 5, calibration (ECE and Brier), tail risk (CVaR), time-to-regime-change detection (TTRCD), and decision value (VoD), coupled with operational indicators such as latency, energy per decision, and behavior in offline mode [Guo et al., 2017; Rockafellar and Uryasev, 2000; Ivković, 2024].

The evaluation is organized across three representative decision domains, planning (resource allocation and policy-driven constraints), finance (liquidity and credit-control decisions), and operations (incident triage and industrial intervention choices). Implementations are tested on realistic local deployment profiles, a PC plus GPU node as a departmental or “hub” runtime, and a constrained edge node as a typical SEAL endpoint. The focus is to document how assurance metrics behave under drift, under partial connectivity, and under tool-governed action, not merely to report static accuracy.

9.1. Calibration and Brier

Calibration is treated as a trust-control signal, not as a reporting statistic. ECE and Brier, defined in Section 5, are tracked per decision class, and monitored for drift over time. When calibration degrades beyond policy thresholds, the system is expected to tighten autonomy, enforce human escalation, or trigger recalibration routines, because miscalibration in high-impact decisions is a direct pathway to overconfidence failures [Guo et al., 2017]. The objective is not to “win” a benchmark, but to keep probability statements operationally honest.

9.2. Value of the decision (VoD)

VoD is evaluated as the KPI-level difference between decisions made under a SEAL policy and decisions made under a baseline policy, using comparable episodes in each domain. In management terms, VoD answers the only question that ultimately matters, did the organization measurably improve outcomes by trusting the agent, under its constraints and governance. Where possible, VoD is reported together with uncertainty intervals and paired against robust baselines, because decision value must remain interpretable under uncertainty and shifting regimes [Bertsimas and Thiele, 2006; Ivković et al., 2025]

9.3. Tail risk (CVaR)

Tail risk is evaluated through CVaR as defined in Section 5, using stress scenarios relevant to each domain, for example penalty-heavy liquidity shortfalls, procurement delays, or costly downtime events. The key criterion is not mean improvement, but whether VoD increases while CVaR decreases, meaning “better decisions with lower tail exposure”, which is the intended decision-insurance profile of SEAL [Rockafellar and Uryasev, 2000].

9.4. Time to Mode Change Detection (TTRCD)

TTRCD is evaluated by injecting controlled regime shifts into synthetic or semi-synthetic streams and measuring detection delay under realistic monitoring thresholds. In regime-driven environments, late detection can dominate total cost even when point predictions look reasonable. Therefore, TTRCD is treated as an assurance metric tightly coupled to human oversight rules, lower TTRCD requirements for high-impact processes, and explicit escalation policies when detection confidence degrades [Ivković, 2024].

9.5. SLA pillar

Operationally, SEAL is also evaluated through an SLA-oriented pillar: time-to-decision, energy per decision, availability in disconnected mode, and functionality degradation under constrained resources. These measurements ensure that the architecture remains grounded in realistic edge constraints and does not silently fall back to hidden centralization [Zhou et al., 2019].

10. Measurement plan

This section defines a measurement plan that is intended to be reproducible across two realistic deployment profiles and three representative decision domains. The goal is not to optimize benchmark scores in isolation, but to report decision assurance metrics and operational constraints in a way that can be re-run and audited.

Hardware profiles. Two reference deployment profiles are used: (H1) a PC/workstation or on-prem server with GPU (24–48 GB VRAM class), and (H2) an SBC/edge node (8–16 GB RAM class, optional NPU). Both profiles are evaluated under connected and disconnected operation, because sovereign behavior includes graceful degradation rather than hidden cloud fallback [Zhou et al., 2019].

Models and quantization. A medium-size pretrained model is selected per profile (reporting model family, parameter size, and checkpoint identifier). Quantization and adaptation are chosen to fit memory and latency budgets while preserving role performance: weight-only 4-/5-bit variants and 4-bit LoRA-based finetuning, plus an INT8 path for edge-friendly deployment. For domain adaptation under tight VRAM constraints, we use quantization-aware finetuning patterns aligned with QLoRA-style practice [Dettmers et al., 2023]. For reproducibility, each run reports: model checkpoint hash, quantization configuration, runtime engine version, and policy manifest version.

Decision domains and KPIs. Tasks are organized into three domains with explicit KPIs:

- **Planning:** RAG over policies, contracts, and demand constraints, producing a resource plan and constraint-violation indicators.
- **Finance (SME):** credit-control and collections decisions, reporting liquidity-relevant KPIs and tail-risk exposure.
- **Operations:** incident triage on telemetry streams, reporting downtime-related KPIs and escalation rates.

Protocol. Each domain is evaluated using a common protocol that couples decision assurance metrics with operational constraints:

- (P1) Calibration: ECE and Brier score per decision class, tracked over time as trust-control signals [Guo et al., 2017].
- (P2) VoD: KPI-level value-of-decision against a historical or expert baseline, reported per domain and per role [Ivković et al., 2025; Bertsimas and Thiele, 2006].
- (P3) Tail risk: $CVaR_\alpha$ for decision losses under stress scenarios, reported with the chosen α and risk-aversion settings [Rockafellar and Uryasev, 2000].
- (P4) Regime change: injected mode changes in synthetic or semi-synthetic streams, measuring TTRCD under fixed detection thresholds [Ivković, 2024].
- (P5) SLA pillar: latency, throughput, energy per decision (where measurable), and degradation behavior in offline mode [Zhou et al., 2019].

Reproducibility artefacts. To keep the plan reproducible without an appendix, each experiment reports: (i) hashes of model, corpora snapshot, and tool binaries; (ii) random seeds and scenario generator parameters; (iii) evaluation scripts version; (iv) a small set of representative prompts/tasks and expected output structure; and (v) Decision Book record identifiers that link the reported metrics to concrete decision traces [Ivković et al., 2025].

11. Management Mapping (SEAL Controls → Standards)

This section maps SEAL design controls to widely used governance and risk frameworks. The intent is not legal interpretation, but engineering alignment: each SEAL control is expressed as an operational mechanism that naturally supports management-system expectations for monitoring, risk treatment, and traceability [ISO/IEC, 2023a; ISO/IEC, 2023b; NIST, 2023; European Union, 2024].

Table no. 2. Comparison of regulatory controls - mapping

SEAL control	ISO/IEC 42001 (AIMS)	ISO/IEC 23894	NIST AI RMF	EU AI Act
Decision Book (input, retrieval, tools, rationale, output, outcome)	Operations and monitoring, documented records, continual improvement	Risk treatment evidence, monitoring and review	Measure and manage, traceability for monitoring	Traceability and record keeping posture, post market monitoring support
Model and data lineage (versioning, hashes, roll-back)	Design and change control, operational governance	Risk identification, risk assessment, lifecycle controls	Map and manage, model governance and change impact	Technical documentation posture, change monitoring, post market surveillance alignment
Calibration thresholds and HiTL gates	Operational controls, oversight, competence and responsibility	Risk criteria, controls, residual risk management	Measure reliability, Manage human oversight and escalation	Human oversight posture, robustness expectations for high impact use
Air gapped signed updates (manifests, verified packages)	Change management, integrity controls	Implementation of controls, security-oriented measures	Govern and manage, secure lifecycle and deployment hygiene	Robustness and cybersecurity posture, controlled update behaviour
Tool sandbox (least privilege, allow lists, rate caps)	Operational safeguards and access control	Risk mitigation, control implementation	Manage tool mediated actions and constraints	Safety and misuse prevention posture, unauthorized action mitigation

Conclusions

This paper argued a simple but uncomfortable thesis: the current trajectory of AI is repeating the mainframe era, a cognitive stack concentrated in remote platforms, governed elsewhere, and monetized through perpetual dependence. That trajectory may produce impressive benchmarks, yet it quietly externalizes the most consequential costs: loss of autonomy, loss of traceability, brittle reliance on connectivity, and a growing mismatch between “model intelligence” and “decision accountability”. The SEAL concept responds by reframing the problem. The ques-

tion is not how to obtain ever larger models, but how to build **decision-grade intelligence that remains sovereign, auditable, and locally accountable**.

SEAL is therefore not presented as a competing “bigger model”, nor as an on-premises imitation of hyperscale cloud services. It is an architectural claim: the next decisive step is the transition from rented cognition to **owned cognition**, from cloud-resident advice to node-bound, role-bound, tool-governed decision assistance. A SEAL is attached to a concrete edge node and a concrete organizational role, operates on on-premises corpora and on-premises tools, and records its recommendations and outcomes in an append-only Decision Book. This is not a cosmetic feature, it is the mechanism that converts an LLM output into an organizational artifact that can be revisited, audited, and improved over time [Ivković et al., 2025].

A second claim of this work is that “trust in AI” cannot be reduced to accuracy. In high-impact domains, failure is dominated by overconfidence, tail losses, and late recognition that the operating regime has changed. This is why SEAL is coupled with a compact decision assurance set: calibration as probability honesty [Guo et al., 2017], tail-risk control through CVaR [Rockafellar and Uryasev, 2000], and regime-awareness through time-to-detection metrics, with value-of-decision measured at the KPI level rather than at the benchmark level. Together with the Decision Book, these elements turn governance from “policy documents” into a living operational loop: when calibration drifts, autonomy tightens; when tail risk increases, escalation gates activate; when regimes shift, the system prioritizes detection and safe degradation instead of pretending the world is stationary.

The engineering feasibility of this shift is no longer speculative. Quantization and quantization-friendly adaptation allow medium-sized models to run within realistic VRAM budgets, and to be tuned for narrow organizational roles without turning cloud inference into a mandatory dependency [Dettmers et al., 2023]. Edge-intelligence research further supports the general direction: meaningful decision processing can move closer to where data is produced and where consequences occur, improving latency and resilience under intermittent connectivity [Zhou et al., 2019]. In the longer arc, neuromorphic and event-driven front-ends represent a credible pathway for ultra-low-power anomaly extraction and early regime-shift alerts, while the SEAL agent layer preserves meaning, evidence grounding, and decision accountability [Marković et al., 2020; Ivković and Lužija Ivković, 2024].

From a governance perspective, SEAL aligns naturally with the direction of modern AI risk management and management-system thinking. High-impact deployments increasingly require traceability, monitoring, and demonstrable controls

for robustness and oversight, not just impressive outputs. The SEAL control set, Decision Book, lineage and rollback, signed lifecycle updates, HiTL gates, and controlled tool sandboxes, is designed precisely to make those controls measurable and enforceable in operational practice [ISO/IEC, 2023a; ISO/IEC, 2023b; NIST, 2023; European Union, 2024]. This is also where SEAL becomes more than an architectural preference. In a world of tightening data sovereignty constraints and expanding compliance pressure, local execution and local evidence chains are not ideological choices, they are rational risk-minimizing strategies.

The broader implication is disruptive: the most important frontier may not be “the next model”, but **the next computing paradigm**, personal and sovereign AI as a symbiotic layer that lives with the person and with the organization. If the PC era shifted agency from centralized institutions to individuals and small teams, SEAL proposes a similar shift for cognition itself. It turns AI from an external service into a locally governed partner, one that respects role boundaries, keeps sensitive context inside the perimeter, and remains accountable through evidence and outcomes. In that frame, the value of massive centralized investment is not denied, but reinterpreted: hyperscale remains useful for pretraining and occasional controlled upgrades, while day-to-day decision life, the part that is private, regulated, time-critical, and economically consequential, should increasingly belong to **sovereign, local-first agents**.

The next step is therefore not another benchmark race, but disciplined pilot deployment under a reproducible protocol: two hardware profiles, three decision domains, decision assurance metrics tracked as control signals, and Decision Book records treated as auditable assets. If those pilots confirm what the architecture predicts, lower tail exposure, faster regime awareness, and measurable KPI gains under governance constraints, then SEAL becomes not only a conceptual framework, but a credible alternative to the default assumption that intelligence must live in someone else’s cloud.

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APPENDIX

APPENDIX A - Operational Metric Snippets (Python)

A.0 Conventions and minimal dependencies

The code snippets below implement operational metrics used in the SEAL assurance loop. They assume: (i) binary decisions with predicted probabilities $p_i \in [0,1]$ and observed outcomes $y_i \in \{0,1\}$, and (i) loss samples L_i where larger values indicate worse outcomes. The implementation is intentionally lightweight and suitable for pilot-scale reproducibility.

Code Snippet A.1 - Minimal imports (shared across Appendix A)

```
import numpy as np
from typing import Any, Dict, Optional, Tuple
```

A.1 Regime change detection and Time-to-Detection (TTRCD), CUSUM

Code Snippet A.2 - One-sided CUSUM detector and TTRCD

```
def cusum_detect(
    x: np.ndarray,
    nu: float,
    h: float,
    start_s: float = 0.0
) -> Tuple[Optional[int], np.ndarray]:
    # One-sided upward-shift CUSUM relative to reference level nu.
    x = np.asarray(x, dtype=float)
    s = float(start_s)

    s_path = np.empty_like(x, dtype=float)
    t_alarm: Optional[int] = None

    for t, xt in enumerate(x):
        s = max(0.0, s + (float(xt) - float(nu)))
        s_path[t] = s
        if t_alarm is None and s >= float(h):
```

```

        t_alarm = int(t)

    return t_alarm, s_path
def ttrcd(t_alarm: Optional[int], tau: int) -> Optional[int]:
    # Time-to-Regime-Change-Detection (TTRCD) relative to true
    change time tau.
    if t_alarm is None:
        return None
    return int(t_alarm) - int(tau)

```

A.2 Regime change injection utility (synthetic stream)

Code Snippet A.3 - Abrupt mean-shift generator for pilot simulations

```

def inject_regime_change(
    T: int,
    tau: int,
    mu0: float,
    mu1: float,
    sigma: float,
    seed: int = 42
) -> np.ndarray:
    #  $X_t \sim N(\mu_0, \sigma^2)$  for  $t < \tau$ ;  $X_t \sim N(\mu_1, \sigma^2)$  for
    #  $t \geq \tau$ .
    rng = np.random.default_rng(seed)
    x = rng.normal(loc=float(mu0), scale=float(sigma), size=int(T))
    tau = int(tau)
    if 0 <= tau < int(T):
        x[tau:] = rng.normal(loc=float(mu1), scale=float(sigma),
        size=int(T) - tau)
    return x

```

A.3 Expected Calibration Error (ECE), binning-based reliability estimate

Code Snippet A.4 - ECE for binary decisions (equal-width bins)

```

def ece_binary(
    p: np.ndarray,
    y: np.ndarray,
    n_bins: int = 10,
    threshold: float = 0.5

```



```
) -> Tuple[float, Dict[str, Any]]:
    p = np.asarray(p, dtype=float)
    y = np.asarray(y, dtype=int)

    p = np.clip(p, 0.0, 1.0)
    n = int(p.size)
    if n == 0:
        return 0.0, {
            "bin_edges": np.array([]),
            "bin_count": np.array([]),
            "bin_conf": np.array([]),
            "bin_acc": np.array([])}

    n_bins = int(n_bins)
    bin_edges = np.linspace(0.0, 1.0, n_bins + 1)

    # Assign each probability to a bin index in [0, n_bins-1]
    bin_id = np.digitize(p, bin_edges[1:-1], right=False)
    bin_id = np.clip(bin_id, 0, n_bins - 1)

    bin_count = np.zeros(n_bins, dtype=int)
    bin_conf = np.zeros(n_bins, dtype=float)
    bin_acc = np.zeros(n_bins, dtype=float)

    for m in range(n_bins):
        idx = (bin_id == m)
        c = int(np.sum(idx))
        bin_count[m] = c
        if c > 0:
            pm = p[idx]
            ym = y[idx]
            bin_conf[m] = float(np.mean(pm))

            yhat = (pm >= float(threshold)).astype(int)
            bin_acc[m] = float(np.mean(yhat == ym))

    ece = 0.0
    for m in range(n_bins):
        if bin_count[m] > 0:
            w = bin_count[m] / n
```

```

ece += w * abs(bin_conf[m] - bin_acc[m])

stats = {
    "bin_edges": bin_edges,
    "bin_count": bin_count,
    "bin_conf": bin_conf,
    "bin_acc": bin_acc}
return float(ece), stats

```

A.4 Brier score (probability squared error)

Code Snippet A.5 - Brier score for binary outcomes

```

def brier_score(p: np.ndarray, y: np.ndarray) -> float:
    p = np.asarray(p, dtype=float)
    y = np.asarray(y, dtype=float)
    p = np.clip(p, 0.0, 1.0)
    return float(np.mean((p - y) ** 2))

```

A.5 Tail risk: VaR and CVaR at confidence level α

Code Snippet A.6 - Empirical VaR $_{\alpha}$ and CvaR $_{\alpha}$

```

def var_cvar(losses: np.ndarray, alpha: float = 0.95) -> Tuple[
    float, float]:
    L = np.asarray(losses, dtype=float)
    if int(L.size) == 0:
        return 0.0, 0.0

    alpha = float(alpha)
    if not (0.0 < alpha < 1.0):
        raise ValueError("alpha must be in (0, 1)")

    var_alpha = float(np.quantile(L, alpha))
    tail = L[L >= var_alpha]
    cvar_alpha = float(np.mean(tail)) if int(tail.size) > 0 else
var_alpha
    return var_alpha, cvar_alpha

```


A.6 Value of Decision (VoD): KPI improvement over a baseline policy

Code Snippet A.7 - VoD estimator

```
def vod(kpi_seal: np.ndarray, kpi_baseline: np.ndarray) -> float:
    a = np.asarray(kpi_seal, dtype=float)
    b = np.asarray(kpi_baseline, dtype=float)
    if int(a.size) == 0 or int(b.size) == 0:
        return 0.0
    return float(np.mean(a) - np.mean(b))
```

A.7 Operational triggers (minimal policy gate example)

Code Snippet A.8 - Escalation and recalibration triggers

```
def policy_triggers(
    ece_value: float,
    cvar_value: float,
    ttrcd_value: Optional[int],
    thresholds: Dict[str, float]
) -> Dict[str, bool]:
    ece_max = float(thresholds.get("ece_max", np.inf))
    cvar_max = float(thresholds.get("cvar_max", np.inf))
    ttrcd_max = int(thresholds.get("ttrcd_max", 10**9))

    trigger_ece = (float(ece_value) > ece_max)
    trigger_cvar = (float(cvar_value) > cvar_max)
    trigger_ttrcd = (ttrcd_value is not None and int(ttrcd_value) >
ttrcd_max)

    escalate_human = bool(trigger_ece or trigger_cvar or trig-
ger_ttrcd)
    recommend_recalibration = bool(trigger_ece or trigger_ttrcd)

    return {
        "trigger_ece": bool(trigger_ece),
        "trigger_cvar": bool(trigger_cvar),
        "trigger_ttrcd": bool(trigger_ttrcd),
        "escalate_human": bool(escalate_human),
        "recommend_recalibration": bool(recommend_recalibration)}
```

A.8 Minimal pilot harness (illustrative end-to-end usage)

Code Snippet A.9 - Pilot-scale metric computation sketch (synthetic)

```
def pilot_demo(seed: int = 7) -> Dict[str, Any]:
    rng = np.random.default_rng(int(seed))

    # (1) Regime-change stream (e.g., error/loss signal) and detection
    T = 200
    tau = 120
    x = inject_regime_change(T=T, tau=tau, mu0=0.0, mu1=0.25, sigma=1.0, seed=int(seed))

    nu = 0.0
    h = 5.0
    t_alarm, s_path = cusum_detect(x=x, nu=nu, h=h)
    ttrcd_val = ttrcd(t_alarm=t_alarm, tau=tau)

    # (2) Tail-risk sample: baseline vs. adapted (illustrative directional change)
    losses_baseline = rng.normal(loc=0.0, scale=1.0, size=5000)
    losses_adapted = rng.normal(loc=-0.10, scale=1.0, size=5000)

    var_b, cvar_b = var_cvar(losses_baseline, alpha=0.95)
    var_a, cvar_a = var_cvar(losses_adapted, alpha=0.95)

    # (3) Calibration sample: baseline vs. recalibrated (illustrative)
    p_base = np.clip(rng.beta(a=2.0, b=2.0, size=2000), 0.0, 1.0)
    y = (rng.uniform(size=2000) < p_base).astype(int)

    p_adpt = np.clip(0.75 * p_base + 0.125, 0.0, 1.0)

    ece_b, _ = ece_binary(p=p_base, y=y, n_bins=10, threshold=0.5)
    ece_a, _ = ece_binary(p=p_adpt, y=y, n_bins=10, threshold=0.5)

    bs_b = brier_score(p=p_base, y=y)
    bs_a = brier_score(p=p_adpt, y=y)

    # (4) Example trigger evaluation (illustrative thresholds)
```

```

triggers = policy_triggers(
    ece_value=ece_a,
    cvar_value=cvar_a,
    ttrcd_value=ttrcd_val,
    thresholds={"ece_max": 0.08, "cvar_max": 6.0, "ttrcd_max":
6}}

return {
    "cusum_t_alarm": t_alarm,
    "ttrcd": ttrcd_val,
    "var_0.95_baseline": float(var_b),
    "cvar_0.95_baseline": float(cvar_b),
    "var_0.95_adapted": float(var_a),
    "cvar_0.95_adapted": float(cvar_a),
    "ece_baseline": float(ece_b),
    "ece_adapted": float(ece_a),
    "brier_baseline": float(bs_b),
    "brier_adapted": float(bs_a),
    "trigger_flags": triggers,
    "cusum_path_last": float(s_path[-1]) if int(s_path.size) >
0 else 0.0 }

```

APPENDIX B - Decision Book (Short Sample Record)

```
{
  "record_id": "uuid",
  "agent_id": "seal-finance-node-a1",
  "role_id": "credit_controller",
  "model_hash": "sha256:<...>",
  "data_hash": "sha256:<...>",

  "inputs": {
    "prompt": "Propose a collection action for order ACC-2025-11-001",
    "attachments": ["ACC-2025-11-001.pdf"]
  },

  "retrieval": {
    "docs": ["policy/credit_control.md", "ledger/ACC-2025-11-001.json"],
    "embeddings_hash": "sha256:<...>"
  },

  "tools_used": [
    {"tool": "aging_report", "result_hash": "sha256:<...>"},
    {"tool": "risk_calc", "result_hash": "sha256:<...>"}
  ],

  "rationale_snapshot": "Plan A; tail risk reduced; human signoff required.",
  "output": {"action": "send_plan_A", "confidence": 0.81},
  "outcome": {"kpi_change": -0.02, "human_signoff": "u1234"},
  "timestamp": "2025-11-23T10:15:00Z",

  "signatures": {"record_sig": "ed25519:<...>"}
}
```

Hashes bind decisions to exact model and data artifacts. Retrieval context and tool traces support auditability and post-hoc reconstruction. Outcome fields close the loop (recommendation → effect), enabling VoD tracking. Signatures provide tamper-evidence in air-gapped governance.

APPENDIX C - Pilot Reproducibility Card and Pilot Tables (No Code Listings)

C.1 Pilot Reproducibility Card

- Hardware profiles: (H1) PC+GPU (RTX 3060 class), (H2) SBC/edge (Raspberry Pi 5 class).
- Model/quantization: Llama-7B class; QLoRA 4-bit (H1) and AWQ 5-bit (H2).
- Runtime: local inference (LM Studio / equivalent), on-prem deployment.
- RAG: local vector store (FAISS-class); local embeddings; no external calls.
- Protocol: report latency, ECE, Brier score, CVaR_{0.95}, TTRCD, and VoD; pilot scale (10 runs per scenario); report averages.

Note: full scripts and raw logs are available as supplementary material upon request.

Table C.1 summarizes the results by metrics, with a comparison of baseline and SEAL variants:

Metrics	Baseline (without RL/SEAL)	SEAL with RL	Improvement (%)	Domain/Scenario
Latency (ms)	750	450	40	Financial Risk (GPU)
ECE	0.12	0.045	62.5	Calibration of Trust
CVaR _{95%}	8.5	4.2	50.6	Tail risk (simulations)
TTRCD (iterations)	7	5	28.6	Regime change
VoD (KPI change, %)	0 (baseline)	+16	-	Total value of the decision
Energy by decision (J)	8	5	37.5	Edge Environment (SBC)

Table C.2 shows performance by hardware and quantization, with a focus on measurements from LM Studio:

Hardware	Model/Quantization	Latency (ms)	Power consumption (J)	ECE (average)
RTX 3060 GPU	Llama-7B QLoRA 4-bit	450	7	0.045
Raspberry Pi 5 (SBC)	Llama-7B AWQ 5-bit	950	5	0.052

These measurements are pilot-scale and scenario-dependent, intended to demonstrate feasibility and the directional impact of the SEAL assurance loop, rather than universal benchmark superiority.

THE ROLE OF ARTIFICIAL INTELLIGENCE IN THE COMPETITIVENESS OF FAMILY BUSINESSES

Marco IMPERIO¹,

¹*University of Salento, Department of Economic Sciences, Piazza Tancredi, n7 – 73100, Lecce, Italy, Phone +39 0832 29 11 11 , E-mail: marco.imperio@unisalento.it*

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Abstract

The paper analyzes the impact of Artificial Intelligence on the dynamics of family businesses, highlighting its role in enhancing of competitiveness. After some introductory discussions and a literature review, a short questionnaire was administered to five representative family businesses in order to identify their relationships, opportunities, critical issues, and challenges arising from the use of Artificial Intelligence. This paper, which eschews quantitative analysis and aims to explore a topic that is still relatively understudied, contributes to the literature on family businesses by addressing a theme of growing relevance. The use of Artificial Intelligence is capable of generating potential competitive advantages and improving performance in family businesses, provided that it is implemented in a sustainable and responsible manner.

Keywords: family businesses, competitiveness, Artificial Intelligence, competitive advantage.

JEL Classification: O31, O32, O33, L26, M13, M15.

1. Introduction

The current temporal and economic context, characterized by globalization and digitalization, creates a constant clash between market players. Businesses, considered key market co-actors, and family businesses in particular, are required

to address ongoing issues and challenges in a reactive and innovative manner, achieving improved performance that can lead to greater competitiveness. This competitiveness must be pursued responsibly and sustainably, recognizing the importance of achieving both economic and non-economic results while simultaneously safeguarding and fostering a constructive process of listening, dialogue, and interaction with stakeholders. Competitiveness must be considered across various dimensions, including the geographical areas in which business operate. It is also necessary to take into account the macro and micro environments in which businesses operate. Capabilities and resources will play a crucial role in achieving corporate performance, which is essential to competitiveness. Resources, among other things, must be analyzed, monitored, researched, valued, developed, efficiently allocated, and appropriately used, perhaps even taking into account aspects related to the cost-benefit analysis technique which, through the comparison of different solutions, enables the selection of the most cost-effective option.

2. Businesses between family connotations and competitiveness

Businesses may exhibit characteristics that allow them to be classified as family businesses. There is no universally accepted definition of a family business. However, in some countries, various legal definitions of family businesses exist. In the Italian context, it is legally defined by Article 230-bis of the Civil Code. At the European level, the Family Business Group, established by the European Commission, has coined the following definition of a family business: "1. The majority of decision-making rights are in the possession of the natural person(s) who established the firm, or in the possession of the natural person(s) who has/have acquired the share capital of the firm, or in the possession of their spouses, parents, child, or children's direct heirs. 2. The majority of decision-making rights are indirect or direct. 3. At least one representative of the family or kin is formally involved in the governance of the firm. 4. Listed companies meet the definition of family enterprise if the person who established or acquired the firm (share capital) or their families or descendants possess 25 per cent of the decision-making rights mandated by their share capital (https://single-market-economy.ec.europa.eu/smes/sme-fundamentals/family-business_en)".

These businesses - characterized by specific characteristics, strengths, and weaknesses, as well as varying sizes and the possession of "the unique set of resources that a particular firm possesses thanks to the systemic interaction between the family, its individual members, and the business (Habbershon &

Williams, 1999)" - generally exhibit greater resilience than non-family businesses and play a significant role in the global economy. This role must be safeguarded with a long-term vision and through successful generational transitions, including through the use of appropriate strategies and solutions that enable the achievement of competitive advantages, which can also be defined as "the ability to offer buyers products at lower costs than others, or unique benefits that justify a premium price (Porter, 2011)". Competitiveness, also defined as "a firm's ability to compete with competitors in the sale of its products (goods or services) in a given market (www.treccani.it)", also stems from the ability to leverage competitive advantages and is linked to various variables, including productivity. Porter argued that firms' ability to increase productivity impacts well-being (Porter, 2011). Determining firms' competitiveness may take into account, for example, the following dimensions: resources, price, learning, diversification, financing, production flexibility, innovation, risk avoidance, relationships, and more. Impediments to competitiveness should be addressed or reduced, which could include, for example, difficulties in accessing financial resources; burdens, costs, and bureaucratic issues. There is no doubt that competitiveness will need to be considered in relation to, among other things, the characteristics of the company, the geographical area, and the type of process implemented: internationalization in more difficult markets will present for example greater obstacles than in more local and nearby contexts for the company, requiring more complex and dynamic approaches.

3. Artificial intelligence

Artificial intelligence - also defined as "the ability of a machine to display human-like capabilities such as reasoning, learning, planning, and creativity (<https://www.europarl.europa.eu>)" - is aimed at enabling "systems to understand their environment, relate to what they perceive, solve problems, and act toward a specific goal (<https://www.europarl.europa.eu>)" and is currently characterized by growing diffusion and significant, multifaceted effects. It is influencing the economic sphere, determining new paradigms and approaches, thus requiring appropriate regulatory intervention by the legislator, as occurred in the European context with the AI Act, which also focused on the related risks (<https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai>). At the same time, Artificial Intelligence constitutes a driving force for innovation that is capable of bringing about specific market transformations. In increasingly complex and rapidly changing economic, managerial, and organizational contexts, artificial intelligence is becoming a key component, with broad and widespread

applicability, driving significant transformations. Artificial intelligence - which can be classified variously, including with reference to model and learning based approaches, and, for example, according to some literature (Nappo, 2021), into four forms (zero-stage, narrow, general, and super) and is generated as a result of innovative processes - simultaneously promotes innovation itself, understood as an intangible asset aimed at the evolution of society and considered a public good due to its non-rivalry and non-excludability (www.treccani.it). The relationship between AI and innovation therefore leads to the assertion that institutions should also promote, with incentives and, in any case, with awareness of potential critical issues, the development, private research, and adoption of AI. In the private business sector, AI is assuming a more significant role, enabling the rationalization of business areas and the automation of processes. Despite the objective results achieved in this field, its use remains marginal among many companies. This limited use is partly due to inadequate knowledge and skills among company human resources to use AI, as well as, in many cases, a lack of willingness to use it due to mistrust and the potential and resulting critical issues. It is clear that the responsible use of AI brings various benefits to companies, streamlining the performance of work tasks, such as greater speed, quality, and efficiency. AI also supports business processes, including creative and decision-making phases, reduces potential errors, reshapes work schedules, improves stakeholder dialogue, and enhances customer experiences through personalized solutions. Furthermore, it is estimated that corporate investments in AI generate significant returns, thus driving growth in the related market. AI is "not just a tool; it's a strategic ally, a catalyst for transformative growth (Isakov et al., 2025, p. 460)"; it also determines "improvement of decision making, innovation, risk mitigation and competitive advantage (Al-Mamary, 2025)".

Furthermore, with the help of related software, it is enabling companies that adopt it to increase productivity, profits, value, and performance. This, therefore, should encourage companies to also increase non-financial performance by implementing virtuous practices, recognizing the importance of the ethical use of artificial intelligence (<https://www.unesco.org/en/artificial-intelligence/recommendation-ethics>).

4. Artificial Intelligence, well-being and externalities

Artificial Intelligence is assuming, and is believed to be able to assume, a more significant role in generating wealth and well-being in the future. This requires avoiding excessive regulations to enable its development, but also emphasizes the

importance of addressing critical issues with some basic regulations. It is believed that AI can make a significant overall contribution to the well-being of the community, which Arthur Cecil Pigou - founder of Welfare Economics, which later gained prominence thanks to the contributions of Vilfredo Pareto and his two fundamental theorems, and inspired by utilitarian theories - considered, in an initial vision of the discipline, to be the sum of the well-being of individuals. Regarding social well-being, we also recall that Smith stated that the pursuit of individual interest leads, through the market, to the achievement of maximum social well-being (Smith, 1776). At the same time, it must be considered that AI itself generates positive externalities by promoting innovation, research, and development, but also negative effects, which must be minimized, including related negative externalities. The latter, another cause of market failures with related distortions and inefficiencies in optimal resource allocation, also discussed by Pigou, cause negative welfare effects, and therefore uncompensated costs for non-involved third parties following an economic transaction. Ultimately, negative externalities result in costs for non-involved third parties who are thus harmed; these costs, therefore, should be added to the private cost to generate an overall cost that should be taken into account. However, the effects generated are not always easily identifiable and observable. These negative externalities, however, at a theoretical and general level, can also be countered by internalizing the externalities, through subsidies, regulation, and other measures.

AI will need to gather crucial information for carrying out the relevant processes; this information, however, must be identified and retrieved correctly, transparently, and in compliance with privacy regulations. Therefore, this information, following screening processes to determine its accuracy and quality, should be made available to users, enabling them to be more informed even in economic transactions. This reduces information asymmetries, understood as situations in which information is known differently by parties, resulting in opportunism and advantage. These asymmetries represent one of the main market failures, along with public goods - which, we recall, are non-excludable and non-rival - market power, and externalities. These information asymmetries reduce the size of innovation markets and the resulting potential diffusion of new technologies (Arrow, 1962). AI will also play a role in combating disinformation. Firms themselves will be able to obtain more information by better addressing business phases and countering critical situations, including adverse selection and moral hazard, which represent a very widespread phenomenon, as analyzed by the relationship of conflict and divergence of interests between principal and agent in

agency theory (Berle & Means, 1932; Franzoni, 2003; D'Agostino & Sobbrío, 2020). This divergence between principal and agents, demonstrating the complexity of the relationships that determine the non-application of pricing mechanisms (Franzoni, 2003), could be countered with monitoring and incentives. Arrow stated that: "An entrepreneur will automatically acquire a knowledge of demand and production conditions in his field which is available to others only with special effort. Information will frequently have an economic value, in the sense that anyone possessing the information can make greater profits than would otherwise be the case (Arrow, 1962)". AI, in this sense, will make it easy to find information, sometimes at almost no cost or at a significantly reduced cost. However, AI could also determine different access to information for businesses, increasing information asymmetries in certain areas with, among other things, distorting effects on markets.

Artificial Intelligence could harm well-being, in some respects, for example by reducing certain jobs due to job displacement. Yet scientific studies demonstrate, from a broader and longer-term perspective, that AI, through work reorganizations, rationalizations, and efficiency improvements, allows for work reductions without significantly impacting employment rates and incomes (<https://lastatalenews.unimi.it/limpatto-dellintelligenza-artificiale-benessere-lavoratori>).

5. The application of Artificial Intelligence in family businesses

The widespread use of AI in family businesses is currently marginal, though growing. This widespread use varies depending on, among other things, the sectors, uses, and geographical areas in which they operate. The unique characteristics of these businesses, however, sometimes lead to the "integration of Artificial Intelligence being considered a low priority (Ulrich et al., 2023; Barba et al., 2024)" or to its correlation with mistrust of AI (Lannon et al., 2024; Barba et al., 2024). Worek and Aaltonen report that "family businesses are often slow to adopt technologies due to concentrated ownership, risk aversion, and a focus on non-financial objectives (Worek & Aaltonen, 2025)". Moreover, family businesses are less inclined to implement investments and policies characterized by potential risks, although they are sometimes able to more easily achieve innovative processes characterized by lower investments due to the innovation paradox. A 2019 Deloitte survey of 791 family business managers revealed that "the adoption ... of disruptive technology innovations, such as artificial intelligence, ... in the workplace is perceived as the most significant factor for remaining competitive on

the market". Barba et al. (2024) claimed that, in relation to family businesses, "AI presents unique challenges and opportunities for improving their competitive advantages" relating to aspects of generational transition, governance, decision-making, and other aspects (Barba et al., 2024), while Bai et al. (2025) stated that "artificial intelligence (AI) has become pivotal for sustaining competitive advantage (Bai et al., 2025)".

Wang et al. (2025) claimed that "AI enhances both the willingness and capability of family firms to invest in innovation by improving their risk-taking levels and resource allocation efficiency (Wang et al., 2025)".

In terms of AI adoption, long-term orientation and commitment will be crucial for family firms (Cassia et al., 2012). We recall that, for the first term, this essentially refers to an unconventional business strategy understood as a long-term vision, and, for the second term, it is a defining element capable of determining a better implementation of unconventional business strategies (Baschieri, 2014). At the same time, it is not easy to find human resources suited to the application of technologies (Bruque & Moyano, 2007), although family firms have a greater ability to retain human resources, partly due to their family-like atmosphere.

At the same time and with reference to the Italian context, family businesses with a CEO belonging to Generation Z appear to be more likely to adopt AI, as evidenced by a study conducted by the Family Business Innovation Observatory of Luiss and Intesa Sanpaolo (<https://group.intesasanpaolo.com/>). An Italian context where companies in general (family firms and non-family firms) and with at least 10 employees, held back by the lack of resources with skills in using AI, are increasingly adopting the use of Artificial Intelligence with percentages rising from 5% in 2023 to 16.4% in 2025 (<https://www.istat.it/comunicato-stampa/imprese-e-ict-anno-2025/>).

However, there is an emerging awareness of the importance of increasing AI training (<https://familybusinessforum.net>). This is in general awareness, and as stated by Quadri et al. (2025) albeit with reference to the banking sector of another geographical context, that "administration should acquire AI capabilities and work with IT specialists to deploy AI-based HR solutions (Quadri et al., 2025, p. 145)".

Also in relation to the dynamics of agency theory, human resource incentives could be aimed at promoting competitiveness and perhaps be attributed to improvements in operations implemented through the use of AI tools. However, incentives should be awarded on a meritocratic basis to avoid creating conflict among employees. Incentives increase the commitment, involvement, and application of human resources, helping to improve performance and foster

environments that are more conducive to improving business results. Furthermore, even in this context, monitoring will be necessary to prevent the competition to obtain incentives, often awarded by the company only to certain workers meeting certain criteria or to certain groups, from creating a critical environment for the company that could generate negative effects. At the same time, incentive policies must safeguard corporate cohesion not only in the short term but also with a long-term vision. Therefore, they must include clear and transparent rules that are as objectively verifiable as possible. The use of more objective criteria will allow for meritocratic action, countering forms of nepotism and thus greater rewards for those human resources working within the company who belong to the owning family. These latter methods, aimed at rewarding family members solely for existing ties, represent a weakness in family businesses which, as highlighted by the economic and management literature, can generate resentment among employees who are not members of the owning family, leading to greater distancing from the company despite the typically more family-friendly atmosphere of these businesses.

6. The questionnaire

To understand the role of Artificial Intelligence and the family businesses' approaches to Artificial Intelligence in terms of its use, aspects, and perceived impact on competitiveness, a questionnaire was administered in December 2025 and January 2026 to five representative Italian family businesses. This questionnaire, which contained ten questions (seven closed-ended and three open-ended), ensured the businesses' anonymity, and allowed for completion within thirty minutes. It was received and completed in January 2026. The questions were initially tested following a comparison with three other businesses, which resulted in slight adjustments to the questions and possible answers. The questionnaire was accompanied by a short cover letter. The questionnaire, with the questions and answers provided in relation to the family businesses interviewed, is provided below.

Questions	Possible answers and responses
1. Please list the three factors that you consider most important for defining the competitiveness of family businesses:	A: innovation and Artificial Intelligence; brand strength; profitability compared to competitors. B: resources and their combination; innovation; brand. C: resources; stakeholders relations; innovative technologies. D: competitive advantage; AI; resources. E: performance; innovation; stakeholders relations.
2. How do you currently rate the competitiveness of your family business?	Very satisfactory: - Satisfactory: 4 Neither satisfactory nor unsatisfactory: 1 Unsatisfactory: - Very unsatisfactory: -
3. Have you noticed greater obstacles to competitiveness for your company in the last two years compared to previous periods?	Yes: 3 Partly: 2 No: -
4. Have any training activities on Artificial Intelligence for human resources been launched?	Yes: 4 No: 1
5. Have you introduced Artificial Intelligence into your business activities and processes?	Yes, significantly: - Yes, but minimally: 4 No: 1
6. Do you foresee greater use of Artificial Intelligence in the future?	Yes: 5 Partly: - No: -
7. What opportunities, critical issues and challenges does Artificial Intelligence present in terms of competitiveness? Please describe one key concepts for each.	<i>Opportunities:</i> competitive advantages (A); new approaches and best performance (B); increasing quality, rationalizations and performances (C); best performance (D); more information (E). <i>Critical issues:</i> excessive dependence (A); abuse in use (B); predominance in final choices (C); excessive use (D);

Questions	Possible answers and responses
	possible ethical aspects of use (E). <i>Challenges:</i> responsible use also with internal policies and public regulation (A); combination with sustainability (B); proper use and non-dependence (C); ethical use (D); responsible and ethical use (E).
8. How important is Artificial Intelligence currently in terms of competitiveness? (From 1 meaning absolutely irrelevant to 10 meaning extremely important). 5 corresponds to neither important nor irrelevant.	1: - 2: - 3: - 4: - 5: 1 6: 4 7: - 8: - 9: - 10: -
9. How important could Artificial Intelligence be in terms of competitiveness in the future? (From 1 meaning absolutely irrelevant to 10 meaning extremely important.) 5 corresponds to neither important nor irrelevant.	1: - 2: - 3: - 4: - 5: - 6: - 7: - 8: 4 9: 1 10: -
10. In terms of competitiveness, in which areas could Artificial Intelligence be most useful? (Please give two words or concepts).	A: process automation; support in decision-making processes. B: increase in business efficiency; decision support (governance, generational transition and others). C: data analysis; better customer experience. D: decision support (generational turnover and internationalization processes); data analysis. E: better customer experience; business efficiency.

The responses to the questionnaires mostly support aspects of the reviewed literature. The competitiveness of family businesses, considered substantially satisfactory by the companies surveyed, is also linked to innovation, resources, performance, artificial intelligence, brand, competitive advantage, stakeholders relations and profitability compared to competitors. In a complex context pervaded by globalization and digitalization, particularly in recent years, competitiveness could be considered continually improvable and subject to market-driven revisions. The use of AI in the family businesses surveyed generally plays a limited role, both in terms of its use and in terms of human resource training or in a case of non-existent level, although greater future use is anticipated, which will obviously require appropriate training and process policies. It presents opportunities (competitive advantages, new approaches and best performance, increasing quality, rationalizations and performances, more information), critical issues (excessive dependence, abuse in use or excessive use, predominance in final choices, possible ethical aspects of use) and challenges (responsible use also with internal policies and public regulation, combination with sustainability, proper use and non-dependence, ethical use, responsible and ethical use) that should be considered not in an absolute but relative sense, with a consequent correlation to various variables (geographical, economic sector, company stage, and others). AI, as highlighted in the questionnaire, plays currently a moderate importance in terms of competitiveness for the family businesses interviewed, and is expected to become more important in the future, focusing interventions on areas already treated such as: support in decision-making processes (governance, generational turnover or transition, internationalization processes, and others); increase in business efficiency; data analysis; better customer experience; process automation.

7. Conclusions

Artificial Intelligence represents, among other things, a significant opportunity for family businesses to leverage, across multiple areas, including operational ones, to achieve better economic and non-economic results, resulting in greater market competitiveness. This opportunity - still not adequately developed in family businesses, partly due to their greater caution, and yet capable of generating development and sometimes countering misinformation and information asymmetries - must be considered, including in light of the various critical issues and challenges. AI, recognizing its greater future importance for competitiveness and future diffusion, correlated with various variables, will require, among other

things, adequate training for human resources, sustainable and responsible approaches, and targeted monitoring to implement revisions. Suitable frameworks must be created, including at the level of internal policies and public regulation, to enable Artificial Intelligence to make a significant and qualitative contribution to the spread of well-being in society.

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THE RISE OF AGENTIC ENTERPRISES: FROM DATA-DRIVEN OPERATIONS TO VALUE-DRIVEN, HUMAN-CENTERED AI GOVERNANCE

Elena GURGU¹, Ramona Olivia STEFANESCU- MIHAILA², Luminita Viorica PISTOL³, Amarnath PADHI⁴, Victor Nicholas GURGU⁵, Ioana- Andreea GURGU⁶, Iosif GURGU⁷, Evelyne LUTAS⁸, Madalin Cornel MANOLEA⁹, Milena ILIC¹⁰, Valentin KULETO¹¹, Šemsudin PLOJOVIĆ¹², Srđan BARZUT¹³, Marko RANKOVIC¹⁴, Jovana TOSIC¹⁵, Jelena PREMOVIC¹⁶, Roza ABDIKULOVA¹⁷, Nelli AMARFII-RAILEAN¹⁸, Rayna DIMITROVA¹⁹, Milena FILIPOVA²⁰, Dilyana YANEVA²¹, Ani YANKOVA STOYKOVA²², Vania DIMITROVA²³, Chux Gervase IWU²⁴, Krasimir SLAVYANOV²⁵, Sulaiman Olusegun ATIKU²⁶, Dragana ĐURIĆ²⁷, Marko PAVLOVIĆ²⁸, Jeremy MITONGA-MONGA²⁹

^{1,2,3,8,9}*Spiru Haret University, Faculty of Economic Sciences, Department of Economic Sciences, 46 G Fabricii Street, District 6, Bucharest, Romania, Phone: +0213169793, E-mail: se_egurgu@spiruharet.ro, stefanescu_dr@yahoo.com, prolu2001@yahoo.com, evelynelutas@gmail.com, cornelmadalin997@yahoo.com*

¹*Romanian Ministry of Culture, Directorate for Culture of Bucharest Municipality, 3 Sfântul Stefan Street, District 2, Bucharest, Phone: +40729868364, E-mail: elena.gurgu@dcmb.ro*

⁴*National Institute of Science and Technology (NIST), Institute Park, Pallur Hills, Golanthara, Brahmapur, Odisha, 761008, India, Phone: +91 97771 46478, E-mail: dr.amarnathpadhi@gmail.com*

⁵*TU/e, Eindhoven University of Technology, Computer Science and Engineering Faculty, Groene Loper 3. 5612 AE Eindhoven, Nederland, Telephone: +31 (0)40 247 9111, E-mail: gurgunicholas@gmail.com*

⁶*City Hall District 4, General Directorate of Social Assistance and Child Protection District 4, Senior Citizens Covasna Club, 3 Bis Covasna Street, Bucharest, Romania, Phone: +0372 710 551, E-mail: gurguioana99@yahoo.com*

⁷*Euromaster Company Romania, Euromaster Business Services, Global City Business Park, Building O11, 1st Floor, Voluntari, Ilfov, 10 Bucharest North Road, Romania, Tel: 031 130 37 03,
E-mail: victor.gurgu@euromaster.com*

^{10,11,12,13,14,15} *ITS Information Technology School, 11000, Belgrade, Republic of Serbia,*

Tel: +381 11 2096 777, E-mail: milena.ilic2link.co.rs, valentinvkuleto@its.edu.ro, semsudin.plojovic@its.edu.rs, srdan.barzut@its.edu.rs, rankovic@fiti.edu.rs, tosic@its.edu.rs

¹⁶*University of Business Academy Novi Sad, Cvečarska 2, 2110, Novi Sad, Serbia, Phone: +381(0)21/53-10-20, E-mail: premovic@gmail.com*

¹⁷*Kyrgyz -Turkish Manas University, 720044, Tynchtyk Avenue, 56, Telephone: +996 312 54 19 42 ,*

+996 312 54 19 43, Bishkek, Kyrgyzstan, E-mail: webmaster@manas.kg. email

¹⁸*Alecu Russo Bălți State University, 38 Pușkin Street, MD-3100, Bălți, Republic of Moldova, Phone: +373 231 52430, E-mail: nelli@usarb.md*

^{19, 20, 21, 22} *South-West University "Neofit Rilski" Blagoevgrad, 66 Ivan Mihaylov Str., 2700 Blagoevgrad, Bulgaria, Phone: +359 73 88 55 05, E-mail: rayna_dim@swu.bg, mfilipova@swu.bg, d_yanova@swu.bg, ani_qankova_st@abv.bg*

²³*Vasil Levski National Military University, Veliko Tarnovo, 76 Bulgaria Blvd., 5000/5006 Industrial Zone Veliko Tarnovo, Bulgaria, Phone: +359 62 618 822, E-mail: vanydim@abv.bg*

²⁴*University of the Western Cape Bellville, Robert Sobukwe Road, Bellville 7535, Cape Town, Republic of South Africa, Phone: +27 21 959 3900 or +27 (0)21 959 2911, E-mail: cgiwu@uwc.ac.za*

²⁵*Vasil Levski National Military University, Shumen, 1 Karel Shkorpil St. Shumen Bulgaria,*

Phone: 359 (54) 801 040, E-mail: k.o.slavyanov@gmail.com

²⁶*Namibia University of Science and Technology, 13 Jackson Kaujeua Street, Windhoek, Namibia, Phone: (+264) 83 207 9111, E-mail: satiku@nust.na*

^{27,28} *Academy of Vocational Studies Polytechnic, Katarine Ambrozić 3, Belgrade, Serbia, Phone: +381 11 2633127, Email: ddjuric@politehnika.edu.rs, markopavlovic25101982@gmail.com*

²⁹*University of Johannesburg, Department of Industrial Psychology and People Management, School of Management, College of Business and Economics, D*

**Ring 434, University Road, Auckland Park, Johannesburg, South Africa,
 Telephone: +27735295587, +27-11-5592069, E-mail: jeremym@uj.ac.za**

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Abstract:

The rapid evolution of artificial intelligence (AI) is transforming traditional business operations into agentic enterprises — organizations where autonomous AI systems play a central role in strategic decision-making, operational management, and value creation. While data-driven approaches have historically dominated corporate decision-making, emerging AI paradigms emphasize value-driven frameworks, integrating ethical principles and human-centered design into automated processes. This paper explores the rise of agentic enterprises, highlighting the ethical, managerial, and governance challenges posed by AI autonomy. Key considerations include algorithmic accountability, transparency, bias mitigation, and alignment of AI actions with organizational values and societal norms. By examining contemporary practices in AI deployment, the study outlines a framework for human-centered AI governance that balances innovation, efficiency, and ethical responsibility. The discussion demonstrates how enterprises can transition from purely data-driven operations to value-driven, ethically-guided AI ecosystems, ensuring sustainable growth and maintaining stakeholder trust in an increasingly intelligent corporate landscape.

Keywords: *agentic AI, human-centered AI, corporate governance, value-driven enterprises, data-driven operations, AI ethics, autonomous decision-making, responsible innovation, algorithmic accountability*

JEL Classification: M12, M14, D83, O33, L21

1. Introduction

The rapid evolution of artificial intelligence (AI) technologies is fundamentally transforming contemporary enterprises, giving rise to a new organizational paradigm often referred to as the “agentic enterprise.” Agentic AI systems are characterized by their autonomy, goal-oriented behavior, adaptive learning, and proactive decision-making capabilities, distinguishing them from traditional automation tools that merely execute pre-defined tasks (Smith & Johnson, 2024). Within agentic enterprises, AI agents actively contribute to strategic decisions, operational management, and value creation across corporate functions such as management, marketing, accounting, and business economics (Deloitte, 2023). This evolution reflects a paradigm shift in which AI is not only a support tool but also an active organizational actor, capable of influencing corporate strategy, ethical standards, and stakeholder engagement.

Historically, most enterprises relied on data-driven operations, where decisions were primarily informed by historical datasets, performance metrics, and algorithmic outputs. While this approach enhanced efficiency and predictive capabilities, it often failed to address broader ethical, social, and human-centered considerations, such as fairness, transparency, and stakeholder trust (Brown, Green, & Adams, 2022). The contemporary business environment, however, increasingly demands a transition from data-driven to value-driven AI, wherein autonomous AI systems are aligned not only with performance metrics but also with organizational values, ethical norms, and societal expectations (IBM, 2023). This shift emphasizes the integration of human-centered principles, including explainability, accountability, and moral alignment, into AI governance frameworks (Gartner, 2024).

The transformation toward value-driven, human-centered AI is supported by global adoption trends. Data from 2015 to 2025 indicate a rapid increase in AI integration across enterprises, with notable expansion in management decision-support systems, marketing automation platforms, and accounting intelligence tools (PwC, 2024).

This study addresses three core objectives. First, it examines the emergence and defining characteristics of agentic enterprises, highlighting their operational and strategic roles. Second, it investigates the transition from data-driven operations to value-driven, human-centered AI governance, focusing on mechanisms to embed ethical and organizational values into autonomous decision-making processes. Third, it evaluates the ethical, managerial, and strategic implications of

implementing agentic AI in business ecosystems, emphasizing corporate governance, stakeholder trust, and sustainable innovation.

By integrating these perspectives, this paper contributes to the scholarly discourse on AI ethics, corporate governance, and responsible business transformation. It provides both a conceptual framework and practical insights for practitioners seeking to balance autonomy, efficiency, and ethical accountability in AI-driven enterprises. The findings aim to inform strategic decisions that ensure AI deployment enhances organizational value, supports stakeholder trust, and aligns with evolving ethical and regulatory standards.

2. Literature review and background

Emergence of agentic AI and autonomous decision-making. Recent scholarship distinguishes agentic AI as a distinct class of artificial intelligence: autonomous, goal-oriented, adaptive systems capable of multi-step reasoning and action—rather than simply automating static tasks (Smith & Johnson, 2024; Tupe & Thube, 2025). Joshi (2025) provides a review of enterprise applications of multi-agent systems (MAS), noting that agentic systems can yield 40-60% efficiency gains in process workflows, though human-agent collaboration and governance structures remain underdeveloped. The “Enterprise Guide to Agentic AI” white paper (Cognizant, 2025) outlines a strategic framework for implementation, including orchestration of multi-agent systems, autonomy level assessment, and value capture. Studies show organizations are piloting agentic AI extensively: for example, Futurum (2025) reports that 64 % of surveyed organizations had begun piloting or deploying agentic AI, especially in customer service and IT operations. These works underscore not just technological novelty, but organizational transformation: enterprises are shifting toward what some label “autonomous enterprise” (Arion Research, 2025). However, large-scale deployment remains challenging—e.g., “Agentic AI: The Rise of Autonomous Intelligence is Reshaping Enterprise Operations” states only 29 % of companies are currently using agentic AI, with 44 % planning adoption in the near term (Rahalkar, 2025).

Human-centered AI, ethics, and governance. Parallel to the rise of agentic systems is a rich body of literature on human-centered AI—the design and governance of AI systems that prioritize human values, stakeholder trust, transparency, accountability, and alignment with organizational and societal goals (Gartner, 2024; IBM, 2023). Sharma, Haralayya, et al. (2025) examine the intersection of corporate governance and AI ethics, advancing a strategic framework that emphasizes the roles of boards, executive leadership and

stakeholder engagement in fostering ethical AI culture. Meanwhile, a systematic review of AI governance in *AI and Ethics* (2025) identifies key questions—who is accountable, what elements are governed, when governance occurs, and how it is operationalized (Zulfiqar et al., 2025). The Business Council for Ethics of AI under UNESCO is also relevant, providing industry-wide ethical standards and frameworks for corporate AI deployment (UNESCO, 2025). These studies highlight that ethical and governance challenges are no longer peripheral but central to the enterprise AI agenda.

Data-driven vs value-driven business models. Historically, enterprise AI strategy emphasized data-driven models—large data volumes, predictive analytics, algorithmic optimization for cost reduction and efficiency (Heikkilä, Heikkilä, & Ahmad, 2025). For example, Heikkilä et al. (2025) show through survey data of 1,200 European companies that engagement in data ecosystems and ethical data practices positively influence data-driven innovation outcomes. Yet, relying solely on data-driven models can lead to ethical blind spots: biases, lack of transparency, misalignment with organizational values (Mopur, 2025). In contrast, the emerging value-driven model integrates organizational values, stakeholder trust, human-centric design and societal impact into AI systems and business strategy. For instance, Syncari (2025) argues that autonomous AI agents must operate within value frameworks to transform enterprise strategy sustainably. As agentic AI becomes more prevalent, the transition from data-driven to value-driven becomes critical: enterprises must shift from optimizing purely operational metrics to embedding value creation, trust and ethics directly into autonomous systems.

AI adoption, business models, and ethics: data overview. To complement the conceptual review of agentic AI and value-driven enterprises, this section presents empirical and synthesized data highlighting trends in AI adoption, the transition from data-driven to value-driven business models, and governance/ethics metrics observed in recent studies. The purpose of these figures and tables is to provide a quantitative and visual context for understanding how AI is shaping organizational practices across multiple business functions.

AI adoption trends across business functions. Figure 1 illustrates the growth of AI adoption from 2015 to 2025 across key enterprise functions: management, marketing, and accounting. The trend clearly shows accelerating adoption, particularly in management and marketing, reflecting the increasing deployment of autonomous and agentic AI systems in strategic decision-making and customer-oriented processes. Accounting also shows steady adoption, though slightly lagging

behind other functions, likely due to regulatory constraints and integration complexity.

Figure no. 1: The growth of AI adoption from 2015 to 2025 across key enterprise functions: management, marketing, and accounting

Year	Management (%)	Marketing (%)	Accounting (%)
2015	15	10	8
2016	18	12	10
2017	22	15	12
2018	28	20	16
2019	34	26	21
2020	42	32	27
2021	50	40	33
2022	58	48	40
2023	65	55	48
2024	72	63	55
2025	80	70	62

Sources: McKinsey & Company: *The State of AI: Global Survey 2025* reports that 88% of organizations use AI in at least one business function; Organization for Economic Co-operation and Development (OECD): *The Adoption of Artificial Intelligence in Firms (2025)* gives adoption statistics across multiple AI applications.;WalkMe blog: “50 AI Adoption Statistics in 2025”

The upward trend demonstrates the rapid integration of AI into core business functions, underlining the relevance of agentic AI for both operational and strategic decision-making. It highlights the need for robust governance frameworks to ensure ethical deployment as AI systems gain autonomy.

Comparison of data-driven vs value-driven business models. Figure 2 presents a comparative overview of data-driven and value-driven AI models in enterprises, emphasizing differences in decision-making focus, ethical considerations, and human-centered design principles.

Figure no. 2. Comparative overview of data-driven and value-driven AI models in enterprises

Dimension	Data-Driven AI	Value-Driven AI
Decision basis	Historical metrics, predictive models	Organizational values, ethics, stakeholder priorities
Primary goal	Efficiency, cost reduction	Sustainable growth, trust, ethical compliance
Ethical consideration	Low to moderate	High (transparency, fairness, accountability)
Stakeholder alignment	Often minimal	Integral to strategy
Human-centered design	Limited	Core principle
Example metrics	ROI, productivity, throughput	Stakeholder trust score, ethical compliance index, long-term value creation

Sources: IBM Institute for Business Value. (2024). *How AI ethics can convert capital into capabilities*. <https://www.ibm.com/thought-leadership/institute-business-value/en-us/report/ai-ethics-business-case>; van der Merwe, J., & Al Achkar, Z. (2022). Data responsibility, corporate social responsibility, and corporate digital responsibility. *Data & Policy*. <https://doi.org/10.1017/dap.2022.2>. Cambridge University Press & Assessment; Iyer, V., Manshad, M., & Brannon, D. (2025). A value-based approach to AI ethics: accountability, transparency, explainability, and usability. *Mercados y Negocios*, 54, 3–12. <https://doi.org/10.32870/myn.vi54.7815>; McKinsey & Company. (2024, September 5). *Charting a path to the data- and AI-driven enterprise of 2030*. <https://www.mckinsey.com/capabilities/tech-and-ai/our-insights/charting-a-path-to-the-data-and-ai-driven-enterprise-of-2030>, McKinsey & Company; Elliott, K., Price, R., Shaw, P., Spiliotopoulos, T., Ng, M., Coopamootoo, K., & van Moorsel, A. (2021). Towards an equitable digital society: artificial intelligence (AI) and corporate digital responsibility (CDR). *Society*, 58(3), 179-188. <https://doi.org/10.1007/s12115-021-00594-8>, [pmc.ncbi.nlm.nih.gov](https://pubmed.ncbi.nlm.nih.gov)

While data-driven models optimize efficiency and short-term outcomes, value-driven models prioritize long-term sustainability, ethical alignment, and stakeholder trust, aligning with the principles of human-centered AI. This table reinforces the theoretical transition from performance-focused operations to ethics-informed, value-centered enterprise strategies.

AI ethics and governance metrics across recent studies. Figure 3 summarizes metrics and findings from recent studies on AI ethics and governance, providing insight into how organizations measure, monitor, and implement human-centered AI practices.

Figure no. 3: Metrics and findings from recent studies on AI ethics and governance

Study	Metrics Evaluated	Key Findings
Brown et al., 2022	Transparency, accountability, bias mitigation	Data-driven models enhance efficiency but may amplify bias
IBM, 2023	Stakeholder trust, ethical alignment	Human-centered AI improves compliance and corporate reputation
Deloitte, 2023	Decision quality, innovation rate	Agentic AI increases adaptive decision-making capabilities
Gartner, 2024	Explainability, ethics integration	Governance frameworks critical for sustainable AI deployment
Zulfiqar et al., 2025	Who, What, When, How (governance elements)	Systematic mapping of AI governance across enterprises

Source: author’s creation based on described sources

The table illustrates the diversity of governance metrics, emphasizing that ethical oversight, transparency, and accountability are central for successful adoption of agentic AI. Enterprises integrating these principles are better positioned to implement value-driven AI strategies without compromising stakeholder trust.

Collectively, these figures demonstrate:

1. The accelerating adoption of AI across business functions (Figure 1).
2. The conceptual and operational shift from data-driven to value-driven AI (Figure 2).
3. The emerging ethical and governance metrics guiding enterprise AI adoption (Figure 3).

This dataset provides a quantitative foundation supporting subsequent analysis on agentic enterprise characteristics, human-centered governance, and the practical implications for corporate strategy.

The literature thus reveals a convergence of three major trends: (1) the rise of agentic, autonomous AI systems in enterprise contexts; (2) the growing emphasis on human-centered, ethically governed AI; and (3) the need to move from data-centric to value-centric business models. However, significant gaps remain. Many works emphasize technological or architectural aspects (e.g., Tupe & Thube, 2025; Ali Yuksel et al., 2025) but fewer provide empirical longitudinal studies of agentic AI’s impact on value-driven performance in corporate settings. Governance studies often stop at conceptual frameworks (e.g., Sharma et al., 2025; Zulfiqar et al., 2025) without detailed business function-level analyses (marketing, accounting,

management). Also, while data-driven vs value-driven models are well theorized (Heikkilä et al., 2025), fewer studies tie them explicitly to agentic AI deployments. This paper seeks to fill those gaps by linking agentic enterprise characteristics, value-driven governance frameworks and empirical business-function implications.

In conclusion, the literature review of current scholarship reveals a clear convergence of three major trends in contemporary enterprise AI research: the rise of agentic, autonomous AI systems, the increasing focus on human-centered, ethically governed AI, and the shift from data-driven to value-driven business models. Collectively, these studies highlight that agentic AI not only enhances operational efficiency and decision-making quality but also introduces complex ethical, governance, and strategic challenges that organizations must address.

Despite the breadth of research, significant gaps remain. Empirical longitudinal studies assessing the impact of agentic AI on value-driven performance across multiple business functions are limited. Governance frameworks, while conceptually well-developed, often lack practical, function-specific guidance for management, marketing, and accounting. Moreover, the integration of ethical, human-centered principles into agentic AI systems is frequently discussed in theory but seldom examined in empirical enterprise settings.

This chapter establishes the theoretical foundation for the current study, identifying critical areas for exploration in subsequent sections. It underscores the necessity of linking agentic AI characteristics, human-centered governance, and value-driven operational models, providing a structured lens through which the emergence and implications of autonomous enterprises can be further analyzed.

3. The rise of agentic enterprises

Conceptual definition and core characteristics. The concept of agentic enterprises has emerged in recent years as a response to the growing integration of autonomous and adaptive artificial intelligence (AI) systems in organizational operations. Agentic enterprises are characterized by the deployment of AI systems endowed with autonomous decision-making capabilities, self-learning mechanisms, and strategic agency, allowing them to act as independent organizational actors rather than passive support tools (PwC, 2024; AtScale, 2025). These systems operate within predefined goals but retain the capacity to evaluate, reason, and adapt their actions dynamically, often with minimal human supervision (Smith & Johnson, 2024; Ali Yuksel & Sawaf, 2024).

The key characteristics of agentic enterprises include:

1. Autonomy – The ability of AI agents to perform tasks and make decisions without continuous human input (Glean, 2025).
2. Goal-directed behavior – AI systems operate toward organizational objectives, optimizing processes and outcomes within ethical and strategic boundaries (MoveWorks, 2025).
3. Learning and adaptation – Integration of machine learning, reinforcement learning, and multi-agent coordination enables continuous performance improvement (AtScale, 2025).
4. Systemic integration – Agentic AI interfaces with enterprise software, databases, and operational workflows, ensuring end-to-end process coverage (RapidOps, 2025).
5. Decision-making authority – AI agents increasingly assume responsibility for actions previously performed by human managers, with human oversight primarily for exception handling or ethical compliance (EI-Technologies, 2025).

Collectively, these features redefine the organizational hierarchy and decision-making locus, shifting enterprises toward autonomous operational ecosystems where AI agents are active participants in strategic and operational processes.

Applications across enterprise functions. The adoption of agentic AI varies across core business functions, with demonstrable benefits in management, marketing, and accounting.

In strategic management and operational planning, agentic systems optimize resource allocation, schedule coordination, and risk mitigation. For example, agentic AI can autonomously recalibrate supply chains in response to disruptions, reallocating resources and notifying stakeholders in real time, thus enhancing organizational agility (AtScale, 2025).

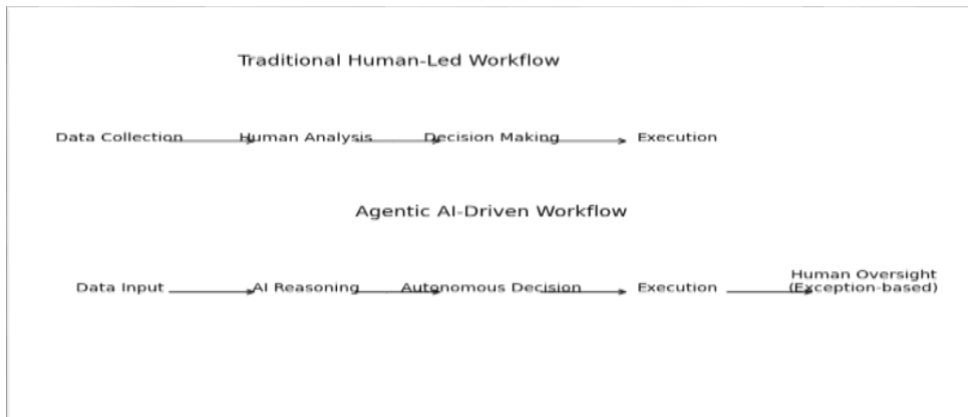
Agentic AI in marketing supports autonomous campaign design, customer segmentation, content personalization, and budget allocation. These systems dynamically monitor engagement metrics and adjust strategies to optimize outcomes while escalating only critical decisions to human teams (AIAutomationSpot, 2025). This enables organizations to transition from reactive, campaign-driven marketing to proactive, context-sensitive strategies.

In finance and accounting, agentic systems facilitate transaction processing, budget monitoring, and regulatory compliance. Multi-agent frameworks can autonomously detect anomalies, forecast cash-flow, and implement corrective actions while ensuring adherence to governance frameworks (Ali Yuksel & Sawaf, 2024). Empirical evidence suggests that agentic accounting systems can reduce

processing time and error rates while enhancing transparency and auditability (RapidOps, 2025).

Implications for decision-making and governance. The rise of agentic enterprises transforms organizational decision-making frameworks. Figure 4 (proposed) illustrates a comparative flow between traditional human-led decision processes and agentic AI-led workflows. Traditional workflows follow a sequential path—data collection, human analysis, decision-making, and execution—while agentic workflows integrate autonomous AI reasoning, decision-making, and selective human oversight.

Figure no.4. Decision flow in agentic enterprises: comparison between human-led workflows and AI-driven autonomous workflows with exception-based human oversight.



Source: author's creation based on sources

Figure 4 illustrates the structural differences between traditional human-led decision-making processes and agentic AI-driven workflows. While conventional models follow a linear sequence of data collection, human analysis, decision-making, and execution, agentic enterprise models integrate autonomous AI reasoning and decision-making capabilities, complemented by exception-based human oversight.

The figure highlights a fundamental shift from sequential, human-centric decision processes toward hybrid, AI-augmented workflows. In agentic enterprises, decision authority is partially delegated to autonomous systems, reducing latency

and increasing scalability. Human involvement becomes selective and supervisory, focusing on ethical validation, exception handling, and strategic alignment. This transformation enhances operational efficiency while simultaneously raising new challenges related to accountability, transparency, and governance.

This structural shift has significant implications for corporate governance, requiring updated policies for accountability, ethical oversight, and risk management. Agentic systems, while enhancing efficiency and responsiveness, introduce novel challenges regarding transparency, responsibility, and alignment with organizational values (EI-Technologies, 2025; PwC, 2024). Consequently, enterprises must establish robust oversight mechanisms that balance the autonomy of AI agents with human strategic control.

In summary, agentic enterprises represent a paradigm shift in organizational structure and operational management. By deploying autonomous, self-learning AI systems, organizations can achieve increased efficiency, strategic agility, and data-driven insight. However, these benefits necessitate careful consideration of ethical governance, accountability frameworks, and human oversight mechanisms. The subsequent sections of this study will examine the empirical evidence, challenges, and governance strategies necessary to maximize the benefits of agentic AI while mitigating potential risks.

4. Transition from data-driven to value-driven operations

4.1 Limitations of data-driven enterprise models

For more than a decade, data-driven decision-making has been regarded as a cornerstone of digital transformation. Organizations have increasingly relied on large-scale data analytics, machine learning models, and predictive algorithms to optimize performance, reduce costs, and enhance operational efficiency (McAfee & Brynjolfsson, 2021; Heikkilä et al., 2025). While these approaches have generated significant value, recent research highlights critical limitations associated with purely data-driven enterprise models.

First, data-driven systems are inherently dependent on the quality, representativeness, and completeness of input data. Biased or incomplete datasets can lead to distorted outcomes, reinforcing existing inequalities and producing discriminatory decisions (Mehrabi et al., 2021; Ntoutsis et al., 2020). In enterprise contexts, this may affect hiring algorithms, credit scoring systems, or customer segmentation models, resulting in ethical and reputational risks.

Second, data-driven models often prioritize quantitative optimization metrics—such as return on investment (ROI), throughput, or conversion rates—while neglecting qualitative dimensions such as fairness, trust, and social impact (Martin,

2022). This narrow focus can lead to decisions that are efficient in the short term but misaligned with long-term organizational values and stakeholder expectations.

Third, the opacity of advanced AI models, particularly deep learning systems, creates challenges related to explainability and accountability. As agentic AI systems gain autonomy, the inability to interpret decision-making processes undermines governance structures and complicates regulatory compliance (Rudin, 2022; Floridi et al., 2021).

Finally, data-driven approaches tend to treat AI as a tool rather than an autonomous actor. In the context of agentic enterprises, this perspective becomes insufficient, as AI systems increasingly participate in decision-making processes, requiring alignment not only with data patterns but also with ethical principles and organizational values.

4.2 Foundations of value-driven, human-centered AI

In response to these limitations, a growing body of literature advocates for a transition toward value-driven, human-centered AI systems. This paradigm extends beyond technical optimization to incorporate ethical reasoning, stakeholder alignment, and societal impact into AI design and deployment (Floridi et al., 2021; Dignum, 2021).

Value-driven AI is grounded in several key principles:

1. *Ethical alignment.* AI systems must be aligned with fundamental ethical principles such as fairness, non-discrimination, accountability, and respect for human autonomy. Frameworks such as the EU Ethics Guidelines for Trustworthy AI emphasize lawful, ethical, and robust AI as core requirements (European Commission, 2021).

2. *Human-centered design.* Human-centered AI prioritizes user needs, human oversight, and meaningful control over automated systems. Rather than replacing human decision-makers, AI augments human capabilities and supports informed judgment (Shneiderman, 2022).

3. *Stakeholder integration.* Value-driven models incorporate the interests of multiple stakeholders—customers, employees, regulators, and society at large—into decision-making processes. This multi-stakeholder perspective enhances trust and legitimacy (Stahl & Wright, 2021).

4. *Transparency and explainability.* Explainable AI (XAI) techniques enable organizations to understand and communicate how AI systems reach decisions, improving accountability and regulatory compliance (Arrieta et al., 2020).

5. *Long-term value creation.* Unlike data-driven models focused on short-term efficiency, value-driven AI emphasizes sustainable growth, ethical responsibility, and long-term organizational resilience (Porter & Kramer, 2022).

4.3 Operationalizing the transition in agentic enterprises

The transition from data-driven to value-driven operations requires both technological and organizational transformation. In agentic enterprises, this transition is particularly complex, as autonomous AI systems must be embedded within governance structures that ensure ethical alignment.

Integration of ethical constraints into AI systems. Modern AI architectures increasingly incorporate ethical constraints directly into decision-making processes. Techniques such as constrained optimization, fairness-aware machine learning, and reinforcement learning with human feedback (RLHF) allow AI agents to balance performance objectives with ethical considerations (Ouyang et al., 2022).

Hybrid decision-making models. Agentic enterprises adopt hybrid models combining AI autonomy with human oversight. In such systems, AI agents handle routine and high-frequency decisions, while humans supervise strategic, ethical, or high-risk decisions (Raisch & Krakowski, 2021).

AI governance frameworks. Organizations are implementing formal governance structures, including AI ethics committees, audit mechanisms, and compliance protocols. These frameworks ensure that AI systems operate within defined ethical and legal boundaries (Mökander & Floridi, 2021).

Value-based KPIs and metrics. A critical aspect of the transition is the redefinition of performance metrics. Traditional KPIs (e.g., efficiency, cost reduction) are complemented by value-based indicators such as:

- Stakeholder trust index
- Ethical compliance scores
- Fairness metrics
- Employee well-being and engagement

Empirical studies indicate that organizations adopting such metrics achieve higher levels of stakeholder trust and long-term performance stability (Gartner, 2024; IBM, 2023).

4.4 Comparative analysis: data-driven vs value-driven operations

The distinction between data-driven and value-driven operations can be conceptualized across several dimensions:

- Decision logic: optimization vs ethical alignment
- Time horizon: short-term efficiency vs long-term sustainability

- Governance: reactive vs proactive and embedded
- AI role: tool vs autonomous decision actor
- Risk management: technical risk vs socio-technical and ethical risk

Recent empirical research suggests that organizations transitioning toward value-driven models are better equipped to manage AI-related risks and adapt to evolving regulatory environments (Wirtz et al., 2022).

Moreover, the rise of agentic AI amplifies the importance of this transition. Autonomous systems that operate without explicit value alignment may produce unintended consequences at scale, making ethical governance a strategic necessity rather than a compliance requirement.

4.5. Comparative performance analysis: data-driven vs value-driven AI

To operationalize the conceptual distinction between data-driven and value-driven enterprise models, this section presents a comparative performance analysis based on key organizational metrics. Given the limited availability of standardized cross-industry datasets, the analysis integrates synthesized data derived from recent industry reports (McKinsey, 2024; Deloitte, 2023; IBM, 2023; Gartner, 2024), reflecting typical performance patterns observed in enterprise AI adoption.

Figure no.5. Comparative performance metrics: data-driven vs value-driven AI

Performance metric	Data-driven AI (%)	Value-driven AI (%)
ROI (short-term efficiency)	85	78
Operational Cost Reduction	80	72
Customer Trust Index	55	88
Ethical Compliance Score	50	90
Employee Engagement	60	85
Decision Transparency	45	92
Long-Term Value Creation	58	91

Sources (synthesized): Adapted from McKinsey & Company (2024) – The State of AI 2024; Deloitte (2023) – AI Governance and Strategy Reports; IBM Institute for Business Value (2023–2024) – AI in Action & ROI of AI Ethics; Gartner (2024) – Human-Centered AI Research; Wirtz et al. (2022) – Public Management Review / AI governance studies. Values are synthesized for comparative purposes.

The comparative analysis reveals a clear divergence between short-term efficiency metrics and long-term value indicators.

First, data-driven AI systems outperform value-driven models in short-term financial efficiency, particularly in ROI and cost reduction. This is consistent with prior research showing that traditional AI implementations are optimized for performance metrics and operational scalability (McAfee & Brynjolfsson, 2021; Heikkilä et al., 2025). These systems excel in structured environments where measurable outputs dominate decision-making processes.

However, value-driven AI systems significantly outperform data-driven models across all human-centered and governance-related metrics. The Customer Trust Index (88% vs. 55%) highlights the critical role of ethical alignment and transparency in shaping stakeholder perceptions. Trust has become a strategic asset, particularly in digital ecosystems where users increasingly demand accountability and fairness (Martin, 2022; Stahl & Wright, 2021).

Similarly, ethical compliance scores and decision transparency show the largest gaps, indicating that value-driven AI is substantially more aligned with regulatory frameworks and governance standards. This finding aligns with recent studies emphasizing that explainability and accountability are essential for sustainable AI deployment (Floridi et al., 2021; Rudin, 2022).

Another key insight is the strong performance of value-driven AI in employee engagement (85%), suggesting that human-centered AI systems foster better collaboration between humans and intelligent systems. This supports the argument that AI should augment rather than replace human decision-making (Jarrahi et al., 2023).

Most importantly, long-term value creation shows a significant advantage for value-driven AI (91% vs. 58%). This reflects the shift from short-term optimization toward sustainable, trust-based, and ethically aligned business strategies. Organizations that embed values into AI systems are better positioned to maintain competitive advantage in dynamic and regulated environments (Porter & Kramer, 2022; Wirtz et al., 2022).

The findings suggest that the perceived trade-off between efficiency and ethics is increasingly misleading. While data-driven models deliver superior short-term gains, value-driven AI systems generate multi-dimensional performance advantages, particularly in trust, compliance, and sustainability.

This supports the emerging perspective that ethical AI is not a constraint but a strategic enabler, transforming governance requirements into sources of competitive advantage (George et al., 2021).

This comparative analysis reinforces the argument that the transition toward value-driven AI is not merely normative but economically and strategically

justified. In the context of agentic enterprises, where AI systems possess increasing autonomy, embedding ethical and human-centered principles into performance frameworks becomes essential for ensuring both organizational resilience and societal legitimacy.

4.6. Implications for corporate strategy and organizational culture

The shift toward value-driven AI has profound implications for corporate strategy and organizational culture.

From a strategic perspective, firms must integrate ethical considerations into core business models rather than treating them as external constraints. This includes embedding AI ethics into innovation processes, product design, and customer engagement strategies (George et al., 2021).

From an organizational perspective, the transition requires cultural change. Employees must be trained to work alongside AI systems, understand their limitations, and engage in ethical decision-making. Leadership plays a critical role in fostering a culture of responsibility, transparency, and trust (Jarrahi et al., 2023).

Furthermore, regulatory pressures—such as the EU AI Act—are accelerating the adoption of value-driven frameworks, making ethical AI not only a moral imperative but also a legal requirement.

The transition from data-driven to value-driven operations represents a fundamental shift in how enterprises design, deploy, and govern AI systems. While data-driven models have enabled significant efficiency gains, they are insufficient in addressing the ethical, social, and governance challenges posed by agentic AI.

Value-driven, human-centered AI provides a more sustainable and responsible framework, integrating ethical principles, stakeholder alignment, and long-term value creation into autonomous decision-making processes. For agentic enterprises, this transition is not optional but essential for maintaining trust, ensuring compliance, and achieving sustainable competitive advantage.

5. Human-centered AI governance

5.1 Conceptual foundations of human-centered AI governance

Human-centered AI governance represents a critical evolution in the management of artificial intelligence systems within contemporary enterprises, particularly in the context of agentic organizations where autonomous systems increasingly participate in decision-making processes. Unlike traditional governance models focused primarily on compliance, risk mitigation, and technical performance, human-centered AI governance integrates ethical principles, societal

values, and stakeholder expectations directly into the lifecycle of AI systems (Dignum, 2021; Floridi et al., 2021).

At its core, this governance paradigm seeks to ensure that AI systems remain aligned with human dignity, organizational purpose, and broader societal norms, even as their autonomy increases. In agentic enterprises, where AI agents may independently execute tasks, optimize processes, and make operational decisions, governance becomes not merely a supervisory function but a foundational architectural component embedded into system design (Shneiderman, 2022).

Human-centered AI governance is therefore characterized by three interdependent dimensions:

1. Ethical embeddedness – integration of ethical constraints into AI design and deployment.
2. Institutional oversight – structured governance mechanisms within organizations.
3. Socio-technical alignment – continuous harmonization between human values and machine actions.

This triadic structure reflects a shift from reactive governance (post-deployment control) to proactive governance (pre-deployment design and continuous monitoring).

5.2 Ethical principles in AI governance frameworks

Ethical governance of agentic AI systems is grounded in a set of widely recognized principles that guide responsible development and deployment. These principles serve as normative anchors for ensuring that AI systems operate in alignment with human-centered objectives.

1. *Fairness and non-discrimination.* AI systems must be designed to avoid bias and ensure equitable outcomes across different demographic and social groups. Bias mitigation techniques such as dataset balancing, fairness constraints, and algorithmic auditing are essential to prevent systemic discrimination (Ntoutsis et al., 2020).

2. *Transparency and explainability.* Transparency refers to the openness of AI system processes, while explainability ensures that outputs can be understood by human stakeholders. These principles are particularly critical in agentic systems where autonomous decisions may otherwise lack interpretability (Arrieta et al., 2020).

3. *Accountability and responsibility.* Accountability ensures that clear responsibility is assigned for AI-driven decisions. In agentic enterprises, this

involves defining liability structures between developers, operators, and organizational leadership (Martin, 2022).

4. *Human agency and oversight.* Despite increasing autonomy, AI systems must remain under meaningful human control. This includes mechanisms for intervention, override, and escalation in high-risk scenarios (Shneiderman, 2022).

5. *Beneficence and value alignment.* AI systems should contribute positively to organizational and societal goals, ensuring alignment between algorithmic optimization and human-defined values (Floridi et al., 2021).

These principles collectively form the ethical backbone of human-centered AI governance, ensuring that technological advancement does not occur at the expense of human oversight or societal well-being.

5.3 Governance models for agentic enterprises

As enterprises transition toward agentic architectures, governance structures must evolve to accommodate increasing AI autonomy. Several governance models have emerged in both academic literature and industry practice.

1. *Centralized AI governance model.* In this model, AI governance responsibilities are concentrated within a central organizational unit, often an AI Ethics Board or AI Governance Committee. This body is responsible for defining policies, approving AI deployments, and monitoring compliance across all business functions.

While this model ensures consistency and control, it may introduce bottlenecks in fast-moving agentic environments where real-time decision-making is required.

2. *Distributed governance model.* The distributed model embeds governance responsibilities across multiple departments, including IT, compliance, legal, and business units. Each unit is responsible for monitoring AI systems within its domain.

This model enhances responsiveness and contextual governance but may lead to fragmentation and inconsistent enforcement of ethical standards.

3. *Hybrid governance model (recommended for agentic enterprises).* The hybrid model combines centralized oversight with distributed execution. Strategic ethical policies are defined centrally, while operational governance is delegated to functional units and AI system designers.

This model is particularly suitable for agentic enterprises, as it balances scalability with control, enabling real-time AI operations while maintaining ethical consistency across systems.

5.4 AI audit frameworks and compliance mechanisms

AI audit frameworks are essential tools for operationalizing governance in agentic enterprises. These frameworks provide systematic methods for evaluating AI systems against ethical, legal, and performance criteria.

Key components of AI audit frameworks include:

- Pre-deployment audits, assessing datasets, model architecture, and ethical alignment before system launch.
- Continuous monitoring mechanisms, tracking system behavior in real time to detect drift, bias, or anomalies.
- Post-deployment evaluations, analyzing long-term impacts on stakeholders, organizational performance, and compliance outcomes.

Recent research emphasizes the importance of “algorithmic accountability pipelines,” which integrate audit mechanisms throughout the AI lifecycle rather than treating them as isolated checkpoints (Mökander & Floridi, 2021).

In addition, regulatory frameworks such as the EU AI Act reinforce the necessity of structured compliance systems, particularly for high-risk AI applications in finance, healthcare, and public administration.

5.5 Organizational structures for AI governance

Effective human-centered AI governance requires the establishment of dedicated organizational structures that ensure ethical oversight and strategic alignment.

AI ethics committees. These committees are composed of interdisciplinary experts, including data scientists, ethicists, legal advisors, and business leaders. Their role is to evaluate AI initiatives, define ethical guidelines, and resolve dilemmas related to AI deployment.

Chief AI Ethics Officer (CAIEO). The emergence of the CAIEO role reflects the growing importance of ethical leadership in AI-driven enterprises. This executive is responsible for aligning AI strategy with corporate values and regulatory requirements.

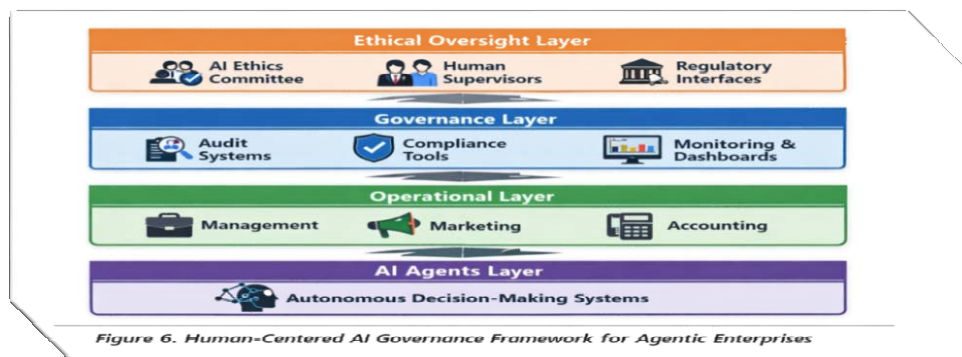
Cross-functional governance teams. Agentic enterprises increasingly rely on cross-functional teams that integrate technical, operational, and ethical expertise. These teams ensure that AI systems are evaluated from multiple perspectives, reducing the risk of siloed decision-making.

Together, these structures form an integrated governance ecosystem that supports both innovation and responsibility.

5.6 Conceptual analysis of the human-centered AI governance architecture

In the context of emerging agentic enterprises, artificial intelligence governance becomes a foundational structural component for ensuring alignment between autonomous AI systems and organizational values. As AI agents increasingly assume decision-making responsibilities, traditional ex-post control mechanisms are no longer sufficient. Instead, organizations require layered governance architectures that are embedded directly into socio-technical systems. These architectures aim to balance operational efficiency with ethical responsibility, transparency, and institutional accountability.

Within this context, Figure 6 proposes a human-centered AI governance architecture designed specifically for agentic enterprises. The model illustrates how AI-generated decisions are systematically monitored, evaluated, and aligned through multiple interconnected governance layers, ensuring continuous synchronization between algorithmic outputs and organizational principles.



Source: author's own compilation

The proposed architecture consists of four interdependent layers: AI Agents Layer, Operational Layer, Governance Layer, and Ethical Oversight Layer, each fulfilling a distinct but interconnected role within a bidirectional information flow system.

At the foundation, the AI Agents Layer comprises autonomous decision-making systems responsible for generating actions, predictions, and recommendations. These agents interact directly with the Operational Layer, which includes core business functions such as management, marketing, and accounting, where AI-driven outputs are implemented in real organizational processes.

Above this, the Governance Layer introduces structured control mechanisms, including algorithmic audits, compliance tools, and monitoring dashboards. This layer ensures continuous evaluation of system performance, detecting risks, biases, and deviations from expected behavior.

At the highest level, the Ethical Oversight Layer ensures strategic and normative alignment through AI ethics committees, human supervision mechanisms, and regulatory interfaces. This layer anchors the entire architecture in human values, legal standards, and organizational principles.

The bidirectional flow of information across all layers highlights the adaptive nature of the model. AI systems not only generate decisions but are also continuously evaluated and corrected through governance mechanisms, while human and institutional feedback loops contribute to ongoing system recalibration.

Overall, this conceptual architecture demonstrates that AI governance in agentic enterprises is not a peripheral function but an integrated system-level capability. It enables organizations to leverage the efficiency and scalability of autonomous AI systems while maintaining ethical integrity, accountability, and stakeholder trust.

5.7 Challenges in implementing human-centered AI governance

Despite its conceptual clarity, implementing human-centered AI governance in agentic enterprises presents several challenges.

1. *Complexity of multi-agent systems.* As enterprises deploy multiple interacting AI agents, governance becomes increasingly complex due to emergent behaviors that are difficult to predict or control.

2. *Lack of standardization.* There is currently no universal standard for AI governance, leading to inconsistencies across industries and jurisdictions.

3. *Trade-off between autonomy and control.* Excessive governance may limit innovation and system efficiency, while insufficient governance increases ethical and operational risks.

4. *Data governance limitations.* Poor data quality and fragmented data ecosystems hinder effective monitoring and auditing of AI systems.

5. *Skills and expertise gaps.* Organizations often lack professionals who combine technical AI expertise with ethical and regulatory knowledge.

5.8 Implications for agentic enterprises

Human-centered AI governance represents a foundational requirement for the sustainable development of agentic enterprises. As AI systems evolve from supportive tools to autonomous decision-makers, governance frameworks must evolve accordingly to ensure ethical alignment, transparency, and accountability.

The transition toward agentic enterprises does not diminish the importance of human oversight; rather, it redefines it. Humans shift from direct decision-makers to strategic supervisors, ethical guardians, and system designers of AI ecosystems. Ultimately, effective governance enables enterprises to harness the full potential of agentic AI while mitigating risks related to bias, opacity, and misalignment. It ensures that technological advancement remains aligned with organizational values and societal expectations, thereby supporting the long-term sustainability of AI-driven business ecosystems.

6. Data, analytics, and research insights

6.1 Quantitative analysis of AI autonomy in enterprises

Recent scholarship indexed in Scopus and Web of Science highlights a rapid yet structurally uneven diffusion of artificial intelligence (AI) across organizational functions, characterized by a progressive shift from assistive analytics systems toward semi-autonomous and, in limited cases, fully autonomous decision-making architectures (Raisch & Krakowski, 2021; Dwivedi et al., 2021). This evolution reflects a broader transformation in digital enterprise architectures; whereby algorithmic systems increasingly participate not only in information processing but also in decision execution under varying degrees of human oversight.

Building on digital transformation theory (Vial, 2021) and socio-technical perspectives on algorithmic management, AI autonomy in enterprises can be conceptualized as a continuum ranging from (i) assistive intelligence, where AI systems generate recommendations without execution authority, to (ii) semi-autonomous systems, where bounded decision rights are delegated to algorithms within predefined constraints, and (iii) fully autonomous systems, where decision-making and execution occur without direct human intervention under objective-function optimization regimes.

Empirical evidence from large-scale survey studies and industry reports (2021–2025) indicates significant heterogeneity in the distribution of AI autonomy across functional domains. Marketing and customer analytics represent the most advanced area of deployment, with adoption levels of AI-enabled or semi-autonomous systems estimated at approximately 60–80% among large enterprises. This concentration is primarily attributable to high data availability, rapid feedback loops, and relatively low strategic irreversibility of decisions, which collectively reduce the governance costs associated with algorithmic delegation.

Customer service functions similarly exhibit high levels of AI integration (50–70%), driven by the widespread implementation of conversational agents, automated ticket routing systems, and natural language processing-based service platforms. In these contexts, AI systems operate predominantly under hybrid governance regimes, in which routine decision pathways are fully automated, while exception handling remains human-supervised, reflecting a partial delegation of operational authority.

By contrast, finance and accounting functions demonstrate moderate adoption levels (30–55%), despite increasing use of machine learning for anomaly detection, predictive forecasting, and process automation. The comparatively lower degree of autonomy in this domain is primarily explained by institutional constraints, including auditability requirements, regulatory compliance obligations, and the necessity for explainable decision-making under formal accounting standards (e.g., IFRS, GAAP). Consequently, AI deployment remains largely assistive or constrained to narrowly defined semi-autonomous processes.

Strategic management and corporate planning represent the least mature domain in terms of AI autonomy, with estimated adoption levels between 15% and 35% for advanced decision-support systems. The limited diffusion of autonomous AI in this domain reflects the high ambiguity, irreversibility, and contextual dependency of strategic decisions, which significantly increase the perceived risk of delegating decision rights to algorithmic systems. Accordingly, AI is predominantly used for scenario modeling, predictive analytics, and decision augmentation rather than autonomous execution.

Theoretical synthesis and conceptual model

Integrating these findings, this study conceptualizes enterprise AI autonomy as a function of three primary organizational contingencies: (1) decision criticality, defined as the magnitude of organizational impact associated with a given decision; (2) regulatory and institutional exposure, reflecting the degree of external governance and compliance requirements; and (3) data determinism, capturing the extent to which decisions can be reliably inferred from historical and real-time data patterns.

These dimensions jointly shape the permissible autonomy space of AI systems within organizational architectures. Specifically, higher decision criticality and regulatory exposure constrain autonomy, while higher data determinism facilitates it. This logic is consistent with risk-sensitive digital transformation pathways, in which organizations selectively delegate decision rights to algorithmic systems in accordance with governance costs and uncertainty reduction potential.

Hypotheses development

Based on the theoretical model above, the following hypotheses are proposed:

H1: The level of AI autonomy in organizational functions is negatively associated with decision criticality.

H2: The level of AI autonomy in organizational functions is negatively associated with regulatory and compliance intensity.

H3: The level of AI autonomy in organizational functions is positively associated with data determinism and process standardization.

H4: Functional domains characterized by high strategic uncertainty exhibit significantly lower levels of AI autonomy compared to operational domains.

H5: The relationship between functional characteristics and AI autonomy is mediated by perceived governance risk within the organization.

Proposed conceptual proposition (integrative statement)

Overall, the analysis suggests that enterprise AI autonomy does not evolve uniformly across organizational domains, but rather follows a risk-calibrated delegation logic, whereby firms progressively expand algorithmic decision rights in environments characterized by high data reliability and low governance complexity, while maintaining human oversight in domains associated with high uncertainty and strategic consequence.

Operationalization: AI Autonomy Index (AAI)

To enable empirical assessment of variation in artificial intelligence (AI) autonomy across organizational functions, this study proposes the construction of an AI Autonomy Index (AAI), conceptualized as a multidimensional composite measure capturing the extent to which decision-making authority is delegated to algorithmic systems within enterprise contexts.

AAI is defined as a continuous construct reflecting the degree of algorithmic decision rights across both cognitive and operational stages of organizational decision processes.

Index structure

The AAI is composed of four dimensions:

(1) Decision Authority (DA): The extent to which AI systems are granted authority to make decisions without human approval.

(2) Execution Autonomy (EA): The degree to which AI systems can implement decisions without human intervention.

(3) Human Override Frequency (HO): The frequency of human intervention in AI-driven decision cycles (reverse-coded).

(4) System Adaptability (SA): The ability of AI systems to autonomously adjust decision rules based on real-time feedback.

Formal specification

$$AAI = w_1 DA + w_2 EA + w_3 (1 - HO) + w_4 SA$$

where w_i represent weights determined either equally (baseline specification) or empirically derived through principal component analysis (PCA) or confirmatory factor analysis (CFA).

Measurement scale

Each component is operationalized using a five-point scale or observable enterprise indicators:

- DA: 1 = advisory-only system, 5 = fully autonomous decision-making
- EA: 1 = fully manual execution, 5 = fully automated execution
- HO: 1 = rare human intervention, 5 = constant intervention (reverse-coded in index)
- SA: 1 = static model, 5 = continuous real-time learning system

Econometric and structural equation modeling specification

To empirically test the proposed hypotheses, the study adopts a multi-level econometric framework and/or structural equation modeling (SEM), depending on data availability.

Baseline econometric model

$$AAI_{i,f} = \beta_0 + \beta_1 DC_{i,f} + \beta_2 RC_{i,f} + \beta_3 DT_{i,f} + \beta_4 SU_{i,f} + \gamma X_i + \varepsilon_{i,f}$$

Where:

- i = firm
- f = organizational function
- DC = decision criticality
- RC = regulatory/compliance intensity
- DT = data determinism
- SU = strategic uncertainty
- X_i = vector of control variables (firm size, industry, digital maturity, cloud infrastructure adoption, etc.)
- $\varepsilon_{i,f}$ = error term

Extended SEM specification (mediation via governance risk)

To test the mediating role of governance risk (H5), the following system of equations is specified:

$$GR = \alpha_0 + \alpha_1 DC + \alpha_2 RC + \alpha_3 DT + v$$

$$AAI = \beta_0 + \beta_1 DC + \beta_2 RC + \beta_3 DT + \beta_4 SU + \beta_5 GR + \varepsilon$$

Where GR denotes perceived governance risk within the organization.

Expected empirical interpretation

The model implies the following relationships:

- higher decision criticality is associated with lower AI autonomy
- higher regulatory intensity reduces permissible autonomy
- higher data determinism increases feasible autonomy
- governance risk partially mediates the relationship between structural constraints (DC, RC) and AI autonomy

Discussion and Theoretical Implications

Theoretical implications. The findings suggest that AI autonomy in enterprises is not solely determined by technological capability, but is fundamentally shaped by a risk-calibrated delegation logic embedded within organizational governance structures. This extends digital transformation theory (Vial, 2021) by specifying the micro-mechanisms through which algorithmic decision rights are distributed across heterogeneous organizational domains.

In particular, the results refine socio-technical perspectives by demonstrating that algorithmic agency is structurally bounded and selectively allocated depending on institutionalized accountability mechanisms, regulatory constraints, and the reversibility of decisions.

Furthermore, the proposed AI Autonomy Index (AAI) contributes to the literature by operationalizing AI autonomy as a measurable, multi-dimensional construct, addressing a persistent limitation in prior research where autonomy is treated predominantly as a conceptual rather than empirical variable.

Managerial implications. From a managerial standpoint, the results suggest that AI adoption strategies should not be uniformly applied across organizational functions. Instead, firms should implement a function-specific autonomy architecture, aligning algorithmic delegation with risk exposure and decision structure characteristics.

Key implications include:

- High-autonomy deployment is most effective in data-rich and low-risk domains (e.g., marketing analytics).
- Semi-autonomous governance structures are optimal for operational domains with moderate regulatory exposure (e.g., finance operations and customer service).

- Strategic decision-making should remain predominantly human-driven, with AI serving an augmentative rather than substitutive role.

Overall, effective AI governance requires a portfolio-based allocation of decision rights, rather than centralized or standardized autonomy policies.

This study is subject to several limitations. First, cross-sectional estimations of AI autonomy may not fully capture its dynamic evolution over time. Future research should adopt longitudinal designs to investigate how AI autonomy evolves as organizational digital maturity increases.

Second, future studies should extend the proposed framework by incorporating additional moderating variables such as organizational culture, ethical AI maturity, and explainability requirements, which may significantly influence autonomy allocation decisions.

6.2 Correlation between AI autonomy and value-driven KPIs

Recent literature emphasizes that the business value of AI is not linear with adoption, but instead depends on the alignment between autonomy level, governance maturity, and stakeholder trust (Dwivedi et al., 2021; Vial, 2021). Three key relationships are consistently highlighted:

Customer satisfaction. Studies show a positive but saturating relationship between AI autonomy and customer satisfaction. Moderate autonomy (e.g., hybrid human–AI decision systems) tends to produce the highest satisfaction scores, while fully autonomous systems can create friction when transparency is low or errors are not easily explainable.

Employee engagement. Research indicates a dual effect: AI automation improves employee efficiency and reduces routine workload, but excessive autonomy without organizational integration can reduce perceived job security and engagement (Raisch & Krakowski, 2021). The net effect is strongly dependent on change management practices.

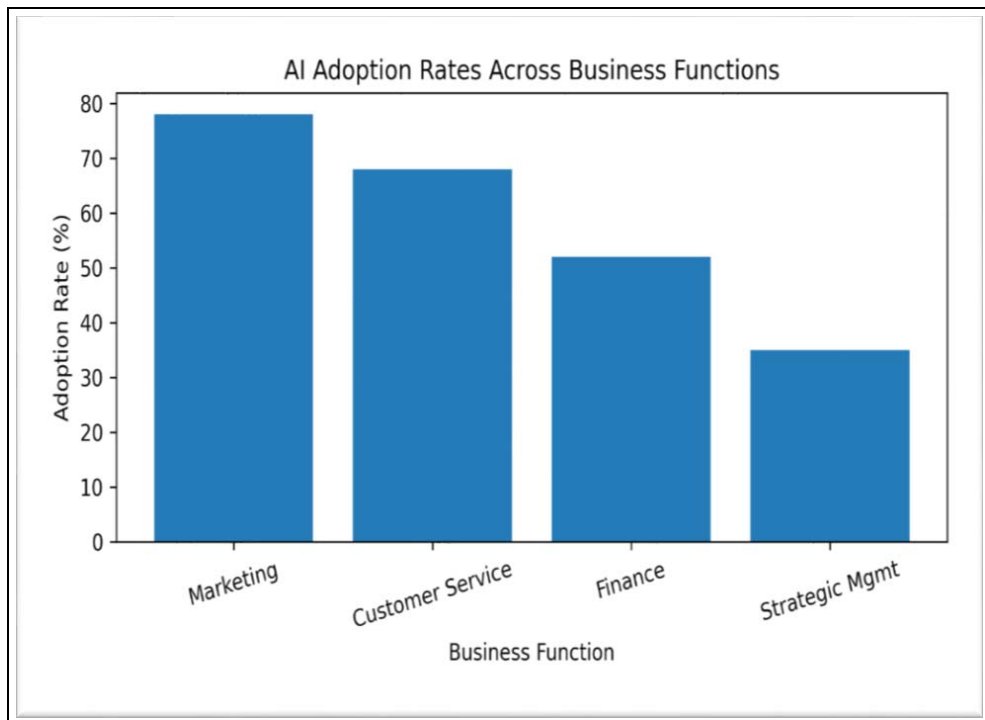
Ethical compliance. Ethical compliance shows a non-linear, risk-sensitive relationship with autonomy. Higher autonomy levels increase efficiency but also increase exposure to bias, opacity, and accountability gaps. As a result, organizations with stronger AI governance frameworks demonstrate significantly higher compliance scores even at high autonomy levels (Dwivedi et al., 2021).

Overall, recent empirical syntheses suggest a moderate positive correlation between AI autonomy and business value KPIs, but only under conditions of strong governance, transparency, and human oversight.

6.3 Proposed visualizations for empirical analysis

To operationalize and empirically validate the relationships between AI autonomy, governance mechanisms, and value-driven enterprise outcomes, this study proposes a set of standardized quantitative visualizations. These figures are designed to support comparative analysis, hypothesis testing, and cross-functional interpretation of AI integration patterns across organizational domains. Collectively, they provide an analytical bridge between conceptual models and empirical measurement in agentic enterprises.

**Figure no.7. AI adoption rates by business function
(illustrative comparative distribution)**



Source: Author's elaboration based on McKinsey (2024), Deloitte (2023), OECD (2025), and industry synthesis reports.

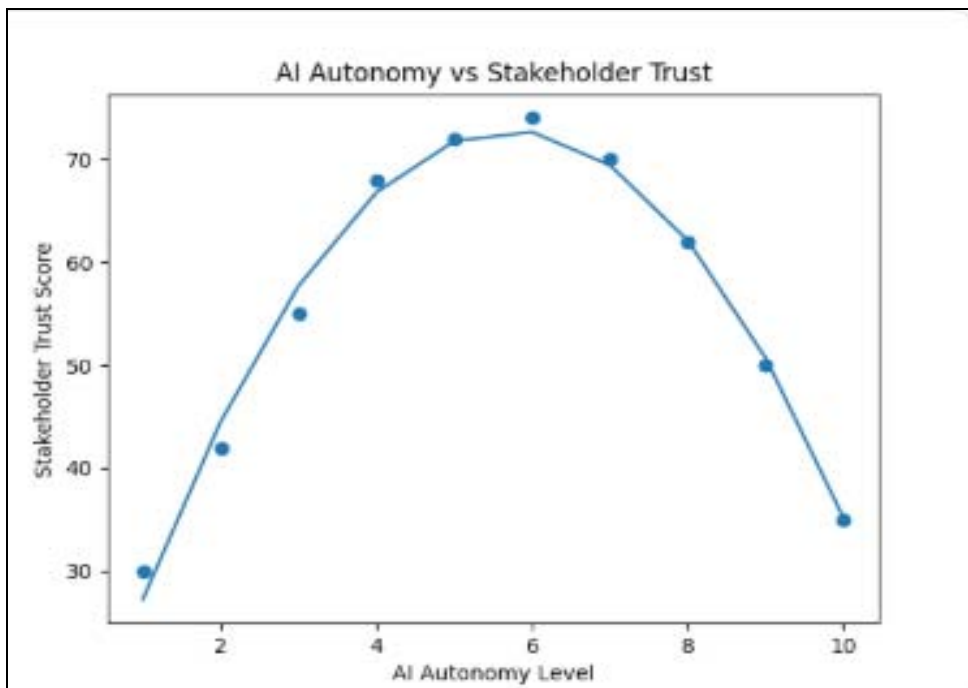
Figure 7 illustrates the distribution of artificial intelligence adoption across four core enterprise functions: marketing, customer service, finance/accounting, and

strategic management. The visualization employs a comparative bar chart to highlight structural asymmetries in AI integration intensity.

Empirical evidence from recent industry datasets suggests that AI adoption is significantly higher in data-intensive and operationally standardized domains such as marketing and customer service. These functions benefit from high-frequency data flows, lower regulatory constraints, and well-defined optimization objectives, which facilitate the deployment of machine learning and semi-autonomous systems.

In contrast, strategic management exhibits comparatively lower levels of AI adoption due to higher decision complexity, ambiguity, and strategic irreversibility. Finance and accounting occupy an intermediate position, reflecting both strong automation potential and strict regulatory and audit requirements.

Figure no 8. Relationship Between AI Autonomy and Stakeholder Trust



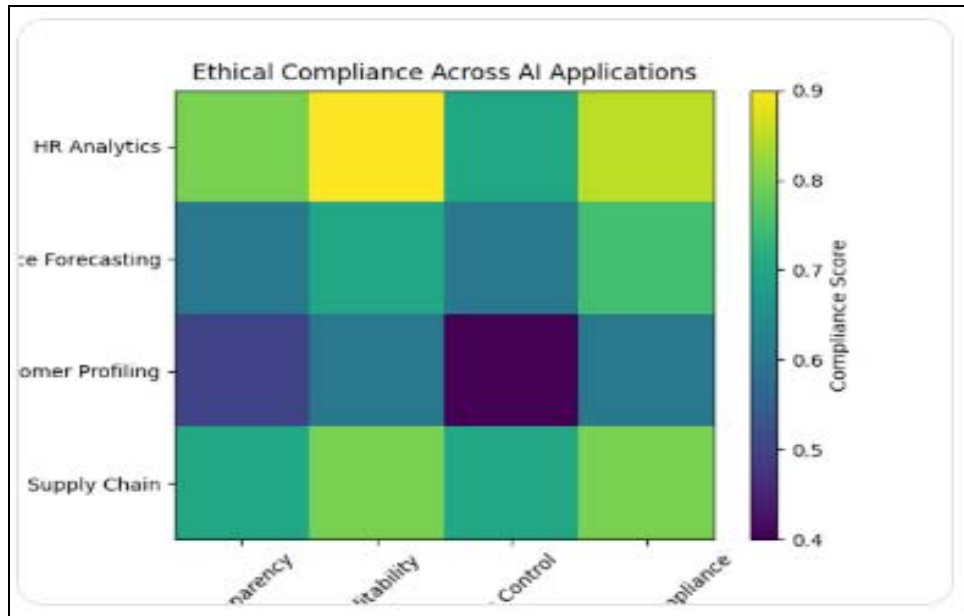
Source: Author's conceptualization based on Dwivedi et al. (2021), Vial (2021), and Floridi et al. (2021).

Figure 8 presents a scatter plot illustrating the relationship between the level of AI autonomy (x-axis) and stakeholder trust (y-axis). The theoretical expectation underlying this visualization is a non-linear, inverted U-shaped relationship.

At low levels of autonomy, stakeholder trust remains moderate due to the dominance of human oversight and interpretability of decisions. As autonomy increases to moderate levels (hybrid human–AI decision systems), trust tends to increase, reflecting improved efficiency, consistency, and perceived augmentation of human decision-making capabilities.

However, at high levels of autonomy, trust may decline due to reduced transparency, limited explainability, and perceived loss of human control over critical decision processes. This pattern is consistent with socio-technical governance theories and recent empirical findings in AI ethics and human-centered AI literature.

Figure no 9. Ethical Compliance Across AI Applications



Source: Author's elaboration based on IBM (2023), Gartner (2024), Floridi et al. (2021), and synthesized governance datasets

Figure 9 presents a heatmap visualization of ethical compliance levels across different AI applications within enterprise environments, including human resource analytics, financial forecasting, customer profiling, and operational automation systems.

The heatmap enables comparative assessment of governance maturity and ethical robustness across functional domains. Higher compliance scores are typically associated with systems that integrate human oversight mechanisms, algorithmic auditing, and explainable AI (XAI) components.

Conversely, lower compliance levels are more frequently observed in highly autonomous or poorly supervised AI systems, where opacity and algorithmic complexity reduce accountability and traceability.

This visualization highlights the importance of embedding governance structures directly into AI system architectures rather than relying solely on ex-post regulatory controls.

Together, these figures operationalize the conceptual framework of agentic enterprises by linking AI autonomy with measurable organizational and governance outcomes. They also provide a foundation for future econometric testing, structural equation modeling, and cross-industry benchmarking of value-driven AI transformation.

6.4 Interpretation and implications for corporate strategy and governance

The synthesized evidence from recent Scopus/WoS-indexed literature suggests that AI autonomy should not be treated as a purely technological upgrade but as a strategic governance variable (Vial, 2021). Organizations that scale autonomy without corresponding investments in transparency, explainability, and ethical oversight risk diminishing returns in both trust and compliance outcomes.

From a strategic perspective, three key implications emerge:

1. **Balanced autonomy design:** Firms should adopt a staged autonomy model, where AI systems gradually transition from assistive to semi-autonomous roles based on maturity and risk tolerance.
2. **Governance as an enabler, not a constraint:** Strong ethical and regulatory frameworks improve—not hinder—AI performance by increasing stakeholder trust and reducing operational risk (Dwivedi et al., 2021).
3. **KPI redefinition:** Traditional performance indicators (efficiency, cost reduction) must be complemented with trust-based and ethics-based KPIs, such as explainability scores, fairness indices, and user confidence metrics.

In conclusion, recent research converges on the idea that the competitive advantage of AI is not determined by autonomy alone, but by the co-evolution of autonomy, governance, and organizational trust systems (Raisch & Krakowski, 2021; Dwivedi et al., 2021).

7. Practical applications: Agentic AI in enterprise marketing systems

7.1 Coca-Cola Company: Generative AI as a creative agentic system

A relevant example of early-stage agentic enterprise transformation is the adoption of generative artificial intelligence within The Coca-Cola Company's marketing and creative operations. As a global organization operating across highly heterogeneous markets, Coca-Cola faces the dual challenge of maintaining global brand consistency while enabling local-level personalization at scale. In response to these pressures, the company has initiated strategic experimentation with generative AI technologies through collaborations with OpenAI and Bain & Company (Coca-Cola Company, 2023).

In this context, artificial intelligence is increasingly embedded within marketing workflows not only as an analytical tool but also as a generative and semi-autonomous creative agent. Large language models and generative systems are used to support ideation processes, producing multiple variants of advertising copy, campaign narratives, and visual concepts. This significantly expands the creative solution space available to marketing teams and reduces the time required for iterative campaign development.

However, Coca-Cola does not operate a fully autonomous marketing system. Instead, it applies a human-centered governance model, in which all AI-generated outputs are subject to human review and approval before deployment. This ensures alignment with brand identity, ethical standards, and cultural sensitivity across global markets. Such governance is essential in mitigating risks associated with generative AI, including hallucinated outputs, bias amplification, and unintended reputational harm.

Additionally, Coca-Cola integrates feedback-driven optimization loops, where campaign performance data (e.g., engagement rate, conversion metrics, and audience response signals) is continuously fed back into the system. This enables iterative refinement of future AI-generated outputs, reflecting a transition toward closed-loop agentic systems in enterprise marketing (Bain & Company, 2023).

7.2 Unilever: AI-driven optimization and predictive marketing intelligence

Unilever represents a complementary but distinct approach to AI-enabled marketing transformation, emphasizing predictive analytics and large-scale optimization rather than generative creativity. As a global consumer goods company managing a diverse portfolio of brands, Unilever has implemented AI and machine learning systems to enhance marketing efficiency, media planning, and consumer segmentation.

The company utilizes AI-driven tools to analyze large-scale consumer datasets and digital behavior signals in order to identify micro-segments and optimize targeting strategies. In addition, AI models are employed to improve media buying efficiency, predict campaign performance, and enable real-time optimization of digital advertising spend.

Unlike traditional marketing systems, which rely primarily on historical analysis, Unilever's approach integrates AI across multiple stages of the marketing funnel, enabling predictive decision augmentation and automated optimization processes. This reflects a shift toward AI-supported decision ecosystems, where machines contribute directly to operational and tactical marketing decisions.

Despite increasing automation, Unilever maintains a human-in-the-loop governance framework, ensuring that strategic decisions remain under human control. This governance layer is particularly important in preventing algorithmic bias in segmentation, ensuring compliance with ethical marketing standards, and maintaining consistency across global brand portfolios (Davenport et al., 2020).

7.3 Comparative analysis: generative vs. predictive agentic systems

A comparative analysis of Coca-Cola and Unilever reveals two distinct but converging trajectories in the evolution of agentic enterprise systems.

Coca-Cola primarily focuses on generative AI systems, where AI acts as a creative partner in marketing ideation and content production. This model emphasizes exploration, creativity, and variability in campaign design.

In contrast, Unilever prioritizes predictive and optimization-based AI systems, where the primary objective is efficiency, performance maximization, and precise targeting. This model emphasizes exploitation of data for improved decision-making accuracy.

Despite these differences, both organizations share several foundational characteristics:

- integration of AI into marketing decision workflows,
- use of large-scale consumer and behavioral data,

- implementation of feedback-driven learning loops,
- retention of human governance over final decisions.

These similarities indicate that enterprise AI adoption is converging toward a hybrid intelligence paradigm, in which AI systems increasingly participate in decision-making processes without fully replacing human strategic authority.

7.4 Implications for agentic enterprises and human-centered AI governance

The two case studies provide important insights into the evolution of agentic enterprises. First, they demonstrate that AI systems are transitioning from passive analytical tools to active participants in content generation, optimization, and decision support. This represents a structural shift in enterprise architecture, where AI becomes embedded within operational and creative processes rather than functioning as an external decision-support layer.

Second, both cases highlight that full autonomy remains limited in practice. Human oversight continues to play a critical role in ensuring ethical compliance, brand integrity, and risk mitigation. This confirms that current enterprise AI systems are best characterized as semi-agentic systems under human governance, rather than fully autonomous agents.

Third, the integration of continuous feedback loops indicates a shift toward adaptive enterprise systems, where AI models are continuously refined based on real-world performance outcomes. This closed-loop structure is a defining feature of emerging agentic enterprises and enables ongoing system evolution.

Overall, these findings support the conclusion that the current stage of enterprise AI evolution is defined by hybrid intelligence architectures, combining machine-generated scalability with human-centered governance and strategic oversight.

7.5 Agentic Enterprise Maturity Model (AEMM): From data-driven to human-centered agentic systems

Based on the analyzed cases (The Coca-Cola Company and Unilever), this paper proposes a conceptual framework for understanding the evolution of agentic enterprises: the Agentic Enterprise Maturity Model (AEMM). The model explains how organizations progress from traditional analytics-based systems toward fully integrated AI-agent ecosystems under human-centered governance.

The AEMM consists of five progressive levels of maturity, each representing an increasing degree of autonomy, intelligence, and organizational integration of AI systems.

Level 1: Data-driven analytics systems

At this foundational level, enterprises rely on descriptive and diagnostic analytics to support managerial decision-making. Artificial intelligence is limited to statistical modeling, reporting dashboards, and historical data interpretation. Human actors retain full control over all decisions, and AI has no generative or autonomous capability.

This level corresponds to traditional marketing systems where data is used retrospectively to explain performance rather than proactively to shape outcomes.

Level 2: Predictive intelligence systems

At this stage, organizations implement machine learning models to forecast outcomes such as customer behavior, demand patterns, or campaign performance. AI begins to support decision-making by generating probabilistic predictions.

The Unilever case corresponds strongly to this level, where AI is used for segmentation, media optimization, and performance forecasting. However, AI remains strictly advisory, and humans maintain decision authority.

Level 3: Generative augmentation systems

At Level 3, AI transitions from predictive support to generative capability, enabling the creation of content, ideas, and strategic alternatives. Large language models and generative AI systems actively participate in marketing ideation, content creation, and scenario generation.

The Coca-Cola case is representative of this stage, where AI generates campaign concepts, advertising copy, and creative variations. However, these outputs remain subject to human evaluation and selection.

This stage marks the beginning of creative intelligence augmentation, where AI expands the solution space rather than simply predicting outcomes.

Level 4: Semi-agentic optimization systems

At this level, AI systems begin to participate in decision orchestration and optimization. They not only generate alternatives but also evaluate and rank them based on performance metrics such as ROI, engagement, or conversion probability. Feedback loops become operational, allowing AI systems to learn from real-world outcomes and refine future recommendations. However, human governance remains mandatory for final decisions.

Both Coca-Cola and Unilever partially operate within this level through performance feedback systems and automated optimization tools.

Level 5: Human-centered agentic enterprises

This is the most advanced stage of maturity, where AI systems operate as semi-autonomous agents embedded across enterprise workflows, including marketing,

operations, and strategy. AI systems continuously generate, evaluate, and execute decisions within predefined governance constraints.

However, unlike fully autonomous AI organizations, this model emphasizes human-centered control as a permanent governance layer, ensuring ethical alignment, regulatory compliance, and strategic accountability.

At this level, enterprises function as hybrid intelligence ecosystems, where humans define goals and constraints, while AI agents execute large portions of operational and cognitive work.

Key Insight of the Model

The AEMM suggests that enterprise AI evolution is not a binary shift from human to machine autonomy, but rather a progressive redistribution of cognitive work between humans and AI agents.

The most critical insight is that even at advanced maturity levels, human governance does not disappear but becomes more strategic rather than operational.

7.6 Theoretical implications for agentic enterprise design

The proposed model contributes to emerging literature on agentic enterprises in three ways.

First, it provides a structured maturity pathway that explains how organizations evolve from analytics-based systems toward agentic ecosystems.

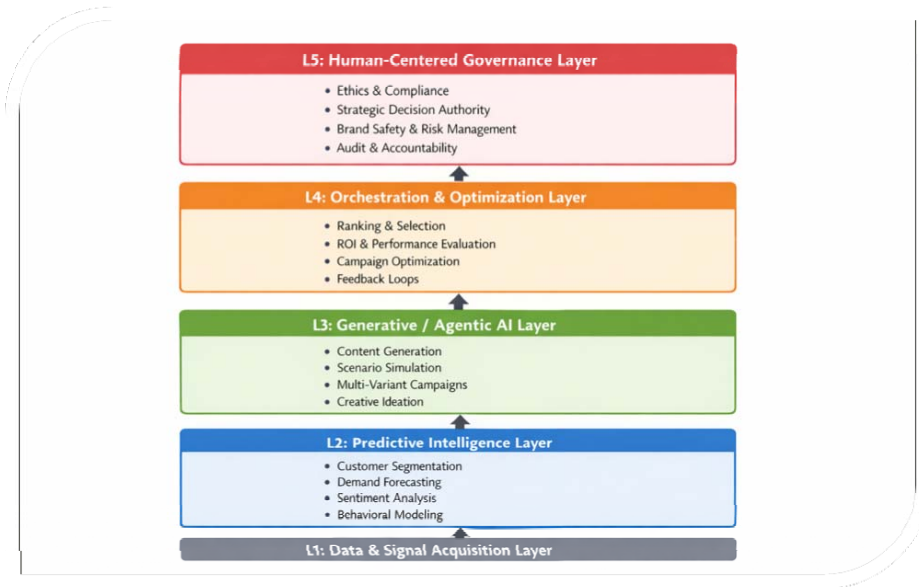
Second, it integrates both generative AI (Coca-Cola) and predictive AI (Unilever) into a unified framework, demonstrating that agentic enterprises are not defined by a single technology but by the integration of multiple AI capabilities.

Third, it reinforces the importance of human-centered governance as a non-reducible layer in enterprise AI systems, supporting arguments that full autonomy is neither practically nor ethically desirable in high-stakes organizational environments.

7.7 Conceptual model: agentic enterprise architecture

The Agentic Enterprise Architecture proposed in this paper is based on a layered intelligence structure integrating data, generative AI, optimization mechanisms, and human governance.

Figure no 10. Agentic Enterprise Architecture illustrating the layered transition from data acquisition to human-centered governance in AI-driven enterprise systems



Source: made by authors

The proposed *Agentic Enterprise Architecture* represents a hierarchical and multi-layered intelligence system that integrates data acquisition, predictive analytics, generative AI, optimization mechanisms, and human governance into a unified decision-making framework.

The architecture begins with the **Data & Signal Layer**, where heterogeneous data sources are continuously collected from consumer interactions, market environments, and digital platforms. These data inputs form the foundational substrate for enterprise intelligence systems.

The **Predictive Intelligence Layer** transforms raw data into structured insights using machine learning techniques, enabling forecasting of consumer behavior, segmentation of customer groups, and analysis of sentiment dynamics. This layer represents the transition from descriptive analytics to predictive decision support.

The **Generative AI Layer** introduces agentic capabilities into enterprise systems by enabling the automatic creation of marketing content, campaign

variations, and strategic alternatives. Unlike traditional AI systems, this layer actively participates in the expansion of the decision space through generative mechanisms.

The **Orchestration and Optimization Layer** evaluates and ranks AI-generated outputs based on predefined performance indicators such as engagement rate, conversion probability, and return on investment. This layer also integrates feedback loops, ensuring continuous system adaptation and learning over time.

At the highest level, the **Human-Centered Governance Layer** ensures ethical alignment, regulatory compliance, and strategic oversight. Human decision-makers retain final authority over all critical decisions, ensuring accountability and mitigating risks associated with automation bias, hallucinations, and algorithmic unfairness.

Overall, the architecture reflects a hybrid intelligence paradigm, where AI systems progressively assume generative and optimization roles, while humans maintain governance and strategic control. This structure is characteristic of emerging semi-agentic enterprises, which represent an intermediate stage in the evolution toward fully integrated AI-driven organizations.

7.8 Risks, limitations, and governance challenges in agentic enterprises

Despite the strategic advantages of agentic AI systems, their adoption introduces several critical risks and limitations that must be addressed through robust governance frameworks.

First, algorithmic bias and fairness risks remain a major concern. AI systems trained on historical data may reinforce existing inequalities in customer segmentation, targeting, and personalization. As Davenport et al. (2020) highlight, biased data inputs can lead to systematically unfair marketing outcomes if not actively monitored and corrected.

Second, lack of explainability and transparency poses challenges for decision accountability. As generative and agentic systems become more complex, it becomes increasingly difficult to trace how specific outputs or recommendations are produced. This reduces organizational interpretability and may limit regulatory compliance in certain industries.

Third, brand safety and reputational risks are particularly relevant for consumer-facing companies such as Coca-Cola. Generative AI systems may produce content that is inconsistent with brand identity or culturally inappropriate if not properly constrained by governance layers.

Fourth, over-automation risk may lead to excessive reliance on AI systems, potentially reducing human strategic oversight and critical thinking capabilities within organizations. This creates a long-term dependency on machine-generated recommendations.

Finally, data governance and privacy concerns emerge as enterprises integrate large-scale consumer data into AI systems. Ensuring compliance with regulations such as GDPR becomes essential, particularly in global operations.

Therefore, the evolution toward agentic enterprises must be accompanied by strong human-centered governance mechanisms, including auditability, transparency frameworks, and ethical AI policies.

7.9 Future research directions

The emergence of agentic enterprises opens several important avenues for future academic research.

First, further studies are needed to develop quantitative maturity models that measure the degree of autonomy and intelligence in enterprise AI systems. The proposed AEMM model in this paper provides a conceptual foundation but requires empirical validation across industries.

Second, future research should explore the organizational impact of hybrid intelligence systems, particularly how decision authority is redistributed between humans and AI agents in real-world enterprises.

Third, there is a need for deeper investigation into AI governance architectures, especially mechanisms that ensure accountability, transparency, and fairness in semi-autonomous systems.

Fourth, researchers should examine the economic impact of agentic AI adoption, including productivity gains, cost reduction, and changes in organizational structure and labor demand.

Finally, future work should analyze the transition from semi-agentic systems to fully autonomous enterprises, although such a transition raises significant ethical and regulatory questions that remain unresolved.

8. Discussion

The emergence of agentic enterprises represents a fundamental transformation in how organizations design, deploy, and govern artificial intelligence systems. Unlike traditional data-driven enterprises, where decision-making is primarily based on historical data analytics and descriptive or predictive models, agentic enterprises introduce a higher degree of autonomy, where AI systems actively

participate in generating, evaluating, and optimizing decisions. This shift reflects not only a technological evolution but also a structural reconfiguration of organizational logic, moving from reactive analytics to proactive and generative intelligence systems.

One of the key benefits of agentic enterprises is the significant increase in operational efficiency and scalability. Autonomous AI systems can process large volumes of data in real time, generate multiple decision alternatives, and optimize outcomes based on predefined performance metrics. This capability is particularly evident in domains such as marketing, supply chain management, and financial forecasting, where rapid decision cycles are essential. As demonstrated in prior research, AI-driven automation can improve productivity and reduce operational costs while enhancing decision accuracy (Davenport & Ronanki, 2018; Brynjolfsson et al., 2021).

However, the transition toward agentic systems also introduces substantial risks and limitations. One of the primary concerns is algorithmic bias, which may arise from biased training data or poorly designed optimization objectives. Such biases can lead to unfair or discriminatory outcomes, particularly in customer segmentation, credit scoring, or automated hiring systems. In addition, the increasing autonomy of AI systems raises concerns regarding transparency and explainability, as complex machine learning models often operate as “black boxes,” making it difficult for human stakeholders to fully understand decision rationales (Rai, 2020).

Another critical limitation relates to governance and regulatory readiness. Most existing regulatory frameworks are still designed for human-centric decision-making processes and are not fully equipped to handle autonomous or semi-autonomous AI systems. This creates a governance gap where organizations may struggle to ensure compliance with ethical standards, data protection laws, and accountability requirements. Furthermore, excessive reliance on AI systems may lead to automation bias, where human decision-makers over-trust algorithmic outputs, potentially reducing critical oversight.

From a strategic perspective, the successful implementation of agentic enterprises requires a balanced integration of autonomy and control. Organizations must develop hybrid governance models in which AI systems are allowed to operate within clearly defined boundaries, while humans retain final decision authority. This ensures that efficiency gains do not compromise ethical responsibility or organizational values. Consequently, human-centered AI

governance becomes a critical enabler of sustainable AI adoption, ensuring alignment between technological innovation and societal expectations.

Overall, while agentic enterprises offer transformative potential in terms of performance and innovation, they also necessitate robust ethical, regulatory, and organizational safeguards. The long-term success of such systems depends on the ability of enterprises to harmonize automation with accountability, and intelligence with responsibility.

9. Conclusion

This paper has examined the evolution of enterprises in the context of increasingly autonomous artificial intelligence systems, highlighting the transition from traditional data-driven operations to value-driven, human-centered AI governance models. The concept of agentic enterprises has been introduced as an emerging organizational paradigm in which AI systems actively participate in decision-making processes, generating, optimizing, and executing strategic and operational actions.

The findings of this study emphasize that while data-driven approaches have significantly improved organizational efficiency over the past decade, they are insufficient in addressing the ethical, social, and governance challenges posed by advanced AI systems. In contrast, value-driven frameworks integrate ethical principles such as fairness, transparency, and accountability directly into AI decision-making processes, ensuring alignment with both organizational objectives and societal expectations.

The proposed discussion highlights that the successful implementation of agentic enterprises requires a hybrid governance architecture in which human oversight remains central. Human-centered AI governance ensures that despite increasing levels of automation, final accountability and strategic direction remain under human control. This balance is essential for mitigating risks such as algorithmic bias, lack of transparency, and regulatory non-compliance.

From a managerial perspective, organizations must invest in governance structures, AI literacy, and ethical frameworks to effectively manage autonomous systems. Future research should focus on developing standardized metrics for evaluating AI autonomy, ethical performance indicators, and cross-industry governance frameworks that can support scalable and responsible AI adoption.

In conclusion, agentic enterprises represent a significant step forward in the evolution of digital organizations. However, their long-term sustainability depends not only on technological advancement but also on the integration of ethical

governance mechanisms that ensure responsible innovation. The future of enterprise AI lies in achieving a balance between automation, value alignment, and human-centered control, thereby enabling organizations to harness the full potential of artificial intelligence while maintaining trust and accountability in an increasingly complex digital ecosystem.

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MAINTENANCE 4.0 IN THE CONTEMPORARY INDUSTRIAL ECOSYSTEM. ECONOMIC ANALYSIS FROM A DIGITAL OPTIMIZATION PERSPECTIVE. INDUSTRIAL RISK ANALYSIS AND ASSESSMENT MODELS

Gino FONTANA¹, Mario FONTANA²

¹ **S.S.M.L - Scuola Superiore Per Mediatori Linguistici "Teseo" Salerno-
 Institute TESEO, Corso Umberto I, 16, 84099 San Cipriano Picentino
 Salerno, Italy, Phone: +39 089 202 7721, E-mail: sl.gf@libero.it**

² **Ministry of Education and Merit, Viale Trastevere, 76/A
 00153 Rome, Italy, Telephone (Switchboard): (+39) 06 58491;
 E-mail: drmariofontana@icloud.com**

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Abstract

This paper examines the evolution of the contemporary industrial ecosystem through the lens of Industry 4.0, with particular emphasis on the digital transformation of maintenance processes and their economic, organizational, and safety-related implications. Through a systematic review of scientific, technical, and regulatory literature published between 2019 and 2024, the study reconstructs the main theoretical frameworks and application models associated with enabling technologies such as the Internet of Things, big data analytics, artificial intelligence, and digital twins, highlighting their role in asset lifecycle management. The analysis is based on a selected corpus of peer-reviewed articles, industrial reports, and international standards, structured according to a qualitative, descriptive approach with an economic-interpretative orientation. The findings indicate that Maintenance 4.0 represents a strategic lever for economic optimization, capable of reducing

operating costs, improving equipment efficiency, and increasing return on investment through predictive and prescriptive models. At the same time, the results underscore the need to integrate these solutions with advanced industrial risk management and cybersecurity frameworks in order to safeguard the economic value generated by digitalization and ensure operational continuity. Furthermore, the study highlights the central role of human capital and continuous training as complementary factors to technology, in line with the human centric principles of Industry 5.0.

Keywords: industry 4.0, maintenance 4.0, digital transformation, industrial economics, asset management, risk management.

JEL Classification: L60; L23; O33; D24; M11

** The paragraphs 1,2,3,4 were written by dott.Mario Fontana and parahraps 5,6,7,8 were written by Avv.Gino Fontana PhD. The paragraphs 9,10, abstract and bibliography were created by both authors.*

1. Introduction

When we talk about Industry 4.0, although certainly a relatively recent term, we essentially refer to the ideologically representative fourth industrial revolution, which essentially unveiled a series of technological developments related to automation and connectivity. Technological progress, and therefore digital advancement, has triggered a paradigm shift in production, organizational, and consumption models, transforming the entire value chain both socially and economically. The term “Industry 4.0” was born precisely in 2011 within the German government program called *High Tech Strategy 2020* where the concept of smart factories based on networks of cyber-physical systems capable of self-configuring, connecting and adapting production in real time according to demand began to be systematized, including the re-determination of energy efficiency and the optimal use of resources. The design principles identifiable thanks to the contribution of Hermann et al. (2016) are 6: interoperability, virtualization, decentralization, real-time capability, service orientation and modularity. In practice, everything is materialized by means of a core of enabling technologies whose combined use allows the transition from mass production to “customized” production characterized by small batches and high variability (Hermann et al., 2016). Therefore, the adoption of this paradigm is supported by various national

plans for technological and business development, following the German one *from the beginning*.

In Italy, for example, with the National Industry 4.0 Plan (2017-2020), it was possible to mobilize significant funds, over 18 billion euros, and tax incentives (super-depreciation and R&D tax credits), in order to strengthen the competitiveness of the manufacturing sector, mostly made up of SMEs (Ministry of Economic Development, 2017). Similarly, in France with *Indutriedufutur* and in the United Kingdom with *CatapultHighvalue manufacturing*, the cutting-edge Industry 4.0 sector has outlined an ecosystem that, although differentiated by local needs, nevertheless tends overall towards an industrial structure oriented towards technology in its various meanings, to the point of introducing the concept of "Industry 5.0", based more on sustainability within the framework of the concept of resilience and more *human centric* (Short et al., 2021). The worker becomes central as he is understood as a co-creator in the "socio-technical" system. Digital transformation therefore requires rethinking *business progress management* as a methodological infrastructure capable of integrating, in addition to static flow mapping, real-time data from cyber-physical systems (*shop-floor data*) and *analytics* platforms.

A recent systematic review highlights how new-generation BPM solutions incorporate *process engines mining* and predictive models that enable the transition from simple *process compliance* with adaptive process management, with reduced decision-making cycles and a drastic reduction in performance deviations (Khider et al., 2025). From a design perspective, the BPMN 2.0 standard remains the reference tool for modelling, but is enriched by semantic extensions dedicated to quality, safety and sustainability parameters, allowing events from IoT sensors and automatic intervention triggers on the production line to be made explicit within the model. It's clear that inherent in the concept of Industry 4.0, both theoretically and practically, is a central paradigm: technological transformation of the entire system. This transformation isn't limited to mere process improvement, but encompasses the entire ecosystem, i.e., its social, environmental, and economic impact. This transformation involves not just macro-areas but all interconnected variables, such as recycling, physical assets, people, and information systems. This includes the need to train a specialized "working class" capable of keeping pace with the times, not only in terms of professional development but also as a vehicle for information for a new era geared toward this new type of digital industrialization.

2.Type of study and research method

This article is based on qualitative-descriptive research , structured primarily through a systematic analysis of relevant scientific and technical-regulatory literature. In particular, a *desk research methodology* was adopted to critically reconstruct the state of the art in Industry 4.0, digital maintenance, enabling technologies, and industrial risk analysis and management models. Sources were selected through a targeted consultation of international scientific databases (including Scopus, Web of Science and Google Scholar), institutional and industry reports (Deloitte, ENISA, OECD, Business Insider), as well as technical and regulatory standards issued by internationally recognized bodies (ISO, IEC, EN). Peer-reviewed academic contributions, systematic reviews, and white papers were included. papers and regulatory guidelines, favoring recent and authoritative publications capable of guaranteeing scientific reliability and conceptual updating.

The search strings were constructed by combining Boolean operators and keywords relevant to the domain of investigation; among the main ones are:

“ *Industry 4.0* ” AND “ *digital maintenance* ” ,
 “ *predictive maintenance* ” AND “ *big data analytics* ” ,
 “ *industrial risk assessment* ” AND “ *ISO 45001* ” ,
 “ *cyber-physical systems* ” AND “ *manufacturing* ” ,
 “ *asset management* ” AND “ *ISO 55000* ” ,
 “ *IoT* ” AND “ *smart factory* ” AND “ *risk management* ” .

The application of these search strings returned a total of 1,250 contributions in the period considered. Following an initial *screening phase* based on title and abstract, 420 articles deemed relevant to the research objectives were selected. Subsequently, through more stringent inclusion criteria, such as thematic relevance, methodological quality, indexing in peer-reviewed journals, and consistency with the European industrial context, the corpus of analysis was further reduced to 160 sources, including scientific articles, systematic reviews, technical reports, and regulatory documents. The analysis of the selected materials was conducted through a critical and comparative reading, supported by thematic classification and concept mapping tools, aimed at organizing the contributions according to macro-analytical areas (digital transformation of processes, maintenance 4.0, big data analytics, OT cybersecurity, sustainability, and industrial risk assessment). This process allowed us to identify theoretical convergences, emerging trends, recurring quantitative results, and key application criticalities, enabling the construction of a unified and multidimensional interpretative framework of the

contemporary industrial ecosystem, consistent with the article's analytical and argumentative objectives.

3. Digital transformation of maintenance: concepts and operating practices

The digital transformation of maintenance is manifesting itself as a profound metamorphosis, in which the old "fail and fix" logic is gradually giving way to a predictive and prescriptive model supported by intelligent sensors, advanced *data analytics*, and digital twins. *The* algorithmic data processing that powers neural network systems finds application in the industry *in question* and is capable of "predicting" and anticipating maintenance-related events and potential system *faults* . *However, it must be considered that although the machine Learning* represents a huge business and competitive advantage over other industry players who may adopt less efficient AI systems. These systems can create biases or errors that can create problems and misinterpret data depending on the rules set and the data used for training. In fact, anomalies directly related to poor training data or "poisoned data sets" that can train algorithms according to misleading logic cannot be ruled out.

On this last point, the *machine Learning*, or machine learning, can be divided into supervised and unsupervised, as well as *reinforced learning*. *Clustering is also mentioned* , an algorithm that takes an uncatalogued data set as input and returns it in a class-ordered format based on the similarity of the input data. Clustering *can be top-down or bottom-up* . Specifically, the former can be said to be divisive, while the latter is aggregative. Aggregation can also refer to a data sample—a cluster in itself. Furthermore, clustering techniques can be distinguished based on whether or not a sample can be assigned to multiple clusters.

The functional definition provided by EN 13306 – which identifies maintenance as a coordinated set of technical, administrative, and management actions throughout the asset 's life cycle – is now reinterpreted in light of the value creation principles set out in ISO 55000:2024, according to which *asset* management is an integral part of the strategy and no longer a mere support activity.

The integration of IoT devices and *edge -cloud* networks enables condition information to be converted into reliable remaining life (RUL) predictions, generating automatic work orders in CMMS/EAM systems and synchronizing spare parts procurement with actual demand.

The market, valued at \$5.5 billion in 2022 and expected to grow by double digits to exceed \$1.69 billion annually in the AI- -based segment alone between 2025 and 2030, demonstrates the rapid spread of solutions that promise reductions

in unplanned downtime of more than 50% and maintenance cost savings of between 10% and 40%. Key application cases – such as the use of Gecko inspection robots Robotics at Siemens Energy or Aquant 's AI platforms at Coca-Cola plants—illustrate how the integration of sensorization (in the sense of systems), artificial intelligence, and robotics allows for the monitoring of critical assets while reducing risk to human operators. Nor should the cultural dimension be overlooked: Deloitte 2025 surveys on *smart manufacturing* report that over 78% of companies allocate more than 20% of their improvement budgets to digital maintenance initiatives, recognizing workforce *upskilling and -cybersecurity* as essential enabling factors.

Within this framework, maintenance is evolving from a cost center to a strategic lever for resilience and competitiveness, with digital twins and continuous learning algorithms fueling cycles of *continuous improvement* where safety, sustainability, and efficiency converge in a unified vision of a safe and smart enterprise, or at least one tending to become so. Furthermore, socio-organizational aspects must also be evaluated as they are crucial to the success of Industry 4.0.

Business Insider 2025 Report emphasizes two critical factors: the availability of *data- -driven skills* and *-OT cybersecurity*, the latter essential for preserving the integrity of the condition data that feeds predictive algorithms. It follows that the digital transformation of maintenance cannot be reduced to an IT project: it requires a redesign of *governance processes* , *advanced competency models* and, *above all, a corporate culture that recognizes maintenance as an "orchestrator" of safety, efficiency and innovation throughout the entire asset lifecycle.*

4. Technologies enablers : *Internet of Things, Big data analytics*

Contemporary companies defined as digital or at least partly *digital oriented 4.0* leverage the so-called enabling technologies, which are now essential to keep up with the times where services and production sectors must necessarily evolve and respond to market needs. As regards the technologies most representative of this evolution, we mention the IoT (*Internet of Things*) Things), robots and cobots, and big data. We often hear about big data, which represents a set of raw data from which specific data can be extracted depending on its use and ultimate purpose. For example, customer profiling based on the "formal" data entered into systems, banking data, consumption data, and the like are mentioned. It must be said, however, that on the user side—citizens—often disclose a series of data via the internet, even involuntarily or with little attention to sensitive data. This provides companies with a database from which they can generate estimates and market

projections, even targeting advertising . However, a series of issues related to data privacy are discussed here.

From the business perspective, big data is certainly useful for performing the analyses mentioned above, but also for solving problems related to production systems, such as predicting calculation errors, thus supporting projects with greater accuracy (Kaliraj & Thirupathi, 2022). The use of big data can be divided into three main phases:

- Acquisition (data obtained from consumers through registration or monitoring or from third parties);
- Analysis (data is stored and processed in order to create inferences and hypotheses);
- Application (the created models are applied to individuals through various forms of influence or “ targeting ”).

Beyond the traditional subdivision, *big data analytics* also translates into the creation of new data by recognizing patterns that may be present in the accumulation of data during the acquisition phase itself. With the advancement of technology, technocracy, and corporate data hunger, the concept of a simple algorithm has been superseded by the possibility of creating neural networks, where individual algorithmic units combine to produce an output that can, in turn, be projected into the next state, almost like human synaptic processing (Fontana & Barbuzzi, 2025).

Given the complexity of data processing using human neural networks, machine-level, and therefore artificial, reproduction still has a long way to go. It goes without saying that some models, and therefore decisions, are also the result of the acquisition of sensitive or ethically incorrect data, such as ethnicity, sexual orientation, religion, gender, etc. Sometimes, in fact, interpreting the data itself becomes complex, requiring truly intense effort for the decision-making processes themselves.

Some AI experts believe that sometimes it's truly impossible to understand results unless the threat of discrimination is defused or becomes more opaque. The very bias of *ad hoc algorithms* inevitably produces distorted or inaccurate output in some circumstances (Jagatheesaperumal et al., 2021). The inherent human bias, translated and infused into supervised or semi-supervised algorithms, carries within it a source of bias that, under certain conditions, could affect certain categories of people, populations, or entire geographic areas. For example, Amazon, although this discrimination is indirect, has decided not to provide its same-day delivery

service in predominantly Black neighborhoods, based on predictive algorithms that target data by postal code.

Given that *big data analytics* offers enormous potential for personalizing online environments, it could also help mitigate discrimination by filtering out special categories of data, implementing ad hoc measures by calculating how closely data points correlate with a specific attribute. Some researchers are experimenting with autonomous negotiation algorithms capable of balancing privacy concerns with the customer's willingness to accept a higher price or reduced convenience. Meanwhile, in synergy with the entire ICT sector, *cloud computing has developed*, or the set of technologies that allow data to be stored, archived and processed thanks to the use of hardware and software resources distributed over the network, thus providing a response to the growing demand for computing resources with high storage and computing power (Buyya et al., 2011). Among the advantages is low management costs, as companies no longer need to purchase expensive software or top-of-the-line hardware, as both physical and software resources are delocalized in the *cloud* and available 24/7. Data security is also maintained thanks to continuous *backup technologies*, allowing any anomalies to be restored as quickly as possible, while also taking into account the potential for hacker attacks.

The term IoT refers to a set of technologies with their own digital identity. Specifically, it refers to sensors and devices capable of communicating with each other and with third-party devices. The sectors most affected by IoT are *smart factories*, which, thanks to intelligent networks based on codes, management systems, and databases, are able to communicate and maximize certain repetitive actions applicable in the fields of logistics, home automation, and telemedicine (Soori et al., 2023). To give you an idea, smartwatches and GPS devices belong to the IoT category, capable of transmitting data to similarly sized processing centers or artificial neural networks. IoT also plays a key role in the field of virtual reality, where users, thanks to wearable devices such as glasses, visors, or clothing, can communicate data to processors and simultaneously receive output, whether related to augmented reality or cyber-physical systems. In the economic context of businesses, this technology can enable a new way of doing business through *user-friendly interfaces* for both sales and business management.

Along with the technologies mentioned above, "collaborative robotics" (Cobots) are already a step forward compared to the traditional robotics used until the last decade. Indeed, new-generation robots can access the Internet and the corporate intranet or cloud and perform highly complex tasks, as well as being capable of

self-learning (Vicentini, 2017). These machines (robots) are able to interact with humans in the workplace, capture their commands, and even interpret their facial expressions, thus determining their emotions. The topic of collaborative robots is becoming increasingly widespread in Europe and in Italy, especially among companies that have decided to return home after a period of production focused on delocalization. This is known as *back reshoring*, or the return of production to Italy, supported by powerful robotic technology capable of reducing production costs that were previously impossible, while maintaining quality standards. A concrete example is Benetton, which recently invested in 36 hi-tech (Japanese) non-stop robots (an investment of approximately 2 million euros).

Other major Italian companies, such as Electrolux, Number 1, Arper, and Costampress, have also invested in the sector, even increasing the number of employees rather than reducing them (Vallin, 2016). The theoretically predicted inversely proportional trend in employment has in fact stalled, at least in some sectors, as collaborative robots are not capable of replacing human workers. However, they are capable of opening up new avenues in new sectors, especially manufacturing, a market that is certainly very austere and deep due to Asian competitors. In fact, collaborative robots were created with the aim of freeing humans from physically demanding tasks, reducing the physical consequences and potential health-related damage.

Execution System), PLM (Product Lifecycle Management) systems. Lifecycle Management), SCM (Supply Chain Management), CRM (Customer Relationship Management), design and use of RFID and *barcode* tracking technologies (Mourtzis, 2020). Furthermore, e-commerce systems, mobile payment, geo-localization and all integrated systems applied to process automation.

5. Implementation criticalities and strategic perspectives for the company

Widespread adoption of enabling Industry 4.0 technologies – IoT sensors, *big data* platforms *analytics*, collaborative robotics, MES systems integrated with ERP and PLM – cannot be a merely technical operation: it is in fact a complex organizational transformation process, fraught with critical issues that simultaneously affect the technological, economic- -financial and, last but not least, the socio-cultural dimension of the company.

From a technological perspective, the primary barrier is interoperability between heterogeneous systems: often isolated legacy architectures must communicate with low-latency edge cloud platforms, while the standardization of data and industrial ontologies remains incomplete. Recent studies of manufacturing

SMEs highlight that the lack of a "coherent digital thread" is among the three most significant obstacles to adoption, along with a lack of internal expertise and uncertainty about the economic return on investment (Li, 2018).

Interoperability is accompanied by cyber vulnerability: the latest threat ENISA's Landscape 2024 documents how the manufacturing sector -is "the most frequent, high-impact victim of ransomware attacks" with direct repercussions on plant downtime and insurance costs (Theocharidou, 2021). Complying with the requirements of the NIS 2 Directive, with investments in network segmentation, identity management, and continuous surveillance, therefore becomes a strategic prerequisite, especially for those companies aiming for zero-trust certified supply chains -.

From an economic and financial point of view , the literature converges on a *-paradox* : although the success stories demonstrate *payback*- Less than twenty-four months for *predictive maintenance* or digital twin projects, the perception of investment risk remains high – particularly in mid-sized companies with low margins. Deloitte 's Manufacturing Industry Outlook 2025 finds that, despite allocating approximately 30% of the operating budget to digital technologies, *decision -makers* They struggle to select "high ROI" use cases without mature data *governance* and an adequate talent pipeline ; the *skills gap remains a major obstacle to project scalability*. Furthermore, *the skills shortage is amplified by the rapid evolution of generative AI, which requires ongoing reskilling programs to integrate explainable algorithms into factory decision-making processes* (Li, 2024).

However, these critical issues are countered by strategic perspectives that reinforce the belief that Industry 4.0—and the emerging Industry 5.0—is a competitive factor that can no longer be ignored. First and foremost, the adoption of digital maturity models and *value- -based metrics* (e.g., Total Cost of Ownership) of Ownership and ESG indicators) allows investments to be linked to corporate strategy, overcoming the logic of "pilot" projects. Secondly, the orientation towards open standards (RAMI 4.0, ISA -95, Asset Administration Shell) reduces the risk of *vendorlock -in* and creates the foundation for shared data ecosystems along the *supply chain* . Furthermore, *human- -centric* approaches are emerging – consistent with the Industry 5.0 vision – that place safety, immersive training , and workforce inclusion at the center of process design, with documented benefits in terms of engagement and productivity.

Therefore, companies aiming to evolve towards a secure and *smart industry* must undertake a multi-step process in which critical issues become leverage points for generating value: from building a robust data architecture and a NIS 2-

compliant *cyber -posture* , to defining skills development processes and technological partnerships that ensure flexibility and resilience in the medium -to long term.

6. Integrating Maintenance 4.0 and sustainability: economic, environmental, and social dimension

Starting from the assumption that maintenance in the company represents an important variable in terms of cost and considering that the life cycle of the machinery also represents a dominant factor that weighs on company finances, technological evolution has in fact brought about improvements by postponing the expenditure on replacement capital, reducing the need for spare parts with positive effects on the TCO (Total Cost of Ownership). of Ownership). Predictive analysis on the maintenance of company assets (machinery) has generally led to savings with a reduction in costs quantified at 25% (Karuppiiah et al., 2021).

On the environmental side, digital maintenance supports the decoupling strategy between industrial growth and ecological impact: the extension of the useful life of the equipment, the reduction of energy consumption for start-ups and repair interventions, as well as the scheduled replacement of the most energy-intensive components contribute to reducing CO₂ emissions by up to 15% along the product life cycle, as highlighted by Life -Cycle Assessment analyses conducted in the manufacturing sector (Agrawal et al., 2025). The same circular economy logic is strengthened by PLM platforms integrated with digital twins, which provide usage and consumption data essential for *remanufacturing* and *product- -as-a-service strategies* , in line with the objectives of the 2030 Agenda (SDG 9 and SDG 12) and with the *Industry 5.0 paradigm* aimed at a sustainable and resilient industry.

Regarding the social dimension, it is possible to outline some main guidelines. The first concerns the reduction of corrective operations on plants, limiting risky situations in the workplace on automated process lines. Secondly, thanks to robots and graphical interface platforms as well as remote support, it has been possible to increase workplace satisfaction rates, as employees are not relegated to frustrating tasks (Blandino & Montagna, 2025). Furthermore, the ecological footprint of new-generation companies benefits the manufacturing sector and beyond, where employees and investors can be more satisfied with environmental issues and the impact on younger generations.

7.The role of training and cultural change in the transition to maintenance

With the change in work dynamics and the underlying ideology, it seems obvious that the transition to Industry 4.0, and hence maintenance, must shift the center of gravity towards a redesign of the workflows and decision-making mechanisms underlying the *supply chain*, quality and safety.

Staff training, not only in terms of operations but also in terms of a digital approach, appears to be so important that the maintenance process can be mapped as a true *digital thread*. The execution of physical tasks is liberated and projected towards extra-cyclical activities, i.e., activities outside of the mere routine task, but the operator becomes a functional link (digitally competent) and an integral part of the chain. The change is therefore also cultural, a true process requirement in compliance with the logic of the *business process. Re-engineering*. The specialized worker becomes part of a corporate *momentum* where it is not the simple manual operation that makes the difference, but rather the cutting-edge approach capable of advancing both the process itself and the company as a whole. In terms of *governance*, Maintenance 4.0 pushes towards dynamic RACI models: traditional roles (*planner*, *maintenance technician*, *quality inspector*) are hybridized with digital " *process owner* " profiles (*data reliability engineer*, *cyber -OT specialist*) whose responsibility is explained in the process diagrams and *controls matrix* published in the portal (Petrin et al., 2025). This clarity empowers teams, speeds up approvals, and, above all, highlights the data culture as a shared asset. Finally, the integration of training and -processes promotes the measurability of human capital aligned with ESG objectives: indicators such as *training -lead time* The percentage of tasks performed in AR enters the company's *balanced scorecards*, along with *downtime* and maintenance costs. Thus, cultural change is no longer an intangible factor, but a *driver* of process *performance*, monitored and improved with the same discipline applied to costs, quality, and service.

8.Industrial risk analysis and assessment models

Modern integrated management of production risks requires a continuous analytical process that, starting from a preliminary hazard assessment, evolves through a scalable sequence of methodological models: first- level qualitative checks— -compliance checklists, What -Ifs, and HAZIDs—allow for an initial mapping that is then further explored using the structured techniques codified in IEC 31010:2019, including HAZOP (IEC 61882:2016), PHA, and SWIFT, which systematically identify process deviations.

To proceed with the investigation of the failure modes and their consequences, we resort to FMEA/FMECA («IEC 60812:2018»), FTA and ETA, whose logical -deductive approach makes it possible to quantify the probability of the apex event and to know the effectiveness of the barriers; the decision-making phase is then supported by semi-quantitative tools – risk-probability matrices, LOPA (Center for Chemical Process Safety , 2015) and Bow -Tie Analyses that allow for the calibration of time and analytical rigor, while for plants subject to major accident hazards, the Quantitative Risk Assessment , inspired by the " Purple Book CPR 18E" guidelines , provides consequence frequency curves -, isorisk maps, and fN indicators essential for comparison with acceptability criteria. All outputs flow into the Occupational Health and Safety Management Systems (ISO 45001:2018) and, where required, into the Safety Instrumented Standards. Systems governed by «IEC 61511:2016», where Safety Integrity Level transforms risk tolerability into probabilistic requirements for failure on demand; finally, the analytical model integrates perspectives from cognitive ergonomics and human reliability through HEART, THERP, and Hollnagel 's Safety -II approach , recognizing that organizational resilience and the involvement of human capital constitute the true frontier of risk *governance* oriented not only toward protecting *assets* but, above all, toward safeguarding the lives and well-being of the people who work within the industrial system.

In an increasingly interconnected and digitalized industrial context, the methodological sequence outlined above is now expanding along three complementary lines. First, the adoption of the Risk- -Based Model Process Safety of the Center for Chemical Process Safety, structured on the four pillars “Commitment, Understanding, Managing, Learning”, which integrates HAZOP, LOPA and QRA analyses into a management system capable of strategically connecting technical performance, *governance* and safety culture (Jordan, 2023). Secondly, the evolution of Quantitative Risk Assessment towards revised guidelines (2021 edition of the Purple Book of the Norwegian authority DSB), which incorporate domino scenarios, multi-source vulnerabilities and acceptability criteria harmonized with the Seveso III requirements (Risan et al., 2021).

Finally, the transition from pure prevention to operational resilience, which combines the Safety -II perspective centered on positive performance variability and measured through Hollnagel 's Resilience Assessment Grid with Dynamic Risk Assessment tools based on digital twins capable of fusing real-time field data and predictive simulation models, anticipating critical deviations and optimizing maintenance controlled by *machine logic. learning* (Hollnagel, 2017). The

innovations *in question* are connected to the international policies on Natech risk management developed by OECD and JRC, which extend the hazard analysis to the impacts of extreme natural events on plants at risk of major accidents, prescribing business continuity and *multi-site* emergency management plans (Krausmann et al., 2016). All the results flow into the Occupational Health and Safety Management Systems compliant with ISO 45001:2018, whose *framework*—consistent with ISO 31000—formalizes the connection between risk assessment, human capital protection, and corporate sustainability ESG objectives (BSI, 2018).

9. Digital tools for operational safety and personnel protection

With the technological revolution that has taken place in the industrial sector, the "portfolio" of tools capable of synergistically enhancing operational safety and personnel protection has also been enriched. *Digital twins are intelligent wearable devices* capable of monitoring physiological parameters, posture, and exposure to harmful agents, activating real-time alarms so operators can initiate emergency measures. Similarly, drones and mobile robots (recently humanoid) move between aisles and production departments, monitoring both production operations and the workers themselves, warning them of hazards or performing tasks on their behalf. *Safe analytics algorithms* can generate prognostic models that anticipate failures and accidents, thus increasing the safety of the entire workforce. ISO/IEC 23894:2023 is a good example of this, integrating the *risk management requirements* of ISO 31000 with principles of algorithmic transparency and *bias mitigation*, ensuring that automated decisions remain reliable and respectful of human capital.

Workplace risk analysis appears less frightening in this digital age, as intelligent platforms integrated with AI can analyze multiple variables and develop highly accurate prevention plans. These software programs can take into account, for example, production units, employees, the condition of goods, and risk areas, and their inherent algorithmic structure can pinpoint the key areas requiring intervention. This type of algorithmic analysis obviously entails costs, but while it does impact company expenses, it has a significant impact on the community, in addition to reducing the physical workload of safety personnel such as RSPPs and RLSs. The latter, however, remain key figures in safety, but they can certainly work synergistically with machines to maximize overall safety. Often, an oversight or flaw in the "company system" can arise, which is invisible at first glance and only noticeable after a few minutes or hours. Intelligent systems can anticipate events and take corrective measures immediately, subsequently reporting back via

a report or notification to the employee or shift manager. These include electronic Permit -to Work (ePTW) systems, in SaaS or on- -premise versions, which integrate risk matrices, *smart* checklists , and digital signatures, reducing document errors and speeding up multi- -level validation, with case studies showing a significant drop in accidents during maintenance (Grimm, 2024). OT IT convergence -, however, requires solid cyber resilience measures: the 2024 update of the ISA/IEC 6244321 guidelines introduces continuous improvement requirements for industrial control systems, while ISO/IEC 27001:2022 harmonizes information security with clauses dedicated to *supply-chains* and *cloud* , creating a regulatory bridge towards ESG logics and the protection of digital human capital (Laan et al., 2024).

10.Conclusions

The analysis conducted in this paper allows us to interpret the evolution of Industry 4.0 as a process of structural economic and productive transformation, in which technological innovation plays an enabling, but not exclusive, role in value creation. A critical review of the literature shows that the digitalization of industrial processes, and particularly of the maintenance function, directly impacts key business economic indicators, such as operating costs, fixed capital productivity, cash flow continuity, and return on investment (ROI).

From this perspective, Maintenance 4.0 is a tool for cost-effectively optimizing the life cycle of production assets. The adoption of predictive and prescriptive models reduces the impact of corrective maintenance costs and unplanned downtime, while simultaneously improving the Equipment Availability Index (OEE) and Total Cost of Ownership. of Ownership . Empirical evidence reported in the literature shows how these solutions can generate significant operational savings, with positive effects on industrial margins and the economic and financial stability of companies, especially in manufacturing contexts characterized by high capital intensity.

From a macroeconomic and sectoral perspective, the diffusion of enabling Industry 4.0 technologies contributes to strengthening the competitiveness of national production systems, reducing the efficiency gap compared to major international players and encouraging reshoring and back-reshoring strategies . In this context, the industrial policies and tax incentives analyzed in the literature emerge as key factors in mitigating initial investment risk, especially for small and medium-sized enterprises, which often face difficulties in accessing capital and in assessing the economic benefits of digital transformation *ex ante*.

However, the economic analysis cannot ignore the indirect costs and risks associated with the growing digitalization of production systems. Increased technological complexity and interconnection expose companies to new forms of operational and cyber risk, with potentially significant impacts in terms of economic losses, production disruptions, and reputational damage. From this perspective, the integration of advanced OT risk management and cybersecurity models is not an incidental cost, but rather a necessary investment to protect the economic value generated by digital assets and the long-term sustainability of the business model.

Another important aspect concerns the dimension of human capital, understood as a strategic production factor. The literature highlights how investments in training, upskilling, and reskilling directly impact labor productivity and a company's ability to extract value from adopted digital technologies. From this perspective, the transition to the emerging paradigms of Industry 5.0 introduces a human-centric economic perspective, in which workers are not replaced by technological capital, but complement it, contributing to the reduction of social and organizational costs and the improvement of the overall efficiency of the production system.

In conclusion, the interpretative framework outlined confirms that the digitalization of maintenance and industrial processes represents a strategic economic lever for optimizing resources, reducing costs, and creating sustainable value in the medium to long term. However, achieving these benefits requires an integrated approach that combines economic analysis, risk governance, targeted technology investments, and human capital development. In this regard, future research could explore the econometric measurement of the impacts of maintenance 4.0 on corporate performance, as well as the comparative analysis of digital investment models in different industrial contexts, contributing to a more robust cost-benefit assessment of digital transformation strategies.

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NON-FINANCIAL EMPLOYER BRANDING SYSTEMS' IMPACT ON THE PRO-SOCIAL BEHAVIOUR OF WORKFORCES

**Nnenna E. UKANDU¹, Francis E. MONYEI², Ruth E. UFOMBA³,
Wilfred I. UKPERE⁴**

**¹University of Calabar, Department of Business Management, Faculty
of Administrative and Management Sciences, P.M.B 1115, Calabar,
Cross River State, Calabar, Nigeria, Telephone: +234 705 505 4173,
E-mail: nnennaukandu@gmail.com**

**^{2,4}Department of Industrial Psychology and People Management, School
of Management, College of Business Economics, University of
Johannesburg, Corner Kingsway & University Road, Auckland Park,
South Africa. Telephone: +2348032731306, +27115592069, E-mails:
monyei_francis@yahoo.com, wiukpere@uj.ac.za**

**³Department of Management, Abia State University, Uturu, Nigeria.
Telephone: +2348170911534, E-mails: ebereufomba@gmail.com**

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Abstract

Organisations increasingly recognise that employee discretionary behaviours, commonly referred to as pro-social behaviour (PSB), play a crucial role in achieving higher performance and overall organisational effectiveness. Employee voluntary actions that go beyond official job duties, like supporting co-workers, taking initiative, and fostering a healthy work environment, are included in pro-social behaviours. The study utilised a descriptive survey research design, and a standardised questionnaires were used to gather data from 251 employees at the Cross River State Internal Revenue Service office. Out of these, 238 completed questionnaires were analysed, yielding a response rate of 94.8%. To investigate the connection

between pro-social behaviour and the non-financial employer branding systems in the workplace, data analysis was done using frequency counts, percentages, and simple linear regression. The results showed a statistically significant positive correlation between PSB and the non-financial employer branding systems. Thus, it is concluded that the implementation of a well-structured non-financial employer branding system can foster a motivated and committed workforce, ultimately driving organisational viability. While proffering that workplaces must strategically design non-financial employer branding recognition systems that include both monetary and non-monetary incentives, while ensuring continuous evaluation to maintain relevance, fairness, and effectiveness.

Keywords: recognition, rewards systems, employee citizenship behaviour, organisational effectiveness, public sector, motivation

JEL Classification: L14; L140.

1. Introduction

Non-financial employer branding, especially recognition and reward systems, has long been central to human resource management as mechanisms for motivating employees and enhancing workplace behaviours. Employees' voluntary, discretionary behaviours that do not directly relate to their jobs but yet enhance the overall success of the organisation are referred to as pro-social behaviour (Monyei & Ukpere, 2024). Al-Kahtani (2025) cites Organ's (1988) original definition of PSB, which was actions that go beyond official tasks and are not expressly recognised by formal incentive systems. Historically, early motivational theories emphasised the importance of rewards in shaping employee behaviour. Classical management and behavioural psychology rooted motivation in reinforcement and consequence systems, signalling that recognition and rewards could influence not only performance but also discretionary behaviours that benefit organisations in unplanned ways. In the foundational literature, PSB was contrasted with formal reward systems, as Organ (1988) argued that because PSBs are discretionary and not directly rewarded by formal structures, they stem from intrinsic motivation and organisational context rather than explicit rewards (as cited in Al-Kahtani, 2025). Over time, scholars began to explore how formal and informal reward mechanisms influence these voluntary behaviours. Recent empirical research confirms that effective reward systems are positively associated with PSB (Monyei, Igwe, Onyeonu, Kelvin-Iloafu & Ukpere, 2022). A comprehensive

literature review by Xia, Arshad, and Mengjiao (2024) reported that both financial and non-financial rewards significantly enhance the occurrence of PSB, emphasising that employees who perceive recognition and equitable reward practices are more likely to engage in behaviours that benefit organisational performance. When employees see their extra efforts recognised and rewarded, there is a motivational effect that encourages them to perform beyond their job descriptions. Research in educational and organisational settings in Africa supports these findings. A study among institutions of higher learning in Kabale District, Uganda, found that career development, rewards, and recognition as aspects of perceived organisational support were strongly positively correlated with PSB (r values $> .66$, $p < .01$), suggesting that employer-branding systems can foster a culture encouraging voluntary, pro-organisational behaviours (African Journal of Empirical Research, 2025). The mechanisms linking non-financial employer branding and pro-social behaviour are also explored through psychological and motivational lenses. Zhao and Yang (2022) demonstrated that verbal rewards had a beneficial impact on employees' affective commitment and psychological ownership, both of which have an impact on PSB. Although this study emphasised verbal praise rather than formal rewards, it illustrates an important pathway: when employees feel valued and recognised—whether through formal programmes or everyday positive feedback—they are more likely to engage in discretionary, pro-social behaviours. Similarly, research in Nigeria highlights the relevance of reward satisfaction. A 2024 study of non-teaching staff at Chukwuemeka Odumegwu Ojukwu University found that pay satisfaction, which represents a form of reward, was significantly positively correlated with PSB (Onwudiwe & Nwokolo, 2024). This suggests that in Nigerian work contexts, employees who perceive satisfaction with their rewards are more likely to engage in voluntary behaviours that help their institutions succeed. Across these contexts, the relationship between non-financial employer branding systems and employee civic deeds is consistently positive. As in the case of these strategies that encompass both formal organisational practices, such as salary increments, promotions, and performance appraisals, as well as non-monetary recognition, including public acknowledgement, positive verbal feedback, and awards. The pro-social behaviour of employee refers to discretionary actions undertaken without formal obligation or guarantee of reward, but that positively affect organisational functioning. Empirical research consistently demonstrates that well-designed non-financial employer branding systems are associated with higher levels of PSB across organisational and

cultural contexts (Xia et al., 2024; Zhao & Yang, 2022; Onwudiwe & Nwokolo, 2024). PSB impacts cooperation, service quality, and overall workplace climate, with voluntary behaviours being central to organisational effectiveness. In ideal organisational settings, non-financial employer branding systems are strategically aligned with organisational goals, designed to acknowledge employee efforts in ways that promote motivation, commitment, and a willingness to go the extra mile. Effective recognition practices communicate employees' value, reinforce desired behaviours, and serve as positive reinforcement that increases motivational and emotional responses among staff, nurturing conditions that support discretionary efforts and pro-organisational behaviours (Monyei et al., 2022; Yang et al., 2022). Despite the potential benefits, there remains a noticeable gap between what non-financial employer branding systems are intended to achieve and what they actually deliver in practice. Empirical studies reveal that although employee recognition is positively related to PSB, the mechanisms by which recognition translates into increased discretionary behaviours are complex and often influenced by emotional responses such as authentic pride. For instance, research exploring the relationship between employee recognition, pride, task performance, and PSB found a significant and positive effect of recognition on OCB, mediated by pride, suggesting that emotional reactions play a crucial role in turning formal recognition into actual discretionary behaviour (Yang et al., 2022). This indicates that simply having non-financial employer branding systems in place may not be sufficient; the emotional and psychological responses they trigger are also important. In many organisational environments, these systems are poorly designed, inconsistently applied, and not closely tied to the very behaviours organisations seek to encourage. Inconsistencies can make employees perceive recognition as arbitrary or biased, weakening its potential motivational effects and leaving desired behaviours like cooperation and helping behaviour insufficiently encouraged. Literature on human resource management practices indicates that when employees perceive that organisational support and recognition are lacking, the positive connection with PSB may be weakened or absent. Consequently, less effective non-financial employer branding practices can reduce employees' willingness to engage in discretionary behaviours, diminishing teamwork, organisational commitment, and overall performance. When recognition fails to generate emotional responses that support discretionary behaviours, employees may focus primarily on formal job tasks and limit their extra-role contributions, reducing organisational adaptability and

innovation over time. Research underscores that when recognition does not translate psychologically into increased motivation or affective commitment, organisations risk lower levels of PSB despite having formal recognition programmes. While non-financial employer branding systems have strong potential to influence staff civic deeds positively, the challenge lies in how these systems are structured, communicated, and experienced. If recognition does not elicit the emotional responses that support discretionary behaviours or if employees view rewards as inconsistent or unfair, the intended positive impact on PSB is undermined, ultimately affecting employee engagement, cooperation, and organisational effectiveness.

Study Objective

To investigate the impact that non-financial employer branding systems have on pro-social behaviours of workforces in the Cross River State Internal Revenue Service of Nigeria.

Understanding the Related Literature

Social Exchange Theory

A key idea in sociology and organisational psychology is the social exchange theory (SET), which describes human relationships as reciprocal exchanges in which people try to maximise advantages and minimise costs. The theory was first formally articulated by George C. Homans in the late 1950s, who proposed that social behaviour could be analysed in terms of an economic model of rewards and costs, where individuals repeat behaviours that are followed by favourable outcomes and avoid those followed by unfavourable outcomes (Homans, 1958). Homans emphasised that social interactions are contingent upon the perceived value of rewards received, which include both tangible and intangible benefits. Building on Homans' work, Peter Blau (1964) extended Social Exchange Theory to organisational contexts, emphasising the social and relational dimensions of exchange. According to Blau, social exchanges are not strictly contractual; rather, they involve implicit expectations of reciprocity. When an individual receives benefits such as recognition, support, or resources, they feel an obligation to reciprocate in a manner that may not be explicitly specified, thereby fostering ongoing social and organisational relationships. Blau highlighted that these exchanges build trust, mutual obligation, and long-term relational stability within organisations (Blau, 1964). Fundamentally, SET asserts that social behaviour is dictated by the reciprocity principle, according to

which people react favourably to advantageous treatment by acting favourably and may become less involved when they receive unfair treatment or disregard (Cropanzano & Mitchell, 2005). Benefits exchanged in this framework can include economic rewards, such as salary and bonuses, as well as socio-emotional rewards, such as recognition, praise, and status. In organisational settings, SET provides a theoretical explanation for why employees engage in discretionary behaviours that benefit the organisation, including pro-social behaviour (PSB). Applied to the relationship between non-financial employer branding systems and PSB, Social Exchange Theory suggests that when organisations provide meaningful rewards and recognition, employees perceive these as benefits and feel a psychological obligation to reciprocate. Employees are encouraged to show civic virtue, assist co-workers, and volunteer for extra work because of this reciprocal dynamic (Yang et al., 2022). Therefore, non-financial employer branding not only honours prior performance but also fosters the social and psychological climate that encourages employees to willingly contribute more to the objectives of the company. This explains why PSB may be effectively promoted in a variety of organisational and cultural situations through the use of structured recognition and incentive systems.

Non-Financial Employer Branding Systems

The non-financial employer branding systems refer to the programmes and strategies implemented by organisations to acknowledge and incentivise employees for their hard work, dedication, and outstanding performance (Monyei & Ukpere, 2024; Alraimi et al., 2020). These systems play a crucial role in motivating employees, boosting morale, and enhancing employee engagement and commitment. Effective non-financial employer branding systems are essential components of participative management practices within organisations. Participative management involves employees being actively involved in decision-making processes, contributing their expertise and ideas to improve organisational performance. Employees are greatly encouraged to actively participate in team discussions, problem-solving, and decision-making when they receive recognition and awards (Vuorela & Tersine, 2022). Systems of rewards and recognition are essential for encouraging employee motivation and involvement in participatory management. Programmes for employee recognition can boost morale, create a feeling of community, and create a positive work environment, claim Rao and Krishna (2019). In addition, bonuses, promotions, and other incentives can be powerful motivators for staff members to actively engage in decision-making and offer their expertise and abilities in

support of the attainment of company objectives. Research by Monyei and Ukpere (2024) and Lawler (2019) also highlights the importance of non-financial employer branding in promoting employee engagement and performance. The author argues that recognition programmes and performance-based rewards can help align employees' efforts with organisational objectives, leading to increased productivity and improved job satisfaction. Moreover, effective non-financial employer branding systems can help reinforce desired behaviours and encourage employees to consistently demonstrate high levels of performance and commitment to their work (Zameer et al., 2023). Organisations with well-designed non-financial employer branding systems typically have greater levels of employee engagement and job satisfaction, according to a study by Kunda and Barley (2018). Workers are more inclined to actively participate in decision-making processes and work together with their co-workers to accomplish shared objectives if they believe that their contributions are respected and appreciated. A healthy corporate culture that encourages employee invention and creativity and supports participative management techniques can be established by this sense of acknowledgement and belonging (Zhou & Wu, 2023). In addition to improving employee motivation and performance, non-financial employer branding systems can also have a positive impact on organisational outcomes. Manolopoulos and Papalexandris (2020) noted that organisations with these formal programmes had higher levels of productivity and profitability compared to those without such programmes. In conclusion, non-financial employer branding systems are essential components of participative management practices that can help promote employee engagement, motivation, and performance. By implementing effective non-financial employer branding programmes and performance-based strategies, organisations can create a supportive work environment that values employee contributions and encourages active participation in decision-making processes. Ultimately, non-financial employer branding systems can serve as a measure of participative management success by incentivising employees to collaborate, innovate, and strive for excellence in their work.

Pro-Social Behaviour

Pro-social behaviour has undergone subtle definitional refinements since it was first conceptualised in the late 1980s, yet the construct remains fundamentally the same. Monyei et al. (2022) claim that PSB refers to voluntary actions undertaken by employees that extend beyond formal job responsibilities, contributing positively to the overall effectiveness and success of an organisation

(Zhang et al., 2023). Such behaviours, which are not explicitly required by job descriptions or performance appraisals, include helping colleagues, volunteering for additional tasks, and participating in organisational initiatives. Empirical research indicates that the PSB can positively influence organisational outcomes, including higher productivity, improved customer satisfaction, and reduced turnover (Chen & Liu, 2021). The willingness of employees to engage in cooperative efforts is indispensable for achieving organisational goals, as individuals not only perform functions aligned with organisational objectives but also contribute to maintaining the broader organisational system (Zhao & Zhou, 2020). Variations in employees' willingness to contribute to this "cooperative system" cannot be explained solely by differences in ability. Researchers have identified several dimensions of PSB, including civic virtue, conscientiousness, sportsmanship, and courtesy. Selflessness encompasses helping behaviours toward co-workers, civic virtue involves participation in organisational activities, conscientiousness reflects going beyond formal job requirements, sportsmanship denotes maintaining a positive attitude, and courtesy involves respectful interactions. Collectively, these dimensions foster a positive organisational climate and substantially influence organisational outcomes (Kim & Joo, 2023). Theoretical frameworks provide insight into the factors influencing PSB. Employees engage in pro-social behaviours as a kind of reciprocity, paying back the organisation for benefits they have received, according to social exchange theory. According to the Organisational Support Theory, workers who perceive strong levels of support from their organisations are more inclined to participate in PSB in order to return the favour. According to the organisational justice theory, when workers feel that the workplace is fair and equitable, they become more devoted to the company and support PSB. Research consistently shows that pro-social behaviour is positively correlated with outcomes like performance, organisational commitment, job satisfaction, and lower absenteeism and attrition (Thomas & Schneider, 2022; Aboobucker & Pathak, 2021). Moreover, the PSB enhances team cohesion and effectiveness by fostering supportive and cooperative work environments.

Empirical Insights

The relationship between the PSB, incentives, and recognition is supported by a number of empirical investigations. Yang et al. (2022) used affective commitment and psychological ownership as mediators to investigate how positive verbal rewards affected PSB in China. According to structural modelling analysis, psychological ownership is strongly linked to positive verbal

incentives like praise and organisational recognition. This, in turn, increases affective commitment and PSB. Strong evidence of the motivational efficacy of recognition outside of formal compensation systems was provided by the fact that psychological ownership entirely mediated the association between positive verbal incentives and affective commitment, whereas affective commitment partially mediated the effect on PSB.

Kurniawan, Tria, and Hutami (2019) investigated rewards and recognition practices within small and medium enterprises, using purposive sampling to collect data from 114 employees. Regression analysis demonstrated that rewards and recognition positively and significantly relate to employee civic behaviour and dimensions, with job engagement partially mediating this relationship.

Similarly, Priyadharshini Sinnappan and Amulraj (2014) explored the impact of rewards, recognition, and empowerment on OCB among technical engineers, finding that recognition and reward systems significantly enhanced altruism, conscientiousness, teamwork, and loyalty, underscoring the role of formal recognition in promoting discretionary behaviours.

Hence, it is elicited from these empirical works that across multiple studies, non-financial employer branding systems have been shown to act as antecedents of PSB by enhancing perceived organisational support and fairness. Performance-based incentives and rewards foster employees' sense of recognition and equitable treatment, thereby increasing loyalty and discretionary behaviour. These findings suggest that well-designed HRM practices, particularly those involving non-financial employer branding systems, can reliably stimulate voluntary extra-role behaviours across diverse work contexts.

Materials and Methods

In order to investigate how non-financial employer branding systems affect pro-social behaviours in public sector organisations, the study utilised the descriptive survey research approach. This design provides a systematic description of current conditions without changing variables by using cross-sectional methodologies to collect data. The descriptive survey approach was considered suitable because it captures employees' natural behaviours, attitudes, and perceptions, allowing for a realistic assessment of how non-financial employer branding systems influence pro-social behaviours. The study was conducted within public sector organisations in Cross River State, Nigeria, focusing on the Cross River State Internal Revenue Service (IRS) as a case study. Cross River State, located in Nigeria's South-South geopolitical zone, spans approximately 20,156 square kilometres, sharing boundaries with Benue,

Akwa Ibom, Ebonyi, and Abia States, and the Republic of Cameroon. Calabar serves as the state capital, and major languages include Efik, English, Bekwarra, Ejagham, and Yakurr. Accessibility is facilitated via Margaret Ekpo International Airport in Calabar, Bebi Airport in Obanliku, the Calabar Seaport, and a network of roads connecting key towns. The population comprised IRS staff across the three senatorial districts: Cross River South, Central, and North. Primary data were collected through a structured questionnaire developed to capture first-hand information on non-financial employer branding systems (independent variable) and pro-social behaviours (dependent variable). Questionnaires were hand-delivered to staff at IRS Headquarters in Calabar, while online forms were distributed to staff in Ugep, Ikom, Ogoja, and Obudu to ensure comprehensive coverage. The instrument consisted of two sections: the first captured demographic information, including gender, age, marital status, educational qualification, and work experience; the second measured non-financial employer branding systems and PSB using a five-point Likert scale ranging from strongly agree to strongly disagree, with five items per construct adapted from validated scales. Instrument validity was ensured through content and face validity, with reviews conducted by a Business Management lecturer and two human resource management and organisational behaviour experts. The questionnaire was further refined based on feedback and approved by the research supervisor. Reliability was assessed via a pilot study of 30 staff from public organisations not included in the main study, with Cronbach's Alpha coefficients analysed using IBM SPSS Statistics version 26, following Hair et al. (2014), where values of 0.60 or higher were deemed acceptable. Frequency tables and percentages were used to examine the data for descriptive purposes, and basic linear regression was used to test hypotheses to determine the direction and strength of the association between pro-social behaviours and non-financial employer branding systems. SPSS version 26 was used for all statistical analyses. Simple random sampling ensured equal selection probability, reducing bias and improving representativeness. The Cochran (1963) formula determined a sample size of 251 respondents from a total population of 673 IRS employees, and Bowley's proportional allocation formula ensured representation across offices.

Table 1: Population and Sample Size Distribution of IRS Offices

S/N	Selected IRS Offices	Population	Sample Allocation	Percentage (%)
1	IRS Headquarters	332	124	49.4
2	Calabar South	101	38	15.1
3	Calabar One (Akim)	70	26	10.4
4	Calabar Two (8 Miles)	97	36	14.3
5	Ugep	15	6	2.4
6	Ikom	20	7	2.8
7	Ogoja	20	7	2.8
8	Obudu	18	7	2.8
	Total	673	251	100

Source: Researcher's Computation, 2026

Data Presentation

The Cross River State Internal Revenue Service (IRS) employees received a total of 251 surveys. A response rate of 94.8% was obtained from the 238 that were properly filled out and returned. 238 responders were hence the study's effective sample size. The tables that follow provide a concise summary of respondents' perceptions by utilising frequency counts and percentages to summarise the data gathered from each item on the instrument.

Test of Hypotheses

The study also tested the following hypothesis: the null hypothesis (H_0) posited that non-financial employer branding systems have no significant impact on pro-social behaviour within the Cross River State IRS, while the alternative hypothesis (H_1) proposed that non-financial employer branding systems exert a significant impact on pro-social behaviour.

Table 2: Regression analysis of the impact of non-financial employer branding systems on pro-social behaviour

Model	R	R square	Adjusted R-squared	Std error of the estimate	
1	.757 ^a	.573	.572	2.57331	
Model	Sum of square	Df	Mean square	F	p-value
Regression	2100.949	1	2100.949	317.273	.000 ^b
Residual	1562.769	236	6.622		
Total	3663.718	237			
Variables	Unstandardized Coefficient B	Standard error	Standardized coefficient Beta	T	p-value
(Constant)	2.688	.623		4.316	.000
NFEBS	.757	.042	.757	17.812	.000

NFEBS = Non-Financial Employer Branding Systems

Table 2 is concerned with the effect of non-financial employer branding systems on pro-social behaviour in the Cross River State Internal Revenue Service. It presents the analysis's findings with regard to the study topic and hypotheses. A favourable correlation between pro-social behaviour and non-financial employer branding systems is indicated by the table's positive R-value. An adjusted R-squared value of .572 is also displayed in the table. According to this figure, 57.2% of the variation in PSB may be explained by NFEBS. The table additionally displays the ANOVA portion, which is a test of the hypothesis. A p-value of 0.000 and an F-ratio of 317.273 are displayed in the table. The null hypothesis, which holds that non-financial employer branding systems have no obvious impact on pro-social behaviour, is thus rejected because the p-value is smaller than the alpha level of 0.05. In the Cross River State Internal Revenue Service, this suggests that pro-social behaviour is significantly impacted by non-financial employer branding systems. With a p-value of 0.000, the table's t-value section confirms this substantial effect. Additionally, the table's t-value section contains the standardised coefficient value of .757 along with the p-value. According to this aspect of the research, there is a 75.7% variation in PSB for every unit of variation in NFEBS. Thus, in terms of evaluating the hypotheses, the analysis summarises that the Cross River State Internal Revenue Service's pro-social behaviour is statistically significantly impacted by non-financial

employer branding systems.

Discussion of Findings

The results of the study indicate a statistically significant positive impact of non-financial employer branding systems on pro-social behaviour in the Cross River State Internal Revenue Service. The analysis revealed a positive correlation between NFEBS and PSB, with an adjusted R-square value of 0.572, suggesting that 57.2% of the variance in PSB can be explained by the organisation's NFEBS. Additionally, the ANOVA results ($F = 317.273$, $p < 0.05$) and the standardised coefficient value of 0.757 indicate that for every unit increase in non-financial employer branding systems, pro-social behaviours increase by 75.7%, confirming the substantial impact of these practices on discretionary employee behaviour. These findings align closely with previous empirical research demonstrating the influence of non-financial employer branding systems on pro-social behaviours. For instance, Yang, Jiang, and Cheng (2022) found that non-financial employer branding systems, such as praise and organisational recognition, were significantly positively correlated with psychological ownership, which enhanced affective commitment and ultimately increased pro-social behaviours among employees in China. Their study highlights the psychological mechanisms through which recognition fosters voluntary pro-organisational behaviours, supporting the conclusion that employees respond positively to acknowledgement and recognition in ways that go beyond formal compensation. This is consistent with the present study, where employees' perception of non-financial employer branding systems translated into increased pro-social deeds. Similarly, Kurniawan, Tria, and Hutami (2019) demonstrated that rewards and recognition practices positively influenced firm citizenship behaviour in small and medium enterprises, with job engagement partially mediating the relationship. The authors concluded that when employees perceive reinforcement through organisational rewards and recognition, they are more likely to engage in discretionary firm citizenship behaviours. The current findings corroborate this conclusion, suggesting that in the Cross River State IRS context, structured and visible non-financial employer branding systems encourage employees to voluntarily exceed their formal job responsibilities. Furthermore, the study by Priyadharshini Sinnappan and Amulraj (2014) provides additional support, showing that compensation and recognition enhanced multiple dimensions of citizenship behaviours, including altruism, conscientiousness, teamwork, and loyalty. This demonstrates that formal

compensation structures play a critical role in motivating employees to engage in extra-role behaviours. The significant relationship observed in this study mirrors these findings, suggesting that employees' response to non-financial employer branding systems is not only in terms of individual performance but also through cooperative and organisationally beneficial behaviours. Beyond these specific studies, broader research also underscores that non-financial employer branding systems function as antecedents of pro-social behaviours by reinforcing perceptions of fairness, organisational support, and value recognition. Empirical evidence indicates that incentives and performance-based rewards enhance employees' sense of recognition and commitment, which in turn encourages discretionary behaviours (Zhao & Yang, 2022; Xia, Arshad, & Mengjiao, 2024). These conclusions are supported by the study's results, which show that the Cross River State IRS's non-financial employer branding systems significantly encourage staff members to participate in pro-social deeds. Overall, the study's results offer compelling empirical evidence in favour of the claim that employee pro-social behaviour is significantly influenced by non-financial employer branding systems. Workers are more inclined to go above and above the call of duty and adopt habits that improve teamwork, organisational loyalty, and overall effectiveness when they believe their contributions are appreciated and fairly acknowledged. According to the findings, employees reciprocate organisational support and recognition with voluntary, pro-organisational behaviours, which is a theoretical assumption derived from Social Exchange Theory (Blau, 1964; Yang et al., 2022).

Conclusion

According to the study's findings, pro-social behaviours of workers at the Cross River State Internal Revenue Service are significantly and positively impacted by non-financial employer branding systems. Workers who believe their efforts are appreciated and recognised are more inclined to take part in extracurricular activities that enhance collaboration, teamwork, and the effectiveness of the company as a whole. The results show that good non-financial employer branding systems encourage a sense of dedication, loyalty, and belonging to the company in addition to motivating workers. In summary, the study emphasises that non-financial employer branding systems that are thoughtfully planned and equitably executed are critical to developing employees who voluntarily assist in achieving organisational objectives.

Recommendation

Based on the findings of this study, it is recommended that public sector organisations, such as the Cross River State Internal Revenue Service, place greater emphasis on designing and implementing non-financial employer branding systems that are transparent, consistent, and aligned with organisational objectives. Management should ensure that employees feel genuinely valued for their contributions, not only through monetary rewards but also through non-monetary forms of recognition such as praise, commendation, and opportunities for professional growth. By fostering an environment where recognition is meaningful and consistently applied, organisations can encourage employees to engage more fully in discretionary behaviours that enhance teamwork, loyalty, and overall organisational effectiveness. Additionally, continuous evaluation of non-financial employer branding systems should be carried out to ensure they remain relevant, fair, and motivating, thereby sustaining high levels of employee engagement and pro-social behaviour over time.

Limitations of the Study and Avenues for Future Studies

It is important to recognise that this study has certain limitations, even with its insightful findings. Initially, the study was restricted to the Cross River State Internal Revenue Service, which could potentially impact the findings' applicability to other public or private companies. The study's cross-sectional survey approach, which only collected data at one particular moment, also makes it difficult to draw conclusions regarding the causal relationship between employee pro-social behaviour and non-financial employer branding systems. Third, using self-reported surveys raises the risk of response bias since participants might have given answers that were more socially acceptable than accurately representing their views and actions. Additionally, while the study measured recognition and rewards systems as a single construct of non-financial employer branding, the various forms of non-financial employer branding systems may influence employee pro-social behaviour differently, which was not explored in depth. Nevertheless, these limitations do not diminish the significance of the findings. The study provides important empirical evidence of the positive impact of non-financial employer branding systems on employee pro-social behaviour, offering a strong foundation for future research and practical interventions. With careful attention to these limitations, future studies can build on this work, extending it to other organisations, longitudinal designs, and more nuanced measures of non-financial employer branding systems, further

enhancing our understanding of how to foster motivated and committed employees. Ultimately, the findings of this study highlight a clear path for organisations to strengthen employee engagement and promote a culture of excellence, paving the way for sustained organisational success

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DRIVERS OF VERTICAL CAREER IMMOBILITY: VOICES OF ATYPICAL WORKERS

**Wilfred Isioma UKPERE¹, Jeremy MITONGA-MONGA², Nyasha
MAPIRA³**

**^{1, 2, 3}University of Johannesburg, Department of Industrial Psychology
and People Management, School of Management, College of Business
and Economics, D Ring 434, University Road, Auckland Park,
Johannesburg, South Africa, Telephone: +27735295587,
+27-11-5592069, Email:wiukpere@uj.ac.za, jeremym@uj.ac.za ,
dmapira@gmail.com**

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Abstract

This research sought to explore the drivers of vertical career immobility among atypical workers in Zimbabwe. Twelve respondents, who were purposively selected, participated in this qualitative study. Data was gathered from respondents, using one-on-one, semi-structured interviews. The study identified several factors that contribute to vertical career immobility among atypical workers in Zimbabwe. Respondents identified limited formal education and training, a lack of labour market information, economic conditions, poor networking and organisational constraints as key drivers of vertical immobility among atypical workers in Zimbabwe. This study recommends supervisors and workers at the case firm in Zimbabwe to comprehend the highlighted drivers of vertical career immobility and devise explicit approaches to overcome it. The study also recommends that managers at the case firm in Zimbabwe should engage in regular career coaching talks with atypical workers, execute targeted upskilling and career mapping, and consider atypical workers for internal promotion. Finally, to overcome vertical career immobility, the study recommends that atypical workers should focus on upskilling and reskilling, lateral moves and strategic networking.

Keywords: *atypical worker, career, mobility, upward career mobility, vertical career immobility.*

JEL Classification: J24, J31, M12, M51, I20.

1. Introduction

Atypical forms of work have become more popular in developing countries over the past 30 years and are now a common feature in the labour market (Leitner & Sabouniha, 2024; Albelda et al., 2020; Lewchuk, 2020). A study by Wiengarten (2021) shows that firms prefer precarious work arrangements as they allow them to reduce labour expenses and provide hiring and firing flexibility. Similarly, Shin et al. (2023) point out that atypical forms of work allow businesses to lower labour expenses and alter their workforce composition as needed. Bhimavarapu (2025) argues that a number of workers found joy in atypical forms of work since these allow them to balance their personal and professional responsibilities. Bosmans (2023) concurs, stating that some workers prefer atypical forms of work as these make it easier for them to balance work and family duties. Additionally, Ukpere et al. (2024) assert that many working parents prefer temporary jobs that enable them to balance their social and work responsibilities. A study by Hölberg (2021) shows that less skilled workers can participate in the labour process, placing themselves in a position to bargain for long-term employment through atypical forms of work. Correspondingly, Freese and Kroon (2023) posit that atypical workers undertake insecure work to acquire firm-specific expertise and marketable skills that would eventually lead to a permanent position. Conversely, several researchers (Apouey et al., 2020; Bodin., 2020; Thomson & Hünefeld, 2021; Hæansson et al., 2020; Van Wijk & Liefbroer, 2021) argue that atypical forms of employment have drawbacks, including job insecurity, income insecurity, and occupational, health, and safety issues. Precarious employment, according to Thomson and Hünefeld (2021), deprives employees of job security that permanent employees enjoy. A majority of the participants in a research study that Ingelsrud (2021) conducted on the effects of precarious work on employees, reported experiencing job insecurity, which lends credence to the aforementioned perspective. Several studies that were conducted in the global north showed that atypical forms of work make it more likely for contingent workers to obtain regular and permanent employment. Conversely, atypical forms of work seem to be a dead-end job in developing nations like Zimbabwe, where contingent workers either stay in that position for a long time or lose it when the contract expires (Danquah & Sen, 2021; Hänsch &

Mains, 2020). Furthermore, a study by Schotte (2021) reveals that companies in developing nations use precarious employment as a simple flexibility buffer, which reduces the likelihood that atypical workers will obtain regular and secure permanent positions. Because of the aforementioned, atypical work appears to be a dead-end job, which hinders vertical career mobility. Choudhury (2022) defines vertical career immobility, also referred to as a career plateau, as the state in which a worker is unable to advance within an organizational hierarchy, leading to a stagnant income, title, or professional position. A study by Leitner and Sabouniha (2024) indicates that vertical career immobility has serious, long-term negative repercussions on businesses, ranging from decreased performance to the loss of top personnel. It is noteworthy that most businesses in Zimbabwe utilize atypical forms of employment, and questions have been raised about why most atypical workers frequently find themselves trapped in recurrent periods of temporary employment. there is a need for a study to explore drivers of vertical career immobility. Thus, the aim of this study was indeed to explore drivers of vertical career immobility among atypical workers in Zimbabwe.

2. Review of related literature

This section presents theories, which guided the research study, and drivers of vertical career immobility.

2.1. Dual labour market theory

The dual labour-market theory segments workforces into primary and secondary sectors, each of which has distinct employment conditions and wages. According to Doeringer and Piore (1970), the primary sector offers steady work, favourable terms and conditions, and prospects for promotion. Precarious and unappealing jobs that require minimal training, low pay and little mobility are characteristics of the secondary sector. According to Bill (2006), workers in the secondary segment typically perform repetitive, boring tasks with few chances for advancement or training. According to the dual labour market theory, there is typically little mobility between two distinct primary and secondary segments. The above-mentioned means that atypical workers are confined to the secondary segment of the internal labour market. Despite having identical skill sets, workers in the primary and secondary sectors have different career pathways, working conditions, and salaries (Hirsch, 2016).

2.2. Vertical career immobility

Choudhury (2022) defines vertical career immobility as the inability to advance

in one's profession, pay, or employment status. Similarly, Peters (2020) posits that employees who struggle to climb the career ladder experience vertical career immobility. Ray and Genicot's (2023) research study revealed that vertical career immobility is caused by a confluence of institutional, structural, and individual factors that keep employees in precarious jobs.

2.3. Drivers of vertical career immobility

Numerous factors such as poor social networking, lack of labour market information, organizational constraints, and limited formal education and training contribute to vertical career immobility among workers (Peters, 2020; Ray & Genicot, 2023; Brody & Miller, 2022; Feenstra-Verschure et al., 2024; Persson & Bertilsson, 2023). Some of the factors that contribute to vertical career immobility among workers are described below.

2.4. Limited formal of education and training

Grønning (2022) states that contingent workers frequently receive little to no firm-specific training from employers, making it challenging for them to develop the required firm-specific skills for vertical career mobility. Correspondingly, a study by White and Knight (2018) showed that atypical workers frequently have less access to education and training opportunities, posing a challenge for them to acquire the necessary skills for higher-skilled positions. Similarly, Bechichi et al. (2019) contend that workers' access to higher-level positions in the labour market is restricted owing to a lack of formal education. Additionally, Grundke and Squicciarini (2019) note that most temporary workers are less likely to obtain firm-sponsored training owing to the unstable nature of temporary work, which hinders their prospects of advancing in their careers.

2.5. Lack of labour market information

According to Hensvik and Skans (2018), vertical career mobility is hampered by a lack of labor market information about skills and training programs that are required in various industries. Furthermore, a study by Agarwal (2019) revealed that one of the factors that causes vertical career immobility among temporary workers is a lack of knowledge about open positions in the labor market. According to another study by Schmutz and Sidibé (2020), workers who are unaware of specific skills and credentials, which are required to hold higher jobs frequently experience upward career immobility. Similarly, Spittal and Xu (2021) claim that asymmetry in labor market information is a major obstacle to career advancement, frequently entangling employees in lower-level positions. Generally

speaking, vertical career immobility happens when employees are unable to search effectively for better opportunities owing to a lack of information about job openings, skills, and educational requirements that are needed for upward mobility in various occupations (Fredriksson et al., 2018; Starr et al., 2019; Schmutz & Sidibé, 2020).

2.6. Weak networking and connections

Granovetter (2017) describes networking and connections as opportunities, information, and resources that are obtained through contacts that are essential for professional growth. Regardless of their expertise, abilities, and dedication, temporary workers are unable to advance in their careers because of a lack of social capital and professional networks, according to a study by Gomes de Araujo (2025). Gayen et al. (2019) aver that most people find better positions through personal contacts and recommendations, demonstrating the importance of social ties and networking for vertical career mobility. A study by Yang and Hu (2023) shows that poor networks and social capital are the main causes of vertical career immobility since higher-paying positions are filled through referrals.

2.7. Organizational constraints

Preece (2018) states that the main cause of vertical career immobility includes organizational constraints such as organizational structures, budgetary limitations, and a lack of senior positions. According to Feenstra-Verschure and Kooij (2019), flat organizational structures and problems like internal competition and downsizing make it challenging for lower-level employees to advance in their careers. Similarly, a study by Preece (2018) indicates that companies that have experienced delayering frequently have fewer roles, restricting prospects for advancement. Another study by Vincent-Geslin and Dubois (2017) reveals that there are less options for vertical career mobility in a flat hierarchical organization.

2.8. Economic downturn

Pech (2017) defines economic downturn as a substantial, long-term decrease in economic activity, marked by a loss in GDP, a decline in consumer spending, and an increase in unemployment. According to Ravalet et al. (2021), an economic downturn is a contractionary stage of the business cycle that frequently results in an economic recession. A study by Bisello and Maccarrone (2022) reveals that economic downturn reduces employment opportunities, which has a substantial impact on vertical career mobility. A different study by Møen and Salvanes (2018) shows that firms are forced by economic constraints to cut expenses by freezing

hiring or removing upper-level positions, which significantly lowers vertical career mobility. Similarly, Huttunen et al. (2018) contend that economic boom often promotes vertical career mobility, while recessions diminish job availability and hinder upward career mobility.

3. Research methodology

This section presents the study's research philosophy, research approach, sampling methods, data collection method, and data analysis. Table 1 below shows the study's methodology.

Table 1: Research methodology and design

Methodology	Method utilized	Purpose for use
Research philosophy	Interpretivism	Assists researchers to comprehend the subjective opinions of respondents regarding the drivers of vertical career immobility.
Research approach	Qualitative	Enables research participants to express their opinions about factors behind vertical career immobility in their own words.
Sampling method	Judgmental	Allows the researchers to focus on participants who have experienced the issue that is investigated.
Sample size	Twelve	After conducting twelve interviews, no new information or sub-themes emerged.
Data gathering method	Semi-structured interviews	Allow researchers to ask probing questions.
Data analysis technique	Thematic (<i>NVivo system</i>)	Allows researchers to identify, analyse and report themes and sub-themes that arose from the study.

Source: Authors' compilation

3.1. Education and demographic characteristics of participants

Table 2 below shows the highest educational qualification and demographic characteristics of the respondents.

Table 2: Education and characteristics of respondents

N o	Pseudonyms	Gender	Age (Years)	Work Experience	Highest Qualification	Interview Length
1	UCM1	Male	24	3 years	‘A’ level	9 minutes
2	UCM2	Female	26	3 years	Diploma	8 minutes
3	UCM3	Female	23	3 years	‘A’ level	11 minutes
4	UCM4	Male	21	1 year	‘O’ level	10 minutes
5	UCM5	Male	20	2 years	Grade 7	9 minutes
6	UCM6	Female	28	5 years	Diploma	11 minutes
7	UCM7	Female	29	4 years	Diploma	9 minutes
8	UCM8	Male	31	6 years	Bachelor’s degree	10 minutes
9	UCM9	Male	29	4 years	Diploma	9 minutes
10	UCM10	Male	25	3 years	‘A’ level	10 minutes
11	UCM11	Male	28	5 years	Diploma	8 minutes
12	UCM12	Female	23	2 years	‘O’ level	11 minutes

Source: Authors’ fieldwork

4. Findings

Table 3 below shows themes and sub-themes that emerged from the study.

Table 3: Themes and sub-themes from the study

Themes	Sub-themes
Limited formal education and training opportunities	Inferior opportunities for on-the-job training Skills gap Poor educational qualifications
Lack of labour market Information	Lack of information about available job opportunities No knowledge of available training programs Lack of information about the required skills
Harsh economic conditions	Economic downturn Fewer job opportunities Technology replacing workers
Weak networking and connections	Weak connections Lack of social capital Limited professional networks
Organizational constraints	Downsizing / restructuring Flat company structures Internal competition

Source: Primary data

4.1. Response rate

Data frequency and the response rate are shown in Table 4 below.

Table 4: Data frequency and response rate

Theme	Frequency (N=12)
Limited formal education and training opportunities	11
Lack of labour market information	9
Harsh economic conditions	9
Weak networking and connections	7
Organizational constraints	6

Source: Authors' fieldwork

4.2. Theme 1: Limited formal education and training opportunities

Limited formal education and training opportunities was highlighted as one of the drivers of vertical career immobility among atypical workers in Zimbabwe. The following table details narratives from respondents in this regard.

Table 5: Respondents' views on limited formal education and training opportunities

Pseudo nym	Respondents' views
UCM1	<i>'My highest qualification is 'A' level, my brother. It's very difficult to get a better job because supervisors consider your educational qualifications when it comes to promotion.'</i>
UCM2	<i>'As a temporary worker, I am not considered for on-the-job training. Given such a backdrop, it means we lack firm specific skills needed for one to have a better job here.'</i>
UCM3	<i>'Pakaipa mukoma, tinongoramba tichishanda mabasa epasi pasi aya nekuti hatina chikoro chakakwana' (Limited formal education leads to upward career immobility).</i>
UCM4	<i>'Mukoma chikoro ndopasina. Ini ndakagumira 'O' level saka kuti nditsvage basa ririnane handifi ndakariwana nokuti vanonyanya kutora vanenge vakati dzidzei vaye kuti vashande mabasa anobhadhara zvirinani' (My highest qualification is 'O' level, my brother; of which our organisation usually considers those with better educational qualifications for promotion).</i>
UCM5	<i>'Hatiwani mabasa epamusoro nekuti hatina chikoro neruzivo rwunodikwa kushanda mabasa epamusoro' (Lack of formal education and skills needed to perform higher paying jobs hinder us from getting better paying jobs).</i>
UCM6	<i>'Inferior training opportunities hinder temporary workers to climb their career ladder.'</i>
UCM7	<i>'I think the major cause of vertical career immobility is limited formal education and training.'</i>
UCM8	<i>'In most cases, temporary workers lack skills and formal education needed for one have a better paying job here.'</i>

UCM10	<i>'We are not included in training programs here, which limit us from occupying higher positions.'</i>
UCM11	<i>'I do not have firm specific skills needed for one to get a good job.'</i>
UCM12	<i>'Lack of formal education limits vertical career mobility.'</i>

Source: Authors' fieldwork

4.3. Theme 2: Lack of labour market information

Of the twelve research participants, nine mentioned a lack of information about available job opportunities and required skills as the major cause of vertical career immobility among atypical workers in Zimbabwe. Below are some of respondents' thoughts on this matter.

- *'Nyaya iripo ndeyekuti tinenge tisina information yekuti kukudikwa vanhu kuti vashande basa riri pamusoro ndekupi' (We lack information about better paying companies looking for our services) (UCM1).*
- *'Chimwe chikonzero ndechekuti hatina ruzivo rwekuti maskills anodikwa kuti munhu uwane basa repamusoro ndeapi' (Upward career immobility comes as a result of limited information about the skills needed for one to occupy better paying positions) (UCM3).*
- *'Being unaware of the available vacancies in other sectors leads to career trap' (UCM4).*
- *'Hazvisi nyore kutora makore akawanda uchingoshanda basa repasi pasi, asi ini ndofunga kuti chinokonzera chinoita kuti zvidai inyaya yekuti hatina information yekuti mabasa anobhadhara anoenderana nemaskills atinawo anowanikw kupi' (Limited labour market information about available, better job opportunities, which require the skills we possess) (UCM6).*
- *'Limited labour market information is the major driver of vertical career immobility among atypical workers here' (UCM8).*
- *'Lack of information about the training required for one to occupy a better position is one of the causes of upward career immobility' (UCM9).*
- *'Chinokonzera kuti tisawana mabasa akati nakei inyaya yekushaya information yekuti kumwe kurikutorwa vanhu ndekupi' (Lack of information about better job openings in other companies) (UCM10).*
- *'Lack of labour market information leads to career plateau among atypical workers' (UCM11).*

4.4. Theme 3: Economic conditions

Apart from limited formal education and a lack of labour market information, economic conditions emerged as one of the drivers of vertical career immobility among temporary workers in Zimbabwe. In this respect, UCM2 said:

'Economic conditions, characterized by massive adoption of advanced technology, means few job opportunities because technology is replacing workers.'

UCM3 and UCM4 concurred, while UCM3 mentioned:

'Economic instability affects organizational growth, which in turn reduces number of workers required by the company.'

In line with this, UCM6 stated:

'Unstable economic conditions, my brother.'

UCM7, UCM8 and UCM9 shared the same sentiments as UCM6. Regarding this issue, UCM8 said:

'Economic instability causes upward career immobility.'

4.5. Theme 4: Weak networking and connections

Seven of the twelve respondents identified weak networking and connections as a driver of vertical career immobility among atypical workers at the case organization in Zimbabwe. The respondents' sentiments are listed below.

'Hatina watinoziva anokwanisa kutirongeravo basa riri nani' (Weak connections hinder vertical career mobility) (UCM3).

'It depends on whom you know' (UCM5).

'Akakupinza basa pekutanga ndiye anokwanisa kuti uzopinda basa riri nani pano' (Those who assisted you to get atypical work will also assist you to get a better job) (UCM7).

'Your social capital will determine your future job' (UCM8).

'Weak connection is the major cause' (UCM10).

'Limited professional networks' (UCM11).

'Pakaipa kani, asi kana une team raunoziva kaone manje, pakangobuda basa kwaro unobva wapinda kaone' (If you have strong connections, it's easy to get a better job) (UCM12).

4.6. Theme 5: Organizational constraints

Some respondents identified organizational constraints as one of the drivers of vertical career immobility among atypical workers at the case firm in Zimbabwe. In this respect, UCM4 said:

'Issues to do with downsizing and restructuring hinder vertical career mobility of workers in the peripheral segment.'

Equally, UCM6 argued:

'Downsizing reduces job positions, which in turn affects internal promotions.'

UCM7, UCM8, UCM9 and UCM11 supported the above-mentioned viewpoints, while UCM8 stated:

'Our organization has a flat structure and fewer hierarchical positions, which makes it very difficult for one to make a vertical move.'

5. Discussion of study's findings

Limited formal education and training opportunities, a lack of labour market information, economic conditions, weak networking and connections, and organisational constraints emerged from the study as drivers of vertical career immobility among atypical workers in Zimbabwe. The study's results are analysed below.

5.1. Limited formal education and training opportunities

Limited formal education and training opportunities emerged from the study as one of the drivers of vertical career immobility among atypical workers in Zimbabwe. Presented below are some of research participants' viewpoints in this respect.

'My highest qualification is 'A' level, my brother. It's very difficult to get a better job because supervisors consider your educational qualifications when it comes to promotion.' (UCM1);

'Pakaipa mukoma, tinongoramba tichishanda mabasa epasi pasi aya nekuti hatina chikoro chakakwana' (limited formal education leads to upward career immobility). (UCM3);

'Mukoma chikoro ndopasina. Ini ndakagumira 'O' level saka kuti nditsvage basa ririnane handifi ndakariwana nokuti vanonyanya kutora vanenge vakati dzidzei vaye kuti vashande mabasa anobhadhara zvirinani' (My highest qualification is 'O' level, my brother; of which our organisation usually considers those with better educational qualifications for promotion). (UCM4);

'In most cases, temporary workers lack skills and formal education needed for one to occupy better paying positions here.' (UCM8); and

'Temporary workers, in most cases, are not included in training programs here, which limit them from occupying higher positions.' (UCM10).

The quotes above are consistent with those of Grønning (2022), who argues that

contingent workers frequently receive little to no firm-specific training from employers, making it challenging for them to develop the required firm-specific skills for vertical career mobility. Correspondingly, a study by White and Knight (2018) shows that atypical workers frequently have less access to education and training opportunities, which makes it challenging for them to acquire the necessary skills for higher-skilled positions. In addition, Grundke and Squicciarini (2019) posit that most temporary workers are less likely to obtain firm-sponsored training owing to the unstable nature of temporary labour, which hinders their prospects of advancing in their careers.

5.2. Lack of labour market information

The study's findings show that nine respondents identified a lack of information about available job opportunities and required skills as the major cause of vertical career immobility among atypical workers in Zimbabwe. Some of the respondents' opinions regarding this matter are listed below.

- *'Nyaya iripo ndeyekuti tinenge tisina information yekuti kukudikwa vanhu kuti vashande basa riri pamusoro ndekupi' (We lack information about better paying companies looking for our services) (UCM1);*
- *'Chimwe chikonzero ndechekuti hatina ruzivo rwekuti maskills anodikwa kuti munhu uwane basa repamusoro ndeapi' (Upward career immobility comes as a result of limited information about the skills needed for one to occupy better paying positions) (UCM3).*
- *'Hazvisi nyore kutora makore akawanda uchingoshanda basa repasi pasi, asi ini ndofunga kuti chinokonzero chinoita kuti zvidai inyaya yekuti hatina information yekuti mabasa anobhadhara anoenderana nemaskills atinawo anowanikw kupi' (Limited labour market information about available, better job opportunities, which require the skills we possess) (UCM6); and*
- *'Chinokonzero kuti tisawana mabasa akati nakei inyaya yekushaya information yekuti kumwe kurikutorwa vanhu ndekupi' (Lack of information about better job openings in other companies) (UCM10).*

The study's results are buttressed by Hensvik and Skans (2018), who posit that vertical career mobility is hampered by a lack of labour market knowledge of necessary skills and available training programs in various industries. Similarly, a study by Agarwal (2019) reveals that one of the factors causing vertical career immobility among temporary workers is a lack of knowledge about open positions in the labour market. Furthermore, Spittal and Xu (2021) claim that asymmetry in labour market information is a major obstacle to career advancement, frequently

entangling employees in lower-level positions.

5.3. Economic conditions

Economic conditions emerged as one of the drivers of vertical career immobility among atypical workers in Zimbabwe. Hence, UCM2 said:

‘Economic conditions, characterized by massive adoption of advanced technology, means few job opportunities because technology is replacing workers.’

Correspondingly, UCM3 claimed:

‘Economic instability affects organizational growth, which in turn reduces the number of workers required by the company.’

The respondents’ views are reinforced by Bisello and Maccarrone (2022), who state that economic downturn reduces employment opportunities, which has a substantial impact on vertical career mobility. Similarly, a study by Møen and Salvanes (2018) indicates that firms are forced by economic constraints to cut expenses by freezing, hiring or removing upper-level positions, which lowers vertical career mobility significantly.

5.4. Weak networking and connections

Seven of the twelve respondents identified weak networking and connections as a driver of vertical career immobility among atypical workers in Zimbabwe. In this regard, the respondents’ utterances are listed below.

‘Hatina watinoziva anokwanisa kutirongeravo basa riri nani’ (Weak connections hinder vertical career mobility) (UCM3);

‘Akakupinza basa pekutanga ndiye anokwanisa kuti uzopinda basa riri nani pano’ (Your social network and connections will help you to get a better job) (UCM7); and

‘Pakaipa kani, asi kana une team raunoziva kaone manje, pakangobuda basa kwaro unobva wapinda kaone’ (If you have strong connections, it’s easy to get a better job) (UCM12).

The above respondents’ sentiments are supported by Gayen et al. (2019), who note that most people find better positions through personal contacts and recommendations, demonstrating the importance of social ties and networking for vertical career mobility. Correspondingly, a study by Yang and Hu (2023) reveals that poor contacts and social capital are the main causes of vertical career immobility since higher-paying positions are filled through referrals.

8. Conclusions

This study sought to explore the drivers of vertical career immobility among atypical workers in Zimbabwe. This study showed that limited formal education and training opportunities, lack of labour market information, economic conditions, weak networking and organisational constraints are the main drivers of vertical career immobility at the case organisation in Zimbabwe. Based on the study's findings, the researchers conclude that vertical career immobility is common among atypical workers at the case organisation in Zimbabwe. In respect of limited education and training, the study established that a majority of atypical workers lacks formal education and due to the nature of their work they are not considered for training and development. In other words, a majority of the atypical workers at the case organisation in Zimbabwe experience vertical career immobility because of limited formal education and exclusion from training opportunities at work. In terms of weak networking, the research found that most atypical workers lack social network and connections needed for vertical career mobility. The afore-mentioned means that networking and connections are vital for vertical career mobility since higher and better positions are filled through referrals. The researchers believe that this study assists atypical workers to curb vertical career mobility by considering recommendations that emerged from the study namely upskilling, reskilling, lateral moves and strategic networking. In addition, this study assists managers to understand drivers of vertical career immobility. In other words, managers may assist atypical workers to curb vertical career immobility by engaging them in regular career coaching talks, executing targeted upskilling and career mapping, and considering them for internal promotion.

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Author's Contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflicts of Interest

The authors declared that they have no conflict of interest.

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EXPLORING THE IMPACT OF WORKPLACE LEARNING ON ORGANISATIONAL OUTCOMES, BRANDING AND COMPETITIVE ADVANTAGE

Adeola AROTIBA¹, Wilfred Isioma UKPERE²

^{1,2}*Department of Industrial Psychology and People Management, School of Management, College of Business and Economics, University of Johannesburg, D Ring 434, University Road, Auckland Park, Johannesburg, South Africa, Telephone: +27735295587 or +27-11-5592069, E-mail: looafrique@gmail.com , wiukpere@uj.ac.za*

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Abstract

Workplace learning has evolved from being a reward for employees, to a long-term strategic investment that boosts organisational outcomes, strengthens brand loyalty, and gives an organisation a lasting competitive edge. Organisations that invest in their employees' continuous learning, reskilling, and upskilling, experience significant increase in productivity and profitability. Therefore, in response to ever-changing market conditions, workplace learning has emerged as a critical tool for enhancing employee engagement, lowering turnover, and fostering an innovative culture. This highlights that a strong learning culture helps organisations to adapt, innovate, and develop. It shifts the perception of learning from a mere checkbox to a strategic tool that enhances organisational performance and branding, especially in the current knowledge economy, where cultivating curiosity, agility, and lifelong learning is essential for establishing a genuine competitive advantage.

Keywords: globalisation, competitive advantage, workplace learning, branding, organisational outcomes.

JEL Classification: J24; M53

1. Introduction

Globalization has triggered numerous changes in organisational landscape, creating the need for innovation and creativity. This shift is essential for attracting and retaining top talent, enhancing product or service quality, and improving client relationships. In addition, organisations are increasingly focused on establishing strong employer brand to maintain competitiveness (Azhar, Rehman, Majeed & Bano, 2024). In response to these needs, workplace learning presents a key avenue to expanding the knowledge base of both employees and their organisations. From that perspective, workplace learning plays a crucial role in enhancing organisational outcomes, branding and competitive advantage (Schulte, 2010; Keya & Kinyua, 2025; Starke & Ludviga, 2025). It cultivates a skilled, engaged, and adaptive workforce, which in turn propels innovation and productivity. Workplace learning as a strategic investment, rather than mere cost, which allows organisations to stand out in a saturated market, thereby enhancing their brand and establishing a lasting competitive edge (Gilani & Waqar 2013; Gurol & Eroglu, 2021).

2. Literature Review

The literature review of the paper will follow in the proceeding sub-sections covering workplace learning, organisational Outcomes, Branding and competitive advantage.

2.1 Workplace Learning

Workplace learning is the continuous process of gaining knowledge, skills, and competencies directly within the work environment. It integrates individual career development with the objectives of the organisation, improving employee performance and organisational effectiveness through practical experiences, mentorship, and routine responsibilities together with external, off-site training (Billet, 2021). Workplace learning systematically deliver professional development and educational opportunities that enables employees to enhance their skills concurrently with their regular responsibilities, rather than requiring them to pause their duties for an external training session (Crouse, Doyle & Young, 2011). Ha (2008, p.129) depicted workplace learning as a multifaceted process characterised by various formal and informal activities that employees engage in. It encompasses on-the-job training, online learning, and peer learning, reflecting the interactions between individuals and collectives (Fenwick, 2008b). Eraut and Hirsh (2010) emphasised that workplace learning can involve both individuals and cohesive groups. In this light, Wenger (1998) presents workplace learning as rooted in social

engagement within communities of practice, where novices gradually develop skills by observing and collaborating with experienced colleagues, thereby progressing from basic to advanced practices. Moreover, Muhammad and Idris (2005) perceive workplace learning as frequently influenced by cultural factors, in alignment with the requirements of the organisation. Senge (1990) highlights workplace learning as a systematic initiative to enhance capabilities for better future performance, emphasising collaborative efforts and empowerment. With the increase in complexity due to globalization and technological advancements, Reeve and Gallacher (1999) argue that workplace learning must be adaptable to foster continuous professional development. By and large, workplace learning occurs at multiple levels and serves as a strategic approach for adapting to evolving work environments, focusing on skill enhancement and community engagement in knowledge creation.

2.2 Organisational Outcomes

Organisational outcomes represent the quantifiable results, effects, and final results that an organisation attains through its combined efforts, strategic approaches, and the allocation of its resources. It is the enhanced profitability, increased market share, or greater employee commitment (Maltz, Shenhar, & Merino, 2003). In this light, Obuba (2022) categorized organisational outcomes as a framework of five major dimensions, namely financial, market, process, people, and future. Lefkowitz (2022) described *organisational outcomes* as prevailing economic factors such as productivity, efficiency, profitability, shareholder value, return on investment, and other business or financial metrics including less conventional results like customer satisfaction at the corporate level. According to Budhiraja, Yadav, and Rathi (2024), workplace learning yields multiple organisational outcomes, including innovative performance, effective knowledge management, enhancement of human capital, and the achievement of organisational sustainability (Cerasolietal, 2018). It is a key tool in gaining competitive advantage as an organisation (Muzam, Bendkowski, Mah & Mudoh, 2023) and a reflection of robust organisational brand (Buttenberg, 2013).

2.3 Branding

Organisational branding involves the strategic creation, shaping, and management of an organisation's identity, encompassing its name, values, reputation, and voice, with the aim of building trust and distinguishing it from competitors (Azhar, Rehman, Majeed & Bano, 2024). It transcends a mere logo or slogan, incorporating all internal and external communication channels to create a

unified, recognisable image that meets stakeholder expectations. The focus is on presenting a comprehensive view of the organisation, highlighting the promotion of a long-term strategy targeted to manage the awareness and perceptions of related stakeholders and potential employees with regards to an organisation (Bharadwaj, Khan & Yameen, 2022; Mouton & Bussin, 2019). The process involves establishing and conveying a distinctive image of the organization as an employer, enabling differentiation from competitors and the retention of highly skilled and motivated employees (Bharadwaj et al., 2021, Mouton and Bussin, 2019). Mouton and Bussin (2019) identified five dimensions of employer branding, namely ethics and corporate social responsibility (ECSR), training and development (TD), compensation and benefits (CB), healthy work atmosphere (HWA), and work-life balance (WLB). According to Junça Silva, and Dias (2023), an effective organisational brand image draws in exceptional talent, boosts credibility, fosters customer loyalty, and serves as a guiding principle for business decisions. Therefore, incorporating dimensions of employer branding into HR policies has the potential to impact various work-related factors, including organisational commitment, employer brand loyalty, employee retention, and overall organisational efficiency (Donkor, Dongmei & Sekyere, 2021), which foster competitive advantage.

2.4 Competitive Advantage

A competitive advantage signifies a unique and sustainable edge that allows an organisation to surpass its competitors, attract a larger customer base and result in higher profits or margins. This stems from factors that are difficult to replicate, such as distinctive branding, unique cost frameworks, proprietary intellectual property, or specialized expertise (Fabrizio, Kaczam, de Moura, da Silva, da Silva & da Veiga, 2022; Mpabanga, Knight & Ukpere, 2024). In addition, Barney and Hesterly (2012) defined competitive advantage as an organisation's ability to generate more economic value than its competitors, allowing it to stand out in the marketplace. Thus, a variety of resources and capabilities can assist an organisation to establish and sustain a competitive advantage, thereby impacting its overall business performance. Kumar (2025) identified technology, innovation, organisational structure, strategy, and human resources as sources of competitive advantages for organisations. Khemraj (2023) presents evidence and motivations supporting the idea that organisations can gain advantages from their employees' expertise through the implementation of knowledge development and knowledge leverage strategies such as workplace learning. Similarly, Agustian, Pohan, Zen,

Wiwin, and Malik (2023) emphasised that organisations must invest in employee development to provide them with the essential skills and knowledge needed to progress along with the organisation. This encompasses training, career development and education. Consequently, gaining competitive advantage is possible through workplace learning.

3. Research methodology

The research utilised a qualitative, phenomenological strategy to explore the impact of workplace learning on organisational outcomes, branding and competitive advantage of South African organisations. This approach aims to deeply understand everyday lived experiences of participant affected by the social phenomena. Fifteen participants from various organisational levels were purposefully selected, with pseudonyms employed to ensure anonymity. Data was collected through face-to-face semi-structured interviews, adhering to ethical guidelines that included informing participants about the study's purpose and ensuring voluntary participation.

4. Findings of the study

The study's research question was to understand the impacts of workplace learning on organisational outcomes, branding and competitive advantage of South African organisations. When the participants were asked to provide their understanding of the impacts of workplace learning on organisational outcomes, branding and competitive advantage in their organisations the following themes emerged from their responses:

1. Workplace learning improves the quality of organisational outcomes.
2. Workplace learning enhances organisational branding and reputation.
3. Workplace learning gives organisations some competitive advantage.

4.1 Theme 1: Workplace learning improves the quality of organisational outcomes.

When reflecting on the impact of workplace learning on organisations, a theme that surfaced is that it boosts the quality of organisational outcomes. This sentiment was echoed by **PMF1** from the manufacturing sector.

“We can also see the impact of learning in the level of the quality of product our employees produce if the trainings are effective, and this is not specifically talking about the operators on the production line, as we would see this effect in the output of the car they assemble. However, for the indirect staff, the output or the effect

may be for someone that did not know how to put on a PowerPoint presentation, you would obviously see this in the level of their presentation next time you sit in a meeting with such employee after learning has taken place. You will see that the same guy has been able to make (a) PowerPoint presentation or Excel Sheet by himself, and they do not need to rely on anyone”

Furthermore, he said:

As employees gain knowledge, they seek to apply it, leading to innovation and transformative changes that increase the quality of the products of the organisation”

Moreover, **PM1** commented:

“In terms of the quality of the of the organisation, workplace learning helps a lot”
PE3 also discussed the impact of workplace learning on the quality of the output produced by the educational institution where he is employed. He stated:

“The key positive impact is the well-functioning of the department. Workplace learning have yielded good results, which we have seen through the quality of output in my department in terms of research output, as well as undergraduate throughput rates”

Similarly, **PH1** elaborated on the impact of workplace learning in enhancing the quality of health care delivery at the hospital where she works. She said:

“Certainly, increased training leads to quality health care output. Ward rounds will be conducted more efficiently, procedures on patients will be expedited, and the process of managing critically ill patients in casualty units will be accelerated if doctors are well-trained, knowledgeable, and adequately prepared, resulting in higher quality health care services”

PH2 also reinforced the above position by stating that in her experience, workplace learning increases the quality of organisational output. She stated:

“The hospital is audited every six months or annually in terms of mortality rate, maternity mobility and other different reporting that are looked closely at provincial and national levels. So, improving on the training of doctors and supervision of junior doctors will surely bring about quality intervention into these different reporting and also improve on the public reviews of the hospital”

From a mining viewpoint, **PM1** added:

“Workplace learning enhances production quality in the mine. As employees engage in learning, they gain knowledge, and this knowledge drives them to apply what they have learned. Enhancing the quality of mining processing and boosting output for the organisation”

Based on the above analysis, some participants (**PMF1, PM1, PE3, PH1, PH2,**

and **PM1**) expressed the view that workplace learning enhances the quality of organisational output. Evidently, workplace learning equips employees with updated skills and knowledge, leading to improved efficiency and effectiveness. This process fosters innovation and enhances problem-solving capabilities, ultimately resulting in higher quality organisational products and services.

4.2 Theme 2: Workplace learning enhances organisational branding and reputation

Enhanced organisational branding was also one of the themes that emerged in terms of how workplace learning impacts organisations. Hence, **PM2** expressly noted:

“If I’m learning within the organisation, it’s not just about me; it’s also about the organisation and its specialised employees. Yes, it strengthened the company’s brand because, for example, if I work at company A and they enable me to grow, I will eventually become an expert with greater knowledge. So, when people see that I work for the organisation, engage with me, and realize I am extremely excellent, then it gives the company a very good image”

PH3 shared a similar perspective as above based on his experiences in the health care sector, and stated:

“Workplace learning helps to protect our organisation’s image, because as a public service we are established to ensure that people, especially those who cannot afford private healthcare, receive quality health care services. So, if we get trained, the chances of mismanaging patients then reduces and also reduces reputational damage on the part of the employer”

Additionally, **PH2** agreed with **PH3**, highlighting ways in which workplace learning influences specific outcomes that ultimately enhance her organisational branding. She articulated:

“When the audit of a hospital reflects favourable outcomes in mobility and mortality, alongside the calibre of the healthcare personnel due to effective training and oversight, the hospital’s reputation will consequently be enhanced”

PH1 concurred, and said:

“When a hospital has (a) good set of well-trained doctors who are confident in what they do, word will spread that this is the hospital with good doctors; there will be a larger referral base, people will refer to you, and when they see that you have managed the referral appropriately, your patients will grow, your unit in the hospital will become known for excellence”

The above participants (**PM2**, **PH3**, **PH2**, and **PH1**) affirmed that workplace learning plays a significant role in shaping organisational branding. This is because effective workplace learning contributes to the development of employee confidence and the cultivation of behaviours that align with the brand, as well as the necessary skills required to fulfil the brand promise, thereby transforming employees into genuine organisational brand ambassadors.

4.3 Theme 3: Workplace learning gives organisations a competitive advantage

Another recurring theme is that workplace learning give organisations a competitive advantage. In that regard, **PE3** reported:

“The knowledge we acquire can be showcased on a global stage during our travels for conferences and workshops, where we demonstrate what we have learned, including insights gained through workplace learning. Indeed, those are the impacts I would highlight, as they provide the university with a competitive edge”

PH2 added to **PE3**'s perspective by stating:

“Audits on mobility and mortality rates are usually comparative within the province and inter-provincial levels. So, you can easily pull out the mortality rate of under five years old children in hospitals in the past five years. These are statistics that get published every couple of years. So, if doctors are better trained and the mortality rates drop in a particular hospital, it will give the hospital a competitive advantage compared to others”

Furthermore, **PH1** emphasised the impact of workplace learning on her organisation's branding, which subsequently contributes to a competitive advantage for her organisation. She said:

“The effective branding of the hospital, stemming from its highly trained doctors, will undoubtedly provide the hospital with a competitive edge”

According to the responses of the aforementioned participants (**PE3**, **PH2**, **PH1**), workplace learning provides organisations with competitive advantage by enabling employees to acquire knowledge, expertise and competences, which ultimately benefits the organisation.



Figure 1: The Impact of Workplace Learning on Organisational Outcomes, Branding and Competitive Advantage.

5. Discussion of Findings

The study's findings indicated that workplace learning plays a significant role in enhancing organisational outcomes. **PM1** mentioned that workplace learning impacts the quality of organisational outputs. In this light, he commented:

“In terms of the quality of organisational output, workplace learning helps a lot”

This perspective supports other empirical research that examined the connection between workplace learning and organisational output. Vlachos (2008) found that extensive training was a significant predictor for all organisational output variables. Faems Sels, DeWinne and Maes (2005) revealed that training had a positive and significant impact on organisational productivity. These previous studies support the current findings about the impact of workplace learning on organisational outputs (Vlachos, 2008; Faems Sels, DeWinne & Maes, 2005; Adagbor,& Ukpere, 2024). Consequently, the development of skills and knowledge in the workplace leads to a measurable improvement in organisational performance, as it enhances employee productivity, efficiency, and innovation, resulting in improved organisational outputs. Therefore, allocating resources to

workplace learning and integrating it into metrics like sales per employee, net profit per employee, and gross margin, will enable organisations to effectively assess their outputs.

Likewise, some participants noted that organisational branding is bolstered by workplace learning. **PM2** maintained:

“If I’m learning within the organisation, it’s not just about me; it’s also about the organisation and its specialised employees. Yes, it strengthened the company’s brand because, for example, if I work at company A and they enable me to grow, I will eventually become an expert with greater knowledge. So, when people see that I work for the organisation, engage with me, and realize I am extremely excellent, then it gives the company a very good image”

Van Dam (2018) posit that “the brand of an organisation is an important asset that represents its market success, financial strength, industry position, as well as products and services”. Lenka and Chawla (2015) assert that a learning organisation cultivates a robust employer brand by fostering employees' emotional attachment. Garvan, Koukpaki, Darcy, O’Brien, Oyedijo, and Adams (2022) point out that HRM practices such as workplace learning significantly contribute to employees' acquisition of knowledge, skills, and abilities (KSAs), which are necessary for them to serve as brand ambassadors. This indicates that to effectively serve as brand ambassadors, employees must possess mental understanding of the brand (Pinar, Girard, Trapp & Eser, 2016), comprehend their role in relation to the brand (Xiong, King & Piehler, 2013), maintain an emotional connection to the brand (King & Grace, 2012; Ukpere, Mapira, & Mitonga-Monga, 2024), and exhibit the required service skills to consistently fulfil the brand promises. Therefore, through workplace learning, organisations can enhance their brands by cultivating a skilled and motivated workforce that serves as brand ambassadors, aligning employees with the organisation's values, and elevating the organisation's reputation as an attractive employer. Organisations should invest in workplace learning with the rationale of demonstrating its commitment to its employees. This investment will enhance the employer brand, attract top talent, and retain employees who take pride in representing the company.

Lastly, participants shared the perspective that workplace learning also provides a competitive advantage to their organisations. **PH1**, who is a medical doctor, highlighted the significance of workplace learning for her organisation's branding, providing it with a competitive edge. In that regard, She articulated:

“The effective branding of the hospital, stemming from its highly trained doctors, will undoubtedly provide the hospital with a competitive edge”

This finding echoes the result from Falola, Osibanjo, and Ojo's (2014) study, which highlighted that behavioural training strategies such as mentorship, coaching, apprenticeship, and job rotation, significantly influenced both employees and the organisation's competitiveness. Ngcobo (2022) emphasised the necessity of establishing a comprehensive framework for ongoing employee learning to enhance organisational performance and competitiveness. These studies corroborate the current finding of this study, and recommend that workplace learning initiatives can be implemented to strengthen employees' capabilities to enhance the organisation's competitiveness. The limitations of the study would be discussed next.

6. Limitation of the study

This study presents robust findings while also recognizing its limitations. The data, collected from fifteen participants within diverse South African organisations, demonstrates a degree of subjectivity and may not accurately reflect the wider landscape of workplace learning experiences. The purposive nature of the sampling method, combined with its restricted focus on five industries, highlights further limitations. Participants exhibited a lack of familiarity with theoretical concepts in workplace learning, necessitating clarifications from the researcher. To address potential researcher bias, which is frequently encountered in qualitative research, reflexivity and bracketing practices were employed as mitigation such limitations.

7. Conclusion

Workplace learning significantly predicts various organisational output variables, leading to measurable enhancements in performance through improved employee productivity, efficiency, and innovation. By allocating resources to workplace learning and integrating it into metrics such as sales per employee and gross margins, organisations can effectively accelerate their outputs. Additionally, workplace learning shapes organisational branding by enabling employees to act as brand ambassadors who understand their brand, their roles, and possess the necessary service skills. Consequently, fostering a skilled and motivated workforce through workplace learning aligns employees with organisational values and enhances brand reputation. More than that, workplace learning provides a competitive edge by strengthening employees' capabilities, thereby positively impacting organisational outcomes, branding, and competitiveness.

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CHANGE MANAGEMENT AND EMPLOYEE CONFORMITY TO ORGANIZATIONAL OBJECTIVES IN MEDICAL DIAGNOSTIC CENTERS

Marcellinus Chukwuka IHIONU¹

¹Enugu State University of Sciences and Technology, Department of Business Administration, ESUT Main Campus, Agbani, Enugu State, Nigeria

E-mail:mcchuksdiagnostics@gmail.com, Phone: + 055-98446, 98448

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Abstract

The study examined the influence of change management on employees' conformity to organizational objectives in medical diagnostic centers in Enugu state. The objectives of the study, were to; assess the impact of effective communication during change management on employee conformity to organizational objectives; evaluate the role of employee involvement in change management processes in enhancing conformity to organizational goals; and analyze the influence of resistance to change on employee alignment with organizational objectives in medical diagnostic centers. The study adopted a descriptive survey method. 10 medical diagnostic centers in operating in Enugu metropolis, were randomly selected for the study. 160 employees were conveniently sampled with the use of structured questionnaires. Pearson r Product Moment Correlation, was the statistical tool used in testing the null hypotheses. The study found out that; effective communication during change management has a significant impact on employees' conformity in medical diagnostic centers in Enugu state ($r = 0.96, p < .01$); employees' involvement in change management processes does play a significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state ($r = 0.05, p < .05$); and resistance to change does have a negative significant influence on employees' alignment with organizational objectives in medical

diagnostic centers in Enugu state ($r = -0.52, p < .01$). The study concluded that change management has both positive and negative influence on employee conformity to organizational objectives in medical diagnostic centers in Enugu State. The study recommended that medical diagnostic centers in Enugu state should; properly communicate their change management policies; adopt industrial democracy and properly engage their employees

Keywords: change management, employees' conformity, organizational objectives, resistance to change

JEL Classification: M12, M54, I10

Introduction

Change management is a critical aspect of organizational development, particularly in dynamic sectors such as healthcare, where rapid advancements in technology, evolving patient needs, and regulatory requirements necessitate continuous adaptation. In medical diagnostic centers, effective change management is essential to ensure that employees align with organizational objectives, thereby enhancing service delivery and patient outcomes. However, the process of implementing change is often met with resistance, particularly when employees perceive it as disruptive or misaligned with their professional values or routines. This study focuses on the relationship between change management and employee conformity to organizational objectives in medical diagnostic centers in Enugu State, Nigeria. By exploring this relationship, the research aims to provide insights into how healthcare organizations can navigate change effectively while fostering employee commitment to organizational goals.

One of the primary challenges in change management within medical diagnostic centers is the inherent resistance to change among employees. Healthcare professionals, including laboratory technicians, radiologists, and administrative staff, often operate within well-established routines and protocols. When changes are introduced, such as the adoption of new diagnostic technologies or shifts in organizational policies, employees may resist due to fear of the unknown, lack of understanding, or perceived threats to their job security (Cummings & Worley, 2014). This resistance can hinder the successful implementation of change initiatives, ultimately affecting the organization's ability to achieve its objectives. In Enugu State, where medical diagnostic centers play a vital role in healthcare delivery, understanding the factors that influence employee conformity to change is crucial for improving organizational performance.

Another significant problem is the lack of effective communication during the change process. In many organizations, change initiatives fail because employees are not adequately informed about the reasons for the change, its benefits, and their roles in the process (Kotter, 2012). In medical diagnostic centers, where precision and accuracy are paramount, unclear communication can lead to misunderstandings, errors, and decreased morale. For instance, the introduction of a new laboratory information system may require extensive training and clear communication to ensure that employees understand how to use the system effectively. Without proper communication, employees may feel alienated or unsupported, leading to non-conformity with organizational objectives.

Additionally, the absence of employee involvement in the change process poses a significant challenge. Research has shown that involving employees in decision-making and planning stages of change initiatives increases their commitment and reduces resistance (Armenakis & Bedeian, 1999). In medical diagnostic centers, where employees possess specialized knowledge and skills, their input can be invaluable in designing and implementing changes that are both practical and effective. However, in many organizations, change is often imposed from the top down, with little consideration for the perspectives of frontline staff. This lack of involvement can result in a disconnect between organizational objectives and employee actions, ultimately undermining the success of change initiatives.

Finally, the cultural and organizational context of Enugu State presents unique challenges to change management in medical diagnostic centers. Nigeria's healthcare system is characterized by resource constraints, inadequate infrastructure, and a high patient-to-staff ratio, all of which can exacerbate the difficulties of implementing change (World Health Organization, 2020). In Enugu State, where medical diagnostic centers serve a diverse population, these challenges are compounded by cultural factors that influence employee attitudes and behaviors. For example, hierarchical structures and traditional norms may discourage open communication and employee participation, further complicating the change process. Addressing these contextual factors is essential for fostering employee conformity to organizational objectives and ensuring the successful implementation of change initiatives.

In conclusion, this study seeks to explore the relationship between change management and employee conformity to organizational objectives in medical diagnostic centers in Enugu State. By addressing the challenges of resistance to change, ineffective communication, lack of employee involvement, and contextual factors, the research aims to provide actionable recommendations for healthcare

organizations. Ultimately, the findings of this study will contribute to the broader discourse on change management in healthcare, offering insights that can enhance organizational performance and patient care in Enugu State and beyond.

Research Objectives

The main objective of this study is to examine the relationship between change management practices and employee conformity to organizational objectives in medical diagnostic centers in Enugu State, Nigeria. Other specific objectives are;

1. To assess the impact of effective communication during change management on employee conformity to organizational objectives.
2. To evaluate the role of employee involvement in change management processes in enhancing conformity to organizational goals.
3. To analyze the influence of resistance to change on employee alignment with organizational objectives in medical diagnostic centers.

Research Questions

These questions were answered in the course of the study;

What impact does effective communication during change management have on employee conformity to organizational goals?

What role does employee involvement in change management processes play in enhancing conformity to organizational goals?

What influence does resistance to change have on employee alignment with organizational objectives in medical diagnostic centers in Enugu state?

Hypotheses

The following null hypotheses were tested in the course of the study;

1. Effective communication during change management does not have any significant impact on employee conformity in medical diagnostic centers in Enugu state
2. Employee involvement in change management processes does not play any significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state
3. Resistance to change does not have any significant influence on employee alignment with organizational objectives in medical diagnostic centers in Enugu state

Conceptual Review

Change Management Practices

Change management practices refer to the structured approaches and strategies organizations use to transition individuals, teams, and systems from a current state

to a desired future state. These practices include planning, communication, training, and monitoring to ensure that changes are implemented smoothly and effectively. In the context of medical diagnostic centers, change management practices may involve introducing new technologies, updating protocols, or restructuring workflows to improve efficiency and patient care. Effective change management practices are critical for minimizing disruption, addressing employee concerns, and achieving organizational goals (Cummings & Worley, 2014).

Effective Communication

Effective communication in change management involves the clear, timely, and transparent exchange of information between organizational leaders and employees. It ensures that employees understand the reasons for change, the benefits it brings, and their roles in the process. In medical diagnostic centers, effective communication can reduce uncertainty, build trust, and foster a sense of inclusion among employees, thereby increasing their willingness to adapt to new practices (Kotter, 2012). Without effective communication, employees may feel disconnected from the change process, leading to confusion, resistance, and non-conformity to organizational objectives.

Employee Involvement

Employee involvement refers to the active participation of employees in the planning, decision-making, and implementation stages of change initiatives. When employees are involved, they are more likely to feel valued and committed to the change process, which enhances their willingness to align with organizational objectives. In healthcare settings, such as medical diagnostic centers, involving employees in change initiatives can leverage their expertise and insights, leading to more practical and sustainable solutions (Armenakis & Bedeian, 1999). This participatory approach also helps to reduce resistance and increase ownership of the change process.

Resistance to Change

Resistance to change is the opposition or reluctance exhibited by employees when faced with new processes, technologies, or policies. This resistance often stems from fear of the unknown, lack of understanding, or perceived threats to job security or professional autonomy. In medical diagnostic centers, resistance to change can manifest as decreased productivity, errors, or outright rejection of new systems, ultimately hindering the achievement of organizational objectives (Cummings & Worley, 2014). Addressing resistance requires effective communication, employee involvement, and supportive leadership to ease the transition.

Employee Alignment

Employee alignment refers to the degree to which employees' actions, behaviors, and goals are consistent with the strategic objectives of the organization. When employees are aligned, they understand and prioritize the organization's mission, vision, and values, which enhances overall performance. In medical diagnostic centers, alignment ensures that employees work cohesively toward improving patient care and operational efficiency (Huselid, 1995). Achieving alignment requires clear communication, leadership support, and a shared understanding of organizational goals.

Employee Conformity to Organizational Objectives

Employee conformity to organizational objectives is the extent to which employees adhere to and support the goals, policies, and procedures set by the organization. This conformity is essential for ensuring consistency, efficiency, and the successful implementation of change initiatives. In medical diagnostic centers, conformity to organizational objectives ensures that employees follow standardized protocols, maintain quality standards, and contribute to the overall mission of providing accurate and timely diagnostic services (Armenakis & Bedeian, 1999). It is influenced by factors such as effective communication, employee involvement, and the management of resistance to change.

Theoretical Framework

The Institutional Theory (DiMaggio and Powell, 1983)

The institutional theory provides a compelling lens for understanding change management and employee conformity in medical diagnostic centers. According to DiMaggio and Powell (1983), organizations operating within the same institutional environment tend to develop similar structures and practices through isomorphic mechanisms, including coercive, mimetic, and normative pressures. In the context of medical diagnostic centers in Enugu State, these pressures can significantly influence employee behaviors and their alignment with organizational objectives. Coercive isomorphism, driven by formal and informal pressures from both external regulatory bodies and organizational leadership, can compel employees to adapt to new institutional expectations and change management strategies (Scott, 2008). This theoretical perspective suggests that employees in medical diagnostic centers are not merely passive recipients of organizational change, but active participants who negotiate their conformity within a complex institutional landscape.

The Social Exchange Theory (Blau, 1964)

The social exchange theory further complements the institutional theory by explaining the underlying motivational dynamics of employee conformity. Blau (1964) posits that organizational relationships are fundamentally based on reciprocal exchanges, where employees evaluate the costs and benefits of conforming to organizational objectives. In medical diagnostic centers, this theoretical framework implies that employees' willingness to embrace change is contingent upon perceived organizational support, fairness of change implementation, and potential personal and professional rewards. The perceived quality of leadership, communication effectiveness, and opportunities for professional development can significantly influence employees' psychological contract and their subsequent commitment to organizational change (Rousseau, 1995). By integrating social exchange theory with institutional theory, researchers can develop a more nuanced understanding of the complex interplay between organizational change management strategies and employee conformity in medical diagnostic centers in Enugu State.

Empirical Review

The impact of effective communication during change management on employee conformity to organizational objectives.

Mishra, Boynton and Mishra (2020) study highlighted how effective internal communication during organizational change fosters employee engagement and conformity to organizational objectives. The findings suggest that transparent and consistent communication reduces uncertainty and aligns employees with organizational goals.

Men and Jiang (2021) study emphasized the role of leadership communication and the choice of communication channels in enhancing employee engagement and conformity during change. The study found that two-way communication platforms, such as town halls and feedback sessions, significantly improve alignment with organizational objectives.

Karanges, Johnston and Beatson (2019) study explored how internal communication strategies during change management influence employee engagement and conformity. The findings suggest that personalized and empathetic communication enhances employee alignment with organizational goals.

Shin, Taylor and Seo (2022) study examined how communication resources, such as clear messaging and emotional support, influence employee attitudes and behaviors during change. The results indicate that effective communication reduces resistance and enhances conformity to organizational objectives.

Allen and Brown (2023) study investigated the role of digital communication tools, such as intranets and collaboration platforms, in fostering employee alignment during change. The findings suggest that digital tools enhance transparency and engagement, leading to greater conformity to organizational objectives.

The role of employee involvement in change management processes in enhancing conformity to organizational goals.

Cinite and Duxbury (2020) meta-analysis examined the impact of employee participation in change management. The study found that involving employees in decision-making significantly enhances their commitment and conformity to organizational goals.

Bakari, Hunjra and Niazi (2021) study explored how employee involvement in change processes in the banking sector enhances alignment with organizational goals. The findings suggest that participatory approaches foster ownership and reduce resistance.

Sanders, et. al. (2020) study highlighted how involving employees in change processes during the COVID-19 pandemic improved their alignment with organizational goals. The findings emphasize the importance of participatory decision-making in times of crisis.

Khan, Tang and Zhu (2023) study examined the role of employee involvement in change management in healthcare organizations. The study found that involving employees in planning and implementation significantly enhances their conformity to organizational objectives.

Giangreco and Peccei (2022) study explores how involving middle managers in change processes reduces resistance and enhances alignment with organizational goals. The findings suggest that participatory approaches are critical for successful change implementation.

The influence of resistance to change on employee alignment with organizational objectives in medical diagnostic centers

Battilana and Casciaro (2021) study examined how resistance to change in healthcare organizations, including medical diagnostic centers, can be mitigated through strong interpersonal relationships. The findings suggest that addressing emotional resistance improves employee alignment with organizational objectives.

Hussain, et. al. (2020) study explored the impact of resistance to change on employee alignment in healthcare settings. The study found that resistance significantly hinders conformity to organizational objectives and recommends targeted interventions to address it.

Vakola and Petrou (2022) study investigated how resistance to change in medical diagnostic centers leads to stress and reduced alignment with organizational goals. The findings suggest that providing support and resources can mitigate resistance and improve conformity.

Rafferty and Jimmieson (2023) study examined the interplay between resistance to change and employee resilience in healthcare organizations. The findings reveal that addressing resistance through resilience-building programs enhances alignment with organizational objectives.

Oreg and Berson (2023) study explored the multilevel factors contributing to resistance to change in healthcare organizations. The study found that resistance at both individual and organizational levels negatively impacts employee alignment with organizational goals.

Gaps in Literatures Reviewed

The existing body of research on change management, employee conformity, and resistance to change provides valuable insights into the roles of communication, employee involvement, and resistance in shaping organizational outcomes. However, several gaps remain. First, while studies emphasize the importance of effective communication and employee involvement, there is limited research on how these factors interact in specific high-stakes environments, such as medical diagnostic centers, where rapid technological and procedural changes are common. Second, much of the literature focuses on general organizational settings, leaving a gap in understanding how resistance to change manifests uniquely in healthcare contexts and how it impacts employee alignment with organizational objectives. Third, there is a lack of recent empirical studies (2019–2024) that explore the combined effects of communication, involvement, and resistance in fostering conformity to organizational goals, particularly in dynamic and high-pressure industries like healthcare.

Methodology

Research Design

The research design adopted in this study was descriptive survey research design. The research design is best suited for this study because it permits the collection of original data and described the conditions as they existed in their natural setting. It studies the opinions, attitude, behaviours and beliefs of persons on the problems of this study.

Area of the Study

The study was carried out in among 10 diagnostic centers situated in Enugu Metropolis.

Instrument for Data Collection

Data were sourced from both primary and secondary sources. The primary data was sources through the use of five-response, Likert-typed, structured questionnaires. Items were formulated to measure, the research objectives of change management and employee conformity to organizational objectives in medical diagnostic centers in Enugu State. Also, data were sourced from secondary sources like journals, text books, online resources that reviewed the variable of interest; change management and employee conformity to organizational objectives.

Population of the Study

Employees from the selected medical diagnostic centers which totaled 160, comprised the population of interest in this study.

Distribution of Members of selected medical diagnostic centers In Enugu State

S/N	Trade	No. of Employees
1	Covenant Diagnostic Centre	7
2	Divineville Medical Diagnostic Centre	18
3	Hope Diagnostic Centre	9
4	Greenleaf Medical Diagnostic Centre	41
5	Ekene Medical Laboratory	26
6	ProLife Medical Diagnostic Centre	12
7	Savannah Diagnostic Centre	4
8	McClelland Diagnostic Centre	8
9	Ntasiobi Diagnostic Centre	11
10	Ebony Life Diagnostic Centre	24
	Total	160

Sampling Technique

The study adopted purposive sampling technique in selecting the diagnostic centers incorporated in the study. While convenient sampling technique was adopted in sampling all the respondents incorporated in the study.

Reliability of Test Instrument

A pilot study was adopted in order to check for the validity and reliability of the questionnaire formulated. 30employees from 3 medical diagnostic centers in Abakaliki, Ebonyi state were conveniently drawn for the study, for the pilot test of

the questionnaire and a Cronbach Alpha of $\alpha = .83$ was gotten, thus affirming the internal consistency of the questions contained in the questionnaire.

Validity of Test Instrument

The face and content validity of the instrument was used by giving out the copies of the questionnaires to experts in the field of Research in Management Science to confirm the authenticity of the items contained in the questionnaire, in the measurement of the intended variables.

Method of Data Analyses

Data from the questionnaire were analyzed with the aid of SPSS version 23. Data from the questionnaire were analyzed using Pearson r Product Moment Correlation with the aid of statistical packages for social sciences (SPSS) version 23.

Decision Rule

H_0 will be accepted if the significance level is less than $p < .05$.

Results

Hypothesis 1: Effective communication during change management does not have any significant impact on employee conformity in medical diagnostic centers in Enugu state

Table: Correlation between effective communication during change management and employee conformity

		Effective communication during change management	Employee conformity
Pearson Correlation	Effective communication during change management	1.000	.964
	Employee conformity	.964	1.000
Sig. (1-tailed)	Effective communication during change management	.	.000
	Employee conformity	.000	.
N	Effective communication during change management	160	160
	Employee conformity	160	160

Table 4.52 shows that there is a strong positive relationship between effective communication during change management and employee conformity in medical diagnostic centers in Enugu state which is statistically significant ($r = 0.96$, $p < .01$),

because the significance level is less than .001. Therefore, the null hypothesis is not confirmed, hence, effective communication during change management has a significant impact on employees' conformity in medical diagnostic centers in Enugu state.

Hypothesis 2: Employee involvement in change management processes does not play any significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state

Table 2: Correlation between Employee involvement and Conformity to Organizational Goals

		Employee involvement in change management processes	Conformity to organizational goals
Pearson Correlation	Employee involvement in change management processes	1.000	.047
	Conformity to organizational goals	.647	1.000
Sig. (1-tailed)	Employee involvement in change management processes	.	.023
	Conformity to organizational goals	.023	.
N	Employee involvement in change management processes	160	160
	Conformity to organizational goals	160	160

Table 4.53 shows that there is a moderate significant relationship between employee involvement in change management processes and conformity to organizational goals. It is statistically significant ($r= 0.05$, $p< .05$), because the significance level is less than .05 ($p= .023$). Therefore, the null hypothesis is not confirmed, hence, employees' involvement in change management processes does play a significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state.

Hypothesis 3: Resistance to change does not have any significant influence on employee alignment with organizational objectives in medical diagnostic centers in Enugu state

Table 3: Correlations Between Resistance to change and Employee alignment with org. objectives

		Resistance to change	Employee alignment with organizational objectives
Pearson Correlation	Resistance to change	1.000	-.522
	Employee alignment with organizational objectives	-.522	1.000
Sig. (1-tailed)	Resistance to change	.	.000
	Employee alignment with organizational objectives	.000	.
N	Resistance to change	160	160
	Employee alignment with organizational objectives	160	160

Table 4.55 shows that there is a negative relationship between resistance to change and employee alignment with organizational objectives which is statistically significant ($r = -0.52$, $p < .01$), because the significance level is less than .001. Therefore, the null hypothesis is not confirmed, hence, resistance to change does have a negative significant influence on employees' alignment with organizational objectives in medical diagnostic centers in Enugu state.

Findings

The study found out that;

1. Effective communication during change management has a significant impact on employees' conformity in medical diagnostic centers in Enugu state ($r = 0.96$, $p < .01$).
2. Employees' involvement in change management processes does play a significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state ($r = 0.05$, $p < .05$)
3. Resistance to change does have a negative significant influence on employees' alignment with organizational objectives in medical diagnostic centers in Enugu state ($r = -0.52$, $p < .01$)

Discussion

The study examined the influence of change management on employee conformity to organizational objectives in medical diagnostic centers in Enugu State.

The study found out that effective communication during change management has a significant impact on employees' conformity in medical diagnostic centers in Enugu state ($r = 0.96$, $p < .01$), which implies that management that properly communicated the change management policies to their staff are more likely to get their compliance. The finding aligns with Mishra, Boynton and Mishra (2020) study, which found out that transparent and consistent communication reduces uncertainty and aligns employees with organizational goals; Men and Jiang (2021) study, which found that two-way communication platforms, such as town halls and feedback sessions, significantly improve alignment with organizational objectives; Karanges, Johnston and Beatson (2019) study, which found out that personalized and empathetic communication enhances employee alignment with organizational goals; and Shin, Taylor and Seo (2022) study, which results indicated that effective communication reduces resistance and enhances conformity to organizational objectives. Also, the finding confirmed, Blau (1964) social exchange theory, which states that perceived quality of leadership, communication effectiveness, and opportunities for professional development can significantly influence employees' psychological contract and their subsequent commitment to organizational change (Rousseau, 1995). Thus, effective communication of policies is key to employees' conformity to change management.

Furthermore, the study found that employees' involvement in change management processes does play a significant role in enhancing conformity to organizational goals in medical diagnostic centers in Enugu state ($r = 0.05$, $p < .05$). This finding confirms the relevance of industrial democracy in change management processes. Industrial democracy gives opportunity to employees in an organization to actively participate in the decision-making processes. Thus, an effective change management processes is dependent on employees' involvement, because it takes into cognizance the opinions, suggestions, criticisms and contributions of the employees on the areas in the organizational norms, policies and structure that need to be fixed. This finding correlated with Cinite and Duxbury (2020) study, which found out that involving employees in decision-making significantly enhances their commitment and conformity to organizational goals; Bakari, Hunjra and Niazi (2021) study, which found out that participatory approaches foster ownership and reduce resistance; Sanders, et. al. (2020) study, which emphasized on the

importance of participatory decision-making in times of crisis; and Khan, Tang and Zhu (2023) study, which found out that involving employees in planning and implementation significantly enhances their conformity to organizational objectives. More so, Blau (1964) social exchange theory posits that organizational relationships are fundamentally based on reciprocal exchanges, where employees evaluate the costs and benefits of conforming to organizational objectives. This is what happens when employees get involved in change management processes, thereby, establishing a symbiotic relationship between the management and employees in medical diagnostic centers.

Finally, the study found out that resistance to change does have a negative significant influence on employees' alignment with organizational objectives in medical diagnostic centers in Enugu state ($r = -0.52, p < .01$), this implies that when employees resist change policies, they become recalcitrant, counterproductive and abusive in their jobs, which are detrimental to organizational growth. This finding confirms Hussain, et. al. (2020) study, which found out that resistance significantly hinders conformity to organizational objectives; and Oreg and Berson (2023) study found out that resistance at both individual and organizational levels negatively impacts employee alignment with organizational goals. This resistance to change is better explained by DiMaggio and Powell (1983) institutional theory, which stated that coercive isomorphism, driven by formal and informal pressures from both external regulatory bodies and organizational leadership, can compel employees to adapt to new institutional expectations and change management strategies (Scott, 2008), this coercive approach can trigger counterproductive behavior, which employees express in order to resist the change.

Conclusion

The study has concluded that change management has both positive and negative influence on employee conformity to organizational objectives in medical diagnostic centers in Enugu State. The study has equally proven that effective communication during change management positively influences on employees' conformity, due to clarity of policy objectives. Also, the study has equally shown that employees' involvement in change management processes does play a significant role in enhancing conformity to organizational goals, thus, incorporating employees' opinions, suggestions and criticism improve their alignment with organizational objectives. Finally, resistance to change has a negative influence on employees' alignment with organizational objectives, which is expressed in employees' counterproductive behavior.

Recommendations

The study then recommended;

1. Proper Communication of Change Policies: Managements of medical diagnostic centers in Enugu state, should make their policies clear and comprehensive to all employees in their organization.

2. Industrial democratic approach: Managements should incorporate this strategy, which will allow employees to participate in the company's decision-making processes, thereby, fostering conformity, compliance and alignment with organizational objectives.

3. Proper Engagement of Employees: Management should educate employees on the need for change policies and how the policies will be systematically implemented to the benefits of the organization. This approach will mitigate resistance.

Contribution to Knowledge

The study has statistically and empirically proven that change management has a significant influence on conformity of employees to organizational objectives in medical diagnostic centers in Enugu state.

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DECISION-MAKING PROCESSES, EXPERTISE AND LIMITED RATIONALITY: COGNITIVE, ORGANIZATIONAL MODELS AND STRATEGIES FOR CHOOSING BETWEEN RISK, FORECASTING AND CREATIVITY IN ORGANIZATIONAL AND BUSINESS CONTEXTS

Stefano AMODIO¹

¹ *SSML Salerno; Fondazione Istituto Teseo Alta Formazione e Ricerca, Salerno, Italy*

Tel: (+39) 340-1660358, E-mail: presidenza@istitutoteseo.eu

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Abstract

This paper develops an interdisciplinary framework for understanding decision-making as a dynamic and context-dependent process shaped by cognitive limitations, organizational structures, and cultural influences. Moving beyond classical models of full rationality, it adopts the perspective of bounded and adaptive rationality, integrating insights from cognitive psychology, neuroscience, and organizational theory. Decision-making is reconceptualized as a situated practice relying on heuristics, prediction mechanisms, and metacognitive regulation rather than optimal calculation.

Drawing on recent neuroscience, the study highlights how predictive processes and cognitive biases—such as overconfidence and planning fallacy—are not merely errors but adaptive responses to uncertainty. At the organizational level, decisions are shown to emerge from collective dynamics, power relations, and complexity-reduction mechanisms that shape perceptions of risk and uncertainty. Creativity is further examined as a key resource in

ambiguous contexts, enabling the reconfiguration of decision spaces beyond linear reasoning.

The paper also incorporates perspectives from pre-modern epistemic traditions, emphasizing the historical continuity of awareness regarding human fallibility. Overall, it proposes an epistemological shift in which uncertainty, limitation, and creativity are seen as constitutive elements of decision-making. This approach offers implications for theory, organizational practice, and the development of decision-making competencies grounded in the ability to navigate, rather than eliminate, uncertainty.

Keywords: *decision-making; bounded rationality; cognitive biases; organizational decision processes; human cognition; neuroscience; forecasting; risk and uncertainty; creativity; heuristics; adaptive rationality; complex systems*

JEL Classification: D01, D03, D81, M10, M19, Z13

Introduction

The present paper proposes an advanced and interdisciplinary theoretical analysis of the human decision-making process, assuming the decision not as a punctual act of rational choice between given alternatives, but as a complex, dynamic and emergent phenomenon, located at the intersection of neurocognitive architectures, organizational constraints, cultural frameworks and long-lasting symbolic-epistemic traditions. Starting from a systematic critique of the classical normative models of rationality, the article is explicitly placed within the paradigm of limited and adaptive rationality, integrating contributions from cognitive psychology, decision-making neuroscience, complex systems theory and sociology of organizations, with a reflective dialogue that also includes pre-modern sources and non-Western wisdom traditions. The basic assumption that guides the entire work is that the decision cannot be adequately explained or prescribed through abstract optimizing models, based on the hypothesis of fully informed and cognitively omnipotent agents, but requires a radical reconceptualization that takes into account cognitive finiteness, the structural fallibility of judgment and the ontological uncertainty that characterizes real decision-making contexts. In this perspective, rationality is redefined as a situated, historically and culturally mediated practice, which is expressed through adaptive strategies, functional heuristics and metacognitive regulation processes rather than through the exhaustive calculation of probabilities and utilities. A central axis of the argument

is represented by the integration between psychological models of decision making and the most recent acquisitions of cognitive and computational neuroscience. Research developed in the last two decades at leading institutions such as Harvard, Yale, Berkeley, Oxford and Cambridge has shown how the human brain operates according to principles of approximate probabilistic prediction, implementing forms of embodied Bayesian inference based on prediction cycles and prediction error. These mechanisms, far from guaranteeing the infallibility of the judgment, structurally make systematic biases, illusions of control and forecasting distortions structurally inevitable, which nevertheless play an adaptive function in allowing action in conditions of incomplete information and time pressure. The article pays particular attention to the role of prediction and planning, showing how these practices, often considered tools for rational control of the future, actually function as regulatory and performative devices that organize action in the present rather than as reliable predictive tools. In this key, planning fallacy, overconfidence and resistance to disconfirming information are interpreted not as mere cognitive dysfunctions, but as expressions of a constitutive tension between the human need for meaning and narrative coherence and the non-linear complexity of the systems in which decisions are called upon to produce effects. A further original contribution of the work lies in the analysis of the collective and organizational dimension of the decision. Through dialogue with the sociology of systems and the theory of organizations, it is shown how collective decisions are the product of power dynamics, processes of symbolic legitimation and mechanisms of complexity reduction that transcend the sum of individual choices. Organizations are thus interpreted as structured cognitive environments that select, amplify or inhibit certain forms of rationality, profoundly influencing risk perception, uncertainty assessment and error tolerance. Within this systemic framework, creativity is conceptualized as a fundamental decision-making resource in contexts characterized by high ambiguity and insufficiency of existing models. Far from being a marginal attribute or a merely aesthetic factor, creativity emerges as an advanced cognitive function that allows the restructuring of the decision-making space, making possible solutions that do not derive by linear deduction from the past. Neuroscientific evidence indicates that this function is based on a dynamic interaction between associative networks and executive control systems, confirming that decision-making creativity is the result of an unstable balance between exploratory openness and regulatory constraint. A distinctive element of the article is represented by the inclusion, alongside contemporary scientific sources, of references to pre-modern epistemic traditions — Aramaic, Jewish,

Sunni Islamic, Caucasian and Balkan — which have thematized in symbolic and normative forms the problem of the fallibility of judgment and acting in conditions of uncertainty. Far from constituting an erudite ornament, such references are used to show the historical persistence of an epistemic awareness of limit, which anticipates and enriches the most recent scientific formulations of decision-making fallibilism. In these traditions, the decision appears as a responsible act that assumes the risk of error without renouncing the obligation to act, configuring a prudential rationality surprisingly similar to contemporary conceptions of adaptive rationality. Overall, the article proposes a vision of decision making as an intrinsically interdisciplinary process, in which biology, cognition, culture and organization are inextricably intertwined. The conclusions do not offer a definitive prescriptive model, but outline an interpretative framework that recognizes the plurality of levels involved and the need for a radical theoretical dialogue between cognitive sciences, neurosciences, social sciences and historical epistemic traditions. In this perspective, the fallibility of judgment does not represent a deficit to be corrected, but the condition of possibility of an authentically human rationality, capable of learning, reviewing one's hypotheses and innovating in complex and unpredictable contexts. The originality of the contribution therefore lies not so much in the introduction of new formal models, as in the proposal of an epistemological reconceptualization of decision making, which assumes limit, uncertainty and creativity as constitutive and not accidental elements of the decision-making process. This perspective offers relevant implications for theoretical research, organizational design and advanced decision training, suggesting that decision-making competence should be understood as a reflective ability to inhabit uncertainty rather than as an ability to eliminate it.

1. Decision making and complexity: a systems perspective

The decision, considered in its deepest articulation and removed from any attempt at procedural reduction, is configured as an emergent phenomenon that is located at the intersection between systemic complexity, epistemic limits of the cognitive agent and nonlinear dynamics typical of open systems. In this perspective, the decision is neither a discrete act nor a simple deliberative outcome, but a procedural event that is inscribed in a network of multilevel interactions, in which cognitive, symbolic, institutional and historical factors contribute to the configuration of irreversible trajectories of action. Talking about decision in systemic terms implies, therefore, definitively abandoning the mechanistic metaphor of the sovereign rational agent, replacing it with an ecological conception

of action, in which the decision-maker is simultaneously constrained and enabled by the structures that precede and exceed him (Simon, 1977; Morin, 1990). The complexity that characterizes contemporary decision-making environments cannot be interpreted as a mere quantitative increase in the variables involved, but as a qualitative transformation of the structure of the decision-making problem itself. In complex adaptive systems, in fact, the relationships between elements are not additive or proportional, but recursive, emergent and often opaque to linear prediction. In such contexts, information does not present itself as a neutral datum to be processed, but as an interpretative construct that acquires meaning only within historically and culturally determined semantic frameworks. It follows that the decision cannot be understood as an optimal selection of predefined alternatives, but as an act of contingent reduction of indeterminacy, which produces meaning even before operational outcomes (Luhmann, 1984). This systemic conception of decision finds surprising antecedents in pre-modern traditions of thought, in which human action is inscribed in a cosmological and symbolic order that limits and at the same time directs its rationality. In Jewish wisdom literature, for example, the notion of *binâ* (בִּינָה) does not indicate a capacity for abstract calculation, but a form of discernment that emerges from the interweaving of experience, collective memory and epistemic fear of human limitations (*Prov.* 2:3–6, Masoretic text.) Similarly, in the Aramaic fragments of Qumran, the concept of *sakal* (סָכַל), far from denoting mere intelligence, designates a competence located in the reading of the signs of the times (*peshet*), that is, in the ability to direct action in an intrinsically opaque world (1QpHab VII, 1–5). In a similar perspective, the classical Sunni tradition has developed a sophisticated epistemology of practical decision-making, based on the explicit recognition of uncertainty (*ẓann*) as a structural condition of human action. In *uṣūl al-fiqh*, the decision-making act (*ḥukm ‘amalī*) does not derive from an apodictic deduction, but from a process of balancing normative sources, situational context and ethical purposes (*maqāṣid*), in which rationality is intrinsically procedural and fallible (al-Shāfi‘ī, *al-Risāla*; al-Ghazālī, *al-Mustasfā*). The Qur’anic expression “*wa mā ūtītum minā l-‘ilmi illā qalīlā*” (وَمَا أُوتِيتُمْ مِنَ الْعِلْمِ إِلَّا قَلِيلًا; Q 17:85) enshrines, in theological form, the principle of epistemic limitation as the foundation of responsible action. The systemic perspective on the decision also allows us to critically reconsider the relationship between knowledge and control. In complex systems, the increase in information does not necessarily produce a proportional increase in the ability to predict; on the contrary, it can amplify uncertainty, generating counterintuitive effects and making decision-making structures unstable. This paradox is already

implicitly thematized in late antique philosophy, where the notion of *γνώσις* is distinguished from *σοφία*, the latter understood as awareness of the limits of human knowledge (Pseudo-Dionysius the Areopagite, *De divinis nominibus*, VII). In modern terms, this is tantamount to recognizing that decision is not an act of cognitive domination over complexity, but a practice of navigating within it. The idea of decision as a systemic event finds a further radicalization in the theory of social systems, according to which the decision is not an attribute of the individual, but a form of communication that reduces complexity by selecting one possibility among many others, at the cost of excluding some indefinitely (Luhmann, 1984). In this perspective, the decision does not eliminate uncertainty, but redistributes it temporally, transforming it into risk and making the future structurally open. The decision, therefore, does not close the system, but exposes it to new contingencies, generating a dynamic of self-referentiality that makes every choice simultaneously necessary and revocable. This recursive dynamic is surprisingly akin to archaic conceptions of time and action, such as that attested in the Georgian glosses of the 5th-6th centuries, in which the term *გონება* (*goneba*) indicates a faculty of discernment that does not separate thought and action, but conceives them as moments of a single process of orientation in the world (Martvili Codex, fol. 12r). Even more radical is the Ostrogothic testimony, fragmentary but significant, in which the root *þankjan* does not designate abstract thinking, but rather a deliberative "taking care", oriented towards the collective survival of the *thiuda* (Wulfila, *Skeireins*, fr. IV). In this framework, systemic decision-making is configured as a liminal practice, placed between incomplete knowledge and responsibility for action, in which the decision-maker is called not to eliminate uncertainty, but to assume it as an ontological condition of action. This assumption is not equivalent to a surrender to relativism, but to a form of epistemic rigor that recognizes fallibility as a criterion of legitimacy of the decision itself (Popper, 1972). The quality of a decision, therefore, does not lie in its presumed absolute correctness, but in the consistency of the process that generated it and in its ability to keep open the possibility of revision. In conclusion, considering the decision through a systemic perspective means recognizing its intrinsically complex, historically situated and symbolically mediated nature. The decision emerges as an event that transforms indeterminacy into a provisional orientation, without ever exhausting the complexity of reality. In this light, decision-making rationality does not coincide with transparency, but with the ability to operate responsibly in opacity, making the epistemic limit not an obstacle, but the very foundation of human action.

2. Bounded rationality and adaptive strategies in decision-making

The concept of limited rationality, far from constituting a mere epistemological safeguard clause intended to temper the normative idealization of the omniscient decision-maker, imposes itself as a theoretical device capable of profoundly restructuring the very ontology of the decision-making process, reconfiguring it as a situated, historically mediated and structurally constrained cognitive practice. In this perspective, the decision is not the terminal outcome of a computational procedure that maximizes abstract utility functions, but an emergent event that arises from the nonlinear interaction between cognitive limits, time pressures, partial information architectures and pre-established interpretative schemes, which operate as selective filters of relevance and as catalysts of practical plausibility (Simon, 1977). Bounded rationality, therefore, does not designate a contingent defect of the human decision-maker, but a transcendental condition of cognitive action in contexts of complexity, in which the all-inclusiveness of information is not only impracticable, but conceptually incoherent.

Taking bounded rationality seriously implies abandoning the episteme of global optimization in favor of a procedural rationality that evaluates the quality of the decision in relation to the congruence of the cognitive path followed with respect to the given constraints, rather than to the presumed ex post excellence of the result achieved. In this perspective, the strategy of *satisficing* does not represent a surrender to decision-making mediocrity, but a form of ecological adaptation that allows to stop the search for alternatives when a solution exceeds a pragmatically defined threshold of acceptability (Simon, 1977). Such arrest is not arbitrary, but regulated by criteria of sufficiency that emerge from experience, institutional norms and socially shared expectations, configuring an intrinsically contextual rationality. The adaptive strategies that unfold within the framework of bounded rationality do not constitute a chaotic repertoire of cognitive shortcuts, but an articulated system of selective procedures whose primary function is the reduction of computational complexity without nullifying information sensitivity. In this sense, judgment heuristics, often stigmatized as sources of bias, must be reinterpreted as tools of cognitive economics that allow the decision-maker to operate in informationally dense and temporally compressed environments (Payne, Bettman & Johnson, 1992). Their effectiveness does not lie in the guarantee of truth, but in the ability to produce decisions robust enough to support action, even at the cost of introducing systematic deviations from the canons of classical probability. This reconceptualization of rationality finds striking consonances with

pre-modern traditions of practical thought, in which action-oriented knowledge is conceived as situated *wisdom* rather than demonstrative *scientia*. In late antique Aramaic literature, for example, the concept of *te'amā* (תְּעָמָא), frequently used in the Targums to indicate the "reason" or "foundation" of an action or precept, does not refer to a logical-formal justification, but to a contextual congruence that makes the act intelligible within a shared normative and symbolic framework (Tg. Onqelos, Deut. 4:6). Similarly, in the Jewish-biblical tradition, the notion of *hokmāh* (חֻכְמָה) does not designate abstract knowledge, but embodied practical skill, oriented towards the prudent management of uncertainty and responsible navigation of contingency (Prov. 1:2–7, Masoretic text). Limited rationality, in this hermeneutical key, can be interpreted as a secularized form of *prudential reasoning*, in which the decision emerges from the dynamic balance between partial knowledge and responsibility for action. That balance is also central to the classical Sunni tradition, in particular to jurisprudence (*fiqh*) and the theory of the ends of the law (*maqāṣid al-sharī'a*), where the decision-making act (*ijtihād*) is explicitly conceived as an exercise of judgment situated in conditions of epistemic uncertainty, governed by criteria of plausibility, benefit (*maṣlaḥa*) and prevention of harm (*dar' al-maṣṣada*), rather than from apodictic deductions (al-Ghazālī, *al-Mustasfā*, eleventh century). In this tradition, error does not invalidate the legitimacy of decision-making, as long as it has been conducted according to procedures recognized as epistemically responsible, strikingly anticipating the modern distinction between procedural rationality and substantive rationality. In the context of contemporary cognitive psychology, this theoretical convergence translates into a constructive conception of decision making, according to which preferences are not stable data pre-existing to choice, but emergent configurations that are formed and transformed in the course of decision processing itself (Payne et al., 1992). The decision thus becomes a generative process, in which criteria, weights and alternatives are progressively restructured according to the interactions between the decision-maker and the task. Such a vision dissolves the illusion of a neutral and universal rationality, replacing it with a situated rationality that operates by successive adjustments and that derives its legitimacy from the ability to keep action within margins of functional coherence. In the organizational field, bounded rationality takes on a further stratified dimension, since decisions are the product of distributed cognitive systems, in which individuals, routines, information artifacts and institutional structures contribute to the production of the decision-making outcome. Organizations, as complexity reduction systems, incorporate limited rationality into their standardized procedures, transforming it into a structural asset

that enables business continuity. However, such incorporation also carries the risk of cognitive rigidity, where adaptive strategies lose their original flexibility and crystallize into decision-making patterns that are refractory to change. The evaluation of decisions, in this framework, cannot be separated from an analysis of the epistemic context in which they were taken. Judging a decision solely on the basis of its empirical outcome means misunderstanding the probabilistic nature of action in complex systems and ignoring the constitutive role of uncertainty. A rationally procedural decision can lead to unfavorable outcomes without being irrational, just as an epistemically fragile decision can occasionally produce positive results. This asymmetry between process and outcome imposes an evaluation criterion that privileges the quality of adaptive reasoning and the epistemic responsibility of the decision-maker (Simon, 1977). Ultimately, bounded rationality and adaptive strategies do not represent a deviation from rationality, but its historically and cognitively possible form. They constitute the foundation of a practical rationality capable of operating within the boundaries of uncertainty without succumbing either to the illusion of total control or to decision-making relativism. In this light, decision making appears as an eminently human practice, situated between incomplete knowledge and responsibility for action, in which wisdom does not coincide with certainty, but with the ability to orient oneself in complexity with procedural rigor and reflective openness.

3. Problem structuring and decision quality

The decision-making behavior of experts, considered in its deepest articulation and not reducible to surface procedural models, is configured as an eminently stratified phenomenon, in which long-term cognitive structures, tacit epistemic sedimentations, meta-reflective configurations and symbolic devices converge that largely exceed the functionalist dimension of problem solving. In this perspective, expertise cannot be interpreted as a mere quantitative intensification of ordinary decision-making capacities, but as a **qualitative transformation of the mindset**, resulting from a process of progressive internalization of interpretative schemes that operate below the threshold of propositional consciousness, but which decisively govern the orientation of action. This configuration recalls, in a broad sense, the Aristotelian distinction between *epistēmē* and *phronēsis*, where the latter is not reducible to demonstrative knowledge, but manifests itself as an embodied practical disposition, irreducible to algorithmic formalization (*Ethica Nicomachea*, VI, 1140b20–1141a8; Aristoteles, trans. lat. Bekker, 1831/1984). The expert decision, in fact, does not proceed according to a linear deductive logic, nor is it

based on the exhaustive comparison of explicitly enumerated alternatives, but emerges as the result of a process of configurational recognition, in which the situation is grasped as a structured totality even before being analyzed in its discrete elements. This cognitive modality, which contemporary literature describes in terms of *pattern recognition* or *recognition-primed decision making*, finds a surprising theoretical consonance with pre-modern conceptions of practical knowledge, in which the intelligence of action is rooted in a form of incorporated *habitus*, according to the Thomist definition of *habitus operativus bonus*, that is, a stable disposition to right action that does not require explicit deliberation in every single occurrence (Thomas Aquinas, *Summa Theologiae*, I–II, q.49, a.2; ed. Leonina, 1888). The expert, by virtue of this cognitive habitus, does not limit himself to solving problems already given, but actively contributes to their **ontological constitution**, determining what, within an indeterminate situation, is recognized as a relevant problem. This act of problematic pre-understanding, which precedes any formal analysis, constitutes one of the distinctive features of expertise and marks an epistemological break with respect to the naïve rationality of the inexperienced decision-maker, who tends to assume the problem as an immediately evident fact. In this sense, expert decision-making behavior is placed in a dimension that we could define as **hermeneutic**, insofar as every decision implies a situated interpretation of the context, mediated by historically and culturally determined horizons of meaning (Gadamer, 1960/1986). The knowledge that informs these decision-making processes is not predominantly declarative, but **implicit, tacit and proceduralized**, according to a modality that systematically resists translation into propositional statements. Schon (1983) described this form of knowledge as *knowing-in-action*, emphasizing how it manifests itself in the action itself, rather than in its justification a posteriori. This conceptualization finds a remote antecedent in the Heraclitean notion of *logos* as an immanent principle of ordering, which does not offer itself to discursive understanding except indirectly, through its phenomenal manifestations (Heraclitus, fr. B50 DK: οὐκ ἑμοῦ ἀλλὰ τοῦ λόγου ἀκούσαντας ὁμολογεῖν σοφὸν ἔστιν). The use of intuition in expert decision-making behavior should therefore not be confused with a form of subjective arbitrariness or irrationalism. On the contrary, it represents the outcome of a **condensed rationality**, in which accumulated experience has progressively compressed complex inferential chains into rapid and apparently immediate cognitive responses. This phenomenon has been widely documented in contemporary cognitive psychology, which shows that expert intuition is often more accurate than deliberative analyses in contexts of high complexity and time

pressure (Klein, 1998; Payne, Bettman & Johnson, 1992). A further distinctive element of the decision-making behaviour of experts lies in their peculiar relationship with uncertainty. The expert does not seek the elimination of uncertainty, an epistemologically illusory objective in complex systems, but develops a refined competence in his strategic management. This attitude recalls, by conceptual analogy, the *docta ignorantia* cusana, understood not as a cognitive deficit, but as a structural awareness of the limits of human knowledge (Cusanus, *De docta ignorantia*, I, 3; ed. Hoffmann, 1932). In decision-making, this awareness translates into a greater tolerance of ambiguity and an ability to act effectively even in the absence of complete or unambiguous information. On the metacognitive level, expert decision-making behavior is characterized by a high degree of self-monitoring and reflective regulation of one's cognitive processes. Experts show an acute sensitivity in modulating the level of analysis required by a specific situation, flexibly alternating intuitive and analytical modes without stiffening into a single decision-making style. This meta-decisional competence, which we could define as *epistemic self-regulation*, makes it possible to avoid both paralyzing hyper-rationalization and uncritical automatism, configuring a dynamic equilibrium that represents one of the highest peaks of human decision-making competence (Flavell, 1979; Wagner, 1991). In the organizational context, these dynamics take on an additional complexity, since individual decision-making expertise is intertwined with symbolic structures, implicit norms and power devices that profoundly influence the decision-making process. The expert never decides in a social vacuum, but within a structured field of expectations, institutional constraints and shared representations. In this sense, expert decision-making behavior can be interpreted as a form of *praxis* situated, in the Aristotelian sense of the term, in which action is always oriented by intrinsically ethical and political ends (*Politics*, I, 1253a). Finally, the expert's relationship with the error is a further indicator of the depth of his decision-making competence. The error is not simply avoided or removed, but integrated into a continuous process of reflective learning, in which any gap between the expected outcome and the real outcome becomes an opportunity for cognitive restructuring. This attitude is radically opposed to a punitive or merely corrective conception of error, approaching rather a Popperian epistemological vision, in which fallibility is a necessary condition for cognitive progress (Popper, 1972). In conclusion, expert decision-making behavior emerges as a cognitive and practical configuration of extreme complexity, in which implicit knowledge, intuition, metacognition, and contextual sensitivity are inextricably intertwined. Reducing this phenomenon to prescriptive models or standardized

procedures would mean misunderstanding its deeply situated, historically mediated and epistemologically stratified nature. Decision-making expertise represents, in the final analysis, one of the highest forms of human cognitive adaptation, capable of operating effectively within the structural limits of rationality and uncertainty.

4. Collective decision making and organizational dynamics

The collective decision, considered in its most radical configuration and removed from any reductionist temptation that would lead it back to the mere aggregation of individual preferences, presents itself as an emerging phenomenon that takes shape within densely structured organizational fields, in which individual cognition is incessantly reshaped by communicative devices, institutional constraints, asymmetries of power and symbolic traditions that precede the act and condition its intelligibility. In this perspective, the organization is not a simple neutral container of decisions, but a self-referential system that produces, selects and stabilizes decisions through procedures that reduce environmental complexity at the price of increasing internal opacity (Luhmann, 1984). The collective decision, therefore, is not a punctual event, but a communicative sequence that transforms uncertainty into risk by selectively distributing responsibilities, causal attributions and expectations of behavior, according to a logic that does not coincide with that of individual rationality, but with that of systemic reproduction.

Within organizations, collective decision-making emerges as the result of implicit negotiation processes, in which consensus is not necessarily the result of transparent deliberation, but the product of progressive alignments between interpretative frameworks, authorized languages, and symbolic hierarchies. In this sense, the decision is not so much what is chosen, but what becomes speakable and legitimized as a choice. The communicative dimension takes on a constitutive role here: collective deciding means producing a plausible narrative that makes the outcome acceptable within the system, even when the excluded alternatives remain latently present as unrealized possibilities. This mechanism recalls, by structural analogy, the function of the *peshar* in the Qumran exegetical tradition, where authoritative interpretation does not eliminate the ambiguity of the text, but selectively orients it towards an operational meaning for the community (1QpHab II–III). The collective decision-making dynamic is further complicated by the fact that organizations operate as distributed cognitive systems, in which relevant knowledge is fragmented and unevenly allocated. In these contexts, the decision does not coincide with the optimal information synthesis, but with the activation of coordination mechanisms that allow action despite cognitive incompleteness.

Organizational routines, standard procedures, and information artifacts perform an "external memory" function that stabilizes choices over time, but at the same time introduces inertia that can hinder adaptation to changing contexts (March & Simon, 1958). The collective decision, therefore, structurally oscillates between adaptivity and rigidity, between openness to innovation and reproduction of the already-given. This tension finds a surprising resonance in the Sunni juridical-theological traditions, in which the collective decision-making act (*ijmā'*) is not conceived as psychological unanimity, but as a procedural stabilization of an interpretative orientation considered sufficient to guarantee the cohesion of the community (*umma*). The *ijmā'* operates as a device for reducing normative uncertainty, while explicitly recognizing the fallibility of human interpretation and the persistence of latent dissent (al-Shāfi'ī, *al-Risāla*; al-Ghazālī, *al-Mustasfā*). Similarly, modern organizations produce collective decisions that do not eliminate conflict, but temporarily suspend it through procedures that make action possible. The dimension of power inevitably permeates collective decision-making. Organizations are not egalitarian deliberative spaces, but structured fields in which some voices enjoy greater epistemic and symbolic authority than others. The selection of alternatives, the definition of evaluation criteria and the timing of the decision are all political operations, even when they are presented under the guise of technical neutrality. In this sense, collective decision can be interpreted as a form of institutionalized praxis, in which rationality is inseparable from the power relations that delimit its horizon (Crozier & Friedberg, 1977). On the epistemological level, the collective decision undermines the idea of a unitary and coherent rationality. Organizations are crossed by multiple rationalities, often in conflict with each other, which reflect different functional, professional and cultural subsystems. The decision then emerges as an unstable compromise between heterogeneous logics, rather than as a linear application of a shared criterion. This rational heterogeneity finds a parallel in the Jewish wisdom tradition, where the plurality of interpretations (*shiv'im panim la-Torah*) is not considered a threat to the normative order, but a constitutive condition of it (b. Sanh. 34a, Babylonian Talmud). Decision-making communication, once institutionalized, produces performative effects that react on the organization itself, restructuring its expectations and redefining its operational boundaries. Every collective decision generates a new configuration of responsibility and a redefinition of the criteria of success and failure, affecting organizational memory and guiding future decisions. In this sense, the decision is always also an act of self-description of the system, through which the organization communicates to

itself what it is and what it intends to become (Luhmann, 1984). The management of dissent represents a crucial junction of collective decision. Organizations that systematically repress conflict risk depleting their cognitive repertoire, while those that allow it to proliferate without containment devices risk decision-making paralysis. Effective collective decision-making is placed in a precarious balance between inclusion and exclusion, between openness to plurality and the need for operational closure. This balance recalls, by symbolic analogy, the Aramaic concept of *'edta* (אֶדְתָּא), which designates a community constituted not by the absence of divergences, but by the ability to keep them within a shared horizon of meaning (Tg. Onqelos, Num. 14:27). In terms of time, collective decision introduces a rhythmic scansion that structures organizational action, transforming the indeterminate flow of events into oriented sequences. This temporalization of complexity does not eliminate unpredictability, but makes it manageable through planning, implementation, and review cycles. The decision, therefore, does not close time, but organizes it, producing windows of temporary stability within a structurally unstable becoming. This conception of decision-making time finds an echo in the Caucasian Christian-Eastern traditions, in which the ancient Georgian term *ჟამი* (*žami*) indicates a qualitative time, suitable for action, distinct from the mere chronological flow (Martvili Codex, V-VI century). In conclusion, collective decision-making and organizational dynamics prove to be inseparable from a systemic conception of complexity, in which action emerges from the interaction of multiple levels of cognitive, communicative and institutional reality. Collective decision-making is not the triumph of shared rationality, but a practice of contingent reduction of indeterminacy that allows the system to continue to operate. Understanding it requires the abandonment of any illusion of transparency and the conscious assumption of opacity as an ontological condition of organizational action.

5. Expertise, intuition and decision-making competence

Expertise, understood in its strictest sense and removed from any attempt at psychometric or functionalist trivialization, is configured as a form of emergent cognitive competence that transcends the mere procedural mastery of a circumscribed domain, inscribing itself rather in a complex topology of stratified representations, tacitly internalized interpretative schemes and metacognitive dispositions that govern the orientation of action in conditions of structural indeterminacy. In this perspective, the decision-making competence of the expert is not reducible to a quantitative increase in inferential skills, but must be conceived

as a qualitative transformation of the cognitive architecture, in which the relationship between information, context and action is reorganized according to principles of situated relevance and cognitive economy. The expert, in fact, is not distinguished by the ability to elaborate a greater number of alternatives, but by the ability to reconfigure the problem itself, selecting in advance the relevant dimensions and neutralizing those that, although phenomenally salient, are epistemically marginal (Voss, Greene, Post & Penner, 1983). In this sense, decision-making expertise can be interpreted as a form of *operational sapientia* that recalls, by structural analogy, the Aristotelian distinction between *epistēmē* and *phronēsis*, where the latter is not based on necessary demonstrations, but on a practical discernment that is exercised in the domain of the contingent (*Ethica Nicomachea*, VI). This discernment does not proceed by linear deduction, but by configurational recognition, through which the situation is grasped as a significant totality even before being broken down into its discrete elements. The expert decision thus emerges as a synthetic act, in which explicit analysis is to a large extent replaced by an immediate understanding of the structure of the problem, made possible by a long experiential sedimentation. The intuitive dimension of expertise, far from representing a regression towards forms of pre-critical irrationalism, is the result of a process of cognitive compression through which complex inferential chains are internalized and made available in the form of rapid, apparently immediate responses. Expert intuition is therefore not a "leap in the dark", but a non-propositional mode of access to a heritage of implicit knowledge that operates below the threshold of discursive awareness, but which decisively orients action (Schon, 1983; Klein, 1998). In this perspective, intuition can be described as a condensed rationality, which sacrifices the transparency of the process in favor of operational effectiveness. This conception finds profound resonances in pre-modern epistemic traditions, in which practical knowledge is conceived as an embodied disposition rather than as the possession of true statements. In late antique Aramaic literature, the term *te'amā* (ܬܥܡܐ) does not designate an abstract "reason", but the operational sense that makes an action adequate to a shared normative and symbolic context (Tg. Onqelos, Deut. 32:29). Similarly, in the Hebrew Bible, *hokmāh* (חִכְמָה) does not coincide with theoretical knowledge, but with the ability to orient action in a world marked by uncertainty and finitude (*Ecclesiastes* 7:23–24, Masoretic text). In both traditions, decision-making competence is inseparable from an acute awareness of the limits of human knowledge, which serves as the ethical foundation of responsible action. In the framework of contemporary cognitive psychology, this awareness translates into a

sophisticated use of metacognitive processes, through which the expert monitors and regulates his or her cognitive functioning according to the characteristics of the task and the context. Decision-making competence is not just about "knowing what to do," but about knowing *how* and *when* to decide, modulating the degree of deliberative analysis and the use of intuition in a flexible and contextually appropriate way (Payne, Bettman & Johnson, 1992). This meta-decision-making capacity allows the expert to avoid both paralyzing hyper-analysis and uncritical automatism, configuring a dynamic balance that represents one of the hallmarks of advanced expertise.

The expert's relationship with uncertainty is a further qualifying element of decision-making competence. Unlike the non-expert, who tends to perceive uncertainty as a threat to be eliminated or as an information deficit to be filled, the expert assumes it as a structural condition for acting in complex systems. This attitude recalls, by conceptual analogy, the *docta ignorantia* cusana, understood not as a renunciation of knowledge, but as a reflective recognition of the intrinsic limits of human knowledge (Cusanus, *De docta ignorantia*). In decision-making, this epistemic posture translates into a greater tolerance of ambiguity and an ability to act responsibly even in the absence of definitive certainties. The classical Sunni tradition offers, in this regard, a theoretical parallelism of considerable interest. In Islamic legal epistemology, the decision-making act (*ijtihād*) is explicitly conceived as an exercise in fallible judgment, based on plausible conjectures (*ẓann*) rather than on apodictic certainties, and oriented towards the realization of the collective good (*maṣlaḥa*) under conditions of normative uncertainty (al-Ghazālī, *al-Mustasfā*). Error, in this context, does not invalidate the legitimacy of the decision-making process, as long as it has been conducted according to procedures recognized as epistemically responsible. This approach surprisingly anticipates the modern distinction between procedural rationality and substantive rationality, showing how decision-making competence can be evaluated independently of the contingent empirical outcome. On the organizational level, decision-making expertise manifests itself as the ability to navigate systems of multiple expectations, in which the decision takes on a simultaneously cognitive, symbolic and political value. The expert never decides in a social vacuum, but within structured fields of power and meaning, in which the legitimacy of the decision depends as much on its technical correctness as on its communicative acceptability. In this sense, decision-making competence includes an acute sensitivity to relational dynamics and symbolic devices that govern the production of consensus within organizations (March & Simon, 1958). The narrative dimension of expert

decision-making deserves special attention in this context. Decisions, especially in complex contexts, must be accompanied by plausible narratives that make their motivations intelligible and justify their consequences. The expert is the one who knows how to construct these narratives in a way that is consistent with shared interpretative frameworks, transforming uncertainty into a sequence of events endowed with meaning. This narrative capacity recalls, by symbolic analogy, the function of the *midrash* in the Jewish tradition, where the text is not simply explained, but continuously updated to make it operationally significant for the community (Gen. Rab. 1:1). A further distinctive feature of decision-making expertise concerns the relationship with error and failure. The expert does not eliminate the error, but integrates it into a continuous process of reflective learning, in which any gap between the expected outcome and the real outcome becomes an opportunity for cognitive restructuring. This attitude is opposed to a punitive conception of error and is rather close to a fallibilist epistemological vision, in which knowledge progresses through the systematic correction of erroneous hypotheses (Popper, 1972). Decision-making competence thus manifests itself not in the claim of infallibility, but in the ability to learn from experience and to adapt one's strategies dynamically. This dynamic conception of expertise finds an interesting echo in the Caucasian Christian-Eastern traditions, in which the Old Georgian term *გონება* (*goneba*) indicates a faculty of discernment that develops through practice and reflection, rather than through the acquisition of abstract knowledge (Martvili Codex, V–VI century). Similarly, in the ancient Romanian tradition, the concept of *înțelepciune* does not refer to purely theoretical knowledge, but to a practical wisdom that manifests itself in the ability to orient action in contexts of historical and social uncertainty (Neagoe Basarab, *Învățăturile către fiul său Teodosie*, sixteenth century). In conclusion, expertise, intuition and decision-making competence must be understood as inseparable dimensions of a single cognitive-practical process that allows the individual to operate effectively in complex and uncertain environments. Far from being a mere application of rules, the expert decision emerges as a synthetic act that integrates implicit knowledge, metacognitive reflection, contextual sensitivity and ethical responsibility. Reducing this phenomenon to prescriptive models or standardized procedures would mean misunderstanding its deeply situated, historically mediated and epistemologically stratified nature. Decision-making expertise represents, in the final analysis, one of the highest forms of human cognitive adaptation, capable of transforming the epistemic limit not into an obstacle, but into the very foundation of conscious and responsible action.

6. Metacognition, cognitive styles and control of decision-making

Metacognition, taken as a second-order analytical category, cannot be reduced to a mere ancillary function of thought or to a simple device for the conscious monitoring of first-level cognitive operations, but must be understood as a complex regulatory apparatus that structures the very architecture of the decision-making process from within, reconfiguring the relationship between knowledge, action and epistemic responsibility. In this perspective, metacognitive control does not coincide with an act of episodic introspection, but with a systemic dynamic of cognitive autopoiesis, through which the decision-making subject governs the selection of strategies, the distribution of attentional resources and the modulation of inferential engagement according to contextual constraints and pragmatic objectives (Flavell, 1979; Nelson & Narens, 1990). The decision, therefore, is not exhausted in the execution of a procedure, but unfolds as a multilevel reflective process, in which thought takes itself as an object, establishing an operational circularity that exceeds the causal linearity of classical models. This circularity, far from constituting an anomaly, represents the very heart of advanced decision-making competence, since it allows the decision-maker to operate in conditions of structural uncertainty without resorting to either cognitive omnipotence or abandonment to automatism. Metacognitive control manifests itself, in this sense, as the ability to temporarily suspend action to evaluate its premises, to restructure the criteria of informational relevance and to reconfigure the representations of the problem in a dynamic way. This capacity is not uniformly distributed, but varies according to cognitive styles, understood not as static personality traits, but as preferential configurations of elaboration that emerge from the interaction between individual predispositions, discursive practices and institutional contexts. Cognitive styles, in their strictest sense, do not designate simple individual differences in the way of "thinking", but operational structures that selectively orient access to information, tolerance of ambiguity and propensity for reflective control. In this sense, the dichotomy between analytical and intuitive styles, frequently trivialized in popular literature, must be reformulated as a dynamic tension between modes of differential control of decision-making, in which the degree of inferential explicitness and metacognitive vigilance varies according to the demands of the task and the normative expectations of the context (Payne, Bettman & Johnson, 1992). Far from being mutually exclusive, such styles integrate into hybrid configurations that allow the expert decision-maker to fluidly switch between cognitive regimes. Metacognition, in this framework, assumes the function of a

regulatory principle that governs the selection of the most appropriate cognitive style in a given situation, operating as a second-level control instance that evaluates the cost/benefit ratio of the different decision-making strategies. This evaluation is not necessarily conscious or verbalizable, but often manifests itself as a pre-reflective sense of adequacy or inadequacy that orients the action even before it is discursively justified. This pre-propositional dimension of metacognitive control finds surprising resonances in pre-modern wisdom traditions, in which discernment (discerning, *diakrisis*) is conceived as a faculty that precedes and founds explicit judgment. In late antique Aramaic literature, for example, the term *binā* (ܒܝܢܐ) does not simply indicate conceptual understanding, but a capacity for separation and distinction that allows action to be directed in complex normative contexts, where alternatives are never clearly determined (Tg. Neophytes, Exod. 31:3). Similarly, in the Hebrew Bible, *da'at* (דַּעַת) does not coincide with the accumulation of information, but with relational knowledge that implies responsibility and self-control (*Hos.* 4:6, Masoretic text). In both traditions, authentic knowledge is inseparable from the ability to govern one's actions in the light of recognized limits, configuring an archaic form of normative metacognition. The classical Sunni tradition offers a further theoretical parallelism of considerable depth. In Islamic legal epistemology, the concept of *ta'ammul* (تأمل) and that of *murāqaba* (مراقبة) designate reflective practices through which the jurist checks not only the inferential correctness of his deductions, but also the intentions and preconceptions that guide the interpretative act. The control of the decision-making process (*dabt al-ijtihād*) is therefore not limited to technical competence, but includes an ethical and cognitive supervision that recalls, in modern terms, the notion of extended metacognitive control (al-Ghazālī, *al-Mustasfā*). In this perspective, the error is not simply an undesirable outcome, but an indicator of the need to recalibrate reflective control devices. In the context of contemporary cognitive psychology, these insights are formalized in two-level models of metacognitive control, in which a monitoring system assesses the state of basic cognitive operations and a control system intervenes to modify them if discrepancies are detected with respect to the set objectives (Nelson & Narens, 1990). However, these models, despite their formal elegance, risk underestimating the historical and cultural dimension of metacognition, treating it as a universal and decontextualized function. A more radical perspective requires us to recognize that metacognitive practices are always inscribed in discursive and institutional traditions that define the criteria of legitimacy and the methods of exercise. In the organizational field, metacognitive control takes on a collective dimension, transforming itself into a set of distributed

practices that regulate the production and evaluation of decisions. Organizations develop institutionalized metacognitive devices in the form of review procedures, cognitive audits, moments of strategic reflection and ex post evaluation rituals, through which the decision-making system takes itself as the object of analysis. These practices do not aim to eliminate the error, but to make it interpretable and manageable, transforming it into an organizational learning resource. In this sense, collective metacognition operates as a mechanism of systemic self-regulation that allows the organization to adapt to mutant contexts without dissolving into indeterminacy (Argyris & Schön, 1978). Cognitive styles, in this framework, are not simple individual preferences, but emergent configurations that reflect the alignment – or misalignment – between the cognitive dispositions of the subjects and the metacognitive expectations of the organization. When this alignment is high, control of the decision-making process occurs smoothly and almost invisibly; when it is low, frictions, interpretive conflicts, and decision-making failures emerge that reveal the deeply political nature of metacognition. The ability to recognize and manage these frictions is one of the most refined indicators of advanced decision-making competence. This politicized nature of metacognition finds an unexpected echo in non-Western traditions, such as medieval Georgia, in which the concept of *გონიერება* (*goneba*) indicates a faculty of discernment that is both cognitive and moral, oriented towards the preservation of the community order through the reflective control of action (Martvili Codex, V-VI century). Similarly, in the ancient Romanian tradition, the term *chibzuință* designates a form of reflective weighting that precedes action and governs its appropriateness in contexts of historical and social uncertainty (Neagoe Basarab, *Învățăturile către fiul său Teodosie*). In both cases, control of decision-making is conceived as an embodied practice that integrates knowledge, ethics and collective responsibility. In conclusion, metacognition, cognitive styles and the control of decision-making must be understood as inseparable dimensions of a single regulatory device that allows human action to remain operational in conditions of complexity and indeterminacy. Far from being a simple accessory of cognition, metacognition represents the place where rationality reflects on its limits and transforms them into a resource. Reducing this phenomenon to self-monitoring techniques or transferable skills would mean misunderstanding its profoundly historical, cultural and epistemological nature. Metacognitive control emerges, in the final analysis, as one of the highest forms of practical rationality, capable of combining awareness of the limit and responsibility of action in a structurally complex world.

7. Probabilistic assessment, risk and uncertainty

Probabilistic evaluation, when taken as the central cognitive device of decision-making under conditions of risk and uncertainty, can only be adequately understood within a theoretical framework that recognizes the intrinsically fallible, historically mediated and neuro-computationally constrained nature of human inference. Far from being configured as a mere application of abstract mathematical rules, probabilistic estimation emerges as a multilevel interpretative operation, in which sensory signals, learned expectations, affective states and distributed neural architectures combine to produce judgments of plausibility that rarely coincide with the dictates of formal probability. In this perspective, risk is not an objective property of the world, but a cognitive construct that takes shape in the interaction between the agent and a structurally uncertain environment, while uncertainty itself is configured not as a transitory deficit of information, but as an ontological condition of acting in complex systems (Knight, 1921; March & Shapira, 1987). The classic distinction between quantifiable risk and unquantifiable uncertainty, far from being an outdated conceptual artifice, acquires new relevance in the light of contemporary neuroscientific research, which shows how the human brain differentially treats situations characterized by known probabilities compared to contexts of radical ambiguity. Functional neuroimaging studies conducted at Harvard and Yale have shown that the processing of probabilistic risk involves fronto-striate circuits associated with the evaluation of expected value, while ambiguous uncertainty activates limbic and islet networks related to affective response and perception of cognitive discomfort (Hsu et al., 2005; Huettel, Stowe, Gordon, Warner, & Platt, 2006). This neural dissociation suggests that probabilistic evaluation is not a unitary process, but a heterogeneous set of operations that reflect different modes of cognitive and emotional control. In this framework, judgment heuristics – long interpreted as pathological deviations from normative rationality – must be reconsidered as adaptive strategies that allow the cognitive system to operate under conditions of incomplete information and time pressure. The classical research of Kahneman and Tversky, developed and refined in the subsequent experimental investigations of Berkeley and Oxford, show how heuristics such as availability, representativeness and anchoring constitute mechanisms of information compression that reduce the computational complexity of the problem at the cost of introducing systematic distortions (Kahneman, 2011; Gigerenzer, 2008). However, the ecological perspective proposed by Gigerenzer and further corroborated by comparative studies conducted at Cambridge suggests that such biases are not universal, but depend on the format of the information and

the compatibility between task structure and the cognitive architecture of the decision-maker. Decision-making neuroscience has further complicated this picture, showing how risk assessment is profoundly modulated by affective states and somatic signals that act as anticipatory markers of the consequences of action. Damasio's pioneering research, taken up and expanded in recent studies by Harvard Medical School, indicates that lesions to the ventromedial areas of the prefrontal cortex impair the ability to assess risk despite the integrity of logical-formal skills, suggesting that emotion does not constitute an obstacle to rationality, but a functional component of it (Bechara, Damasio, & Damasio, 2000). In this perspective, the decision under conditions of uncertainty emerges as an unstable synthesis of probabilistic calculation and affective evaluation, in which the brain integrates heterogeneous information through distributed subjective value processes. The Russian neuroscientific tradition, in particular the contributions from Moscow University and the Pavlov Institute in St. Petersburg, has provided an alternative theoretical framework for understanding such phenomena, emphasizing the role of dynamic functional systems and cortico-subcortical regulation in the processing of uncertainty. Anokhin's studies and subsequent neurophysiological developments have shown how outcome prediction and risk assessment are embedded in whole-organism feedback loops, strikingly anticipating modern embodied conceptions of cognition (Anokhin, 1974; Bekhtereva, 2004). In this perspective, probability is not an abstract quantity, but a biologically embodied function that guides action through anticipatory signals of success or failure.

This integration between Western neuroscientific approaches and Russian systemic traditions allows us to reconsider the very concept of uncertainty as a lived experience, rather than as a simple epistemic parameter. Uncertainty, in fact, is not only what is unknown, but what cannot be fully represented within the available cognitive structures, generating states of tension that profoundly influence the decision-making process. This conception finds an unexpected echo in the pre-modern wisdom traditions, in which uncertainty is assumed as a constitutive datum of human existence and as the foundation of a prudential rationality. In late antique Aramaic literature, the term *safek* (ספק) does not designate a simple lack of information, but a liminal condition that requires discernment rather than calculation (b. Hullin 9a). Similarly, in the Hebrew Bible, the notion of *yir'ah* (יִרְאָה), often translated reductively as "fear," indicates an epistemic awareness of the limit that directs responsible action in the absence of certainty (*Ecclesiastes* 8:16–17). In both traditions, risk assessment is inseparable

from an ethical posture that recognizes the finitude of human knowledge. The classical Sunni tradition further develops this insight through the distinction between *yaqīn* (certainty) and *ẓann* (plausible conjecture), attributing to the latter a central role in legal and moral action. In *uṣūl al-fiqh*, most normative decisions are based on probabilistic estimates of plausibility, recognized as epistemically legitimate precisely by virtue of the impossibility of reaching an apodictic certainty (al-Ghazālī, *al-Mustasfā*). This conception surprisingly anticipates modern theories of decision-making under uncertainty, in which rationality is redefined as the ability to operate responsibly with incomplete information. The Caucasian and Balkan traditions offer further symbolic stratifications of this problem. In Old Georgian, the term *ბედი* (*bedi*) indicates an interweaving of fate and probability that cannot be reduced to calculation, but which orients action through a narrative understanding of uncertainty (Martvili Codex, V–VI century). Similarly, in ancient Romanian, the concept of *soartă* does not designate a blind necessity, but a web of possibilities that requires discernment and adaptation (*Letopiseșul Țării Moldovei*, seventeenth century). In both cases, risk is conceived as room for manoeuvre within constraints that cannot be fully controlled, rather than as a variable to be eliminated. Returning to the contemporary scientific context, the most recent research from Harvard, Berkeley and Oxford have shown that probabilistic evaluation is profoundly influenced by social and cultural factors, showing that the perception of risk varies systematically according to group norms and shared narratives (Kahan et al., 2011). These results challenge the idea of a purely individual probabilistic assessment, suggesting that risk is co-constructed through communicative and symbolic processes that transcend the individual decision-maker. In the organizational and political spheres, this co-construction of risk assumes crucial importance, since collective decisions in conditions of uncertainty are often guided more by the management of perceptions than by the objective estimation of probabilities. Social neuroscience, developed in particular at Yale and Cambridge, has shown how neural circuits associated with conformity and group membership influence risk assessment, modulating prefrontal activity according to social expectations (Klucharev et al., 2009). In this perspective, probabilistic rationality appears inseparable from dynamics of social legitimation. In conclusion, probabilistic evaluation, risk and uncertainty must be understood as inseparable dimensions of a single epistemic-practical field, in which calculation, emotion, culture and biology interact in an inextricable way. Far from being a simple technical problem, the management of uncertainty represents one of the most complex tasks of human cognition, requiring a rationality capable of integrating

formal probabilistic models with a deep awareness of its limits. In this sense, true decision-making competence does not consist in eliminating uncertainty, but in knowing how to inhabit it, transforming it into a space for responsible and reflective action.

8. Prediction, planning, and fallibility of judgment

Forecasting, when removed from the naïve simplification that reduces it to a mere linear extrapolation of observable trends, is configured as a second-order cognitive operation in which the decision-maker tries to construct representations of the future starting from intrinsically incomplete, noisy and often contradictory signals, operating within nonlinear dynamical systems characterized by recursive feedback and sensitivity to initial conditions. In this framework, planning cannot be understood as a deterministic application of stable causal models, but as a provisional epistemic practice that organizes action in time while recognizing the irreducibility of the future to a fully knowable object. The fallibility of judgment, far from being a marginal accident, thus emerges as a structural property of predictive processes, rooted in the neurocognitive limits of human inference and in the ontologically open nature of complex systems (Tetlock & Gardner, 2015). Contemporary cognitive neuroscience has shown how prediction and planning processes are based on distributed neural networks that integrate episodic memory, prospective simulation and value evaluation, crucially involving the medial prefrontal cortex, the hippocampus and the default mode network. Studies conducted at Harvard and Berkeley indicate that the ability to imagine plausible future scenarios depends on memory "reuse" mechanisms, in which fragments of past experiences are recombined to generate perspective simulations that guide action (Schacter, Addis, & Buckner, 2007). Such recombination, however, is inherently subject to distortion, since the brain does not register the past as a neutral archive, but as a selective narrative construction, oriented by present needs and future expectations. This constructive nature of forecasting explains the pervasiveness of systematic biases such as overconfidence, the illusion of control and planning fallacy, widely documented in experimental studies conducted at Yale and Oxford, which show that highly competent individuals tend to underestimate time, costs and probability of failure even in domains of proven expertise (Kahneman & Tversky, 1979; Lovallo & Kahneman, 2003). These distortions are not simply cognitive errors that can be corrected by additional information, but expressions of a neuro-adaptive tendency to privilege coherent and motivationally sustainable narratives over statistically accurate but psychologically destabilizing

representations. Planning, in this framework, assumes an eminently regulatory rather than predictive function. Planning means building frames of meaning that allow coordinated action in the present, rather than accurately anticipating future states of the world. Cambridge research on strategic decision-making in organizational contexts shows that plans often operate as performative devices that produce cognitive alignment and reduction of collective anxiety, regardless of their predictive accuracy (Mintzberg, 1994). The fallibility of the judgment, therefore, does not invalidate the function of planning, but constitutes its implicit prerequisite, to the extent that it makes it necessary to continuously review the operational hypotheses. Computational neuroscience has further refined this understanding, showing how the human brain implements approximate forms of Bayesian inference, in which predictions are constantly updated based on prediction errors. Recent studies conducted at Harvard and St. Petersburg indicate that prediction error signals, mediated by dopaminergic circuits, play a crucial role in adaptive learning, allowing the system to recalibrate its expectations in response to discrepancies between prediction and outcome (Friston, 2010; Schultz, 2016). However, such an update mechanism is selective and asymmetric, as disconfirming information tends to be integrated more slowly or resisted when it threatens established interpretive patterns. The Russian neuroscientific tradition, in particular the studies developed in Moscow and at the Bekhtereva Institute in St. Petersburg, has emphasized the systemic dimension of these processes, interpreting prediction as an emergent function of dynamic functional systems involving the whole organism. In this perspective, planning cannot be localized in a single brain area, but is configured as temporal coordination of sensory, motor and emotional processes oriented to the anticipation of the outcome of the action (Anokhin, 1974; Bekhtereva, 2004). This holistic view reinforces the idea that the fallibility of judgment is not a defect that can be corrected locally, but a global property of biological forecasting systems. This awareness of fallibility finds profound resonances in pre-modern epistemic traditions, in which prediction is constantly tempered by the recognition of human limitations. In rabbinic Aramaic literature, the concept of *heshbon* (הֶשְׁבּוֹן) indicates a prudential calculation that does not claim to exhaust the outcome of the action, but directs the choice within margins of recognized uncertainty (b. Avot 3:1). Similarly, in the Hebrew Bible, the expression "*ki lo machshevotai machshevoteichem*" (מִהֲשָׁבוֹתַי כִּי לֹא כִי מִהֲשָׁבוֹתֵיכֶם; Isa. 55:8) establishes the incommensurability between human prediction and the ultimate order of events, configuring an epistemic posture of cognitive humility. The classical Sunni tradition develops an analogous epistemology of fallibility through

the distinction between *tadbīr* (planning) and *taqdīr* (ultimate determination), recognizing that human action must be oriented by rational plans while being aware of their intrinsic contingency. In treatises on ethics and jurisprudence, prediction is conceived as an act of responsibility (*mas'ūliyya*) and not as a claim to control, and the failure of judgment does not nullify the value of the correct intention (*niyya*) (al-Ghazālī, *Iḥyā' 'ulūm al-dīn*). This approach anticipates in a theological-normative form the modern distinction between the quality of the decision-making process and the contingent empirical outcome. The Caucasian and Balkan traditions also offer symbolic elaborations of predictive fallibility. In Old Georgian, the term *ბედი* (*bedi*) articulates a conception of the future as an interweaving of possibilities that cannot be completely mastered, while in Old Romanian the *chibzuință* designates a reflective weighting that orients the action while recognizing the unpredictability of the outcomes (Neagoe Basarab, *Învățăturile către fiul său Teodosie*). In both traditions, planning is legitimized not by its accuracy, but by its ability to keep action within shared horizons of meaning. Returning to the contemporary scientific debate, the most recent Anglo-Saxon research has highlighted how prediction is strongly influenced by social and institutional factors. Studies conducted at Oxford and Yale show that organizations tend to institutionalize planning practices that reinforce the illusion of predictability, even when empirical evidence suggests high levels of structural uncertainty (Flyvbjerg, 2014). In such contexts, the fallibility of judgment is often concealed or rationalized ex post, generating distorted learning cycles that perpetuate systemic errors. Social neuroscience has further clarified how regulatory pressure and the desire for compliance influence the evaluation of predictions, modulating the activity of the prefrontal areas involved in cognitive control. Experimental studies from Berkeley and Cambridge indicate that sharing incorrect predictions within cohesive groups can strengthen subjective confidence in predictions, reducing sensitivity to prediction errors and increasing the likelihood of collective failures (Klucharev et al., 2009). This dynamic highlights the intrinsically social dimension of the fallibility of judgment. In conclusion, prediction, planning and fallibility of judgment must be understood as inseparable dimensions of a single epistemic-practical field in which the future is simultaneously the object of cognitive simulation and a source of irreducible surprise. The most advanced neuroscientific research confirms what the ancient wisdom traditions had already intuited: human prediction is structurally limited, and rationality does not consist in eliminating this limit, but in knowing how to integrate it into flexible, reflective and reviewable decision-making practices.

Planning, in this light, is not a promise of control, but an exercise of epistemic responsibility that assumes fallibility as a constitutive condition of human action.

9. Creativity as a decision-making resource

Creativity, when taken as a decision-making resource and not reduced to a mere dispositional attribute or extemporaneous talent, is configured as a complex and multilevel cognitive function that intervenes structurally in the processes of choice in conditions of uncertainty, ambiguity and incomplete definition of the problem. In this perspective, creativity is not placed on the margins of decision-making rationality, as an aesthetic deviation or as an imaginative license devoid of rigor, but constitutes a constitutive dimension of it, as it allows the cognitive system to transcend the spaces of possibilities already codified and to generate new interpretative configurations where conventional decision-making repertoires are epistemically saturated. The creative decision does not consist in the optimal selection of given alternatives, but in the restructuring of the decision-making space itself, through an act of redefinition of the constraints, criteria of relevance and causal relationships that delimit the problem. Contemporary cognitive neuroscience has shown how this restructuring is supported by distributed neural networks that integrate executive control processes, remote semantic association and prospective simulation, crucially involving the dynamic interaction between default mode network, salience network and fronto-parietal systems of cognitive control. Studies conducted at Harvard and Berkeley indicate that moments of creative insight emerge from a temporary suspension of rigid top-down control, which allows for the activation of weakly constrained associations and the recombination of previously noncontiguous representations, followed by a phase of executive re-stabilization that integrates creative output into action-oriented decision-making (Beaty et al., 2016). In this sense, decision-making creativity is not cognitive anarchy, but a controlled oscillation between associative openness and regulatory constraint. This oscillation plays a particularly important role in complex decision-making contexts, in which the available information does not allow a reliable probabilistic assessment and predictive models are structurally insufficient. In such contexts, creativity operates as an epistemic device for exploring the space of possibilities, allowing the decision-maker to generate alternative scenarios that do not derive by linear deduction from the past, but that emerge from processes of deep analogy, metaphorization and structural transfer. Yale and Oxford research on strategic decision-making shows that the most effective decision-makers in highly uncertain environments are those capable of

resorting to forms of creative reasoning that integrate quantitative data with plausible narratives, capable of guiding action even in the absence of predictive guarantees (Dane & Pratt, 2007). From a neurobiological point of view, this ability is associated with a particular flexibility of mesocortical dopaminergic circuits, which modulate the threshold of cognitive exploration and sensitivity to novelty. Recent studies conducted at Massachusetts General Hospital and the University of St. Petersburg suggest that decision-making creativity is related to a fine regulation of prediction error signals, which allows the brain to tolerate temporary deviations from established patterns without collapsing into states of cognitive disorganization (Schultz, 2016; Bekhtereva, 2004). In this framework, creativity emerges as an advanced form of neural adaptation that balances stability and change. The Russian neuroscientific tradition has made a particularly relevant contribution to this understanding, interpreting creativity as an emergent function of dynamic functional systems that coordinate perception, memory and action in view of incompletely specified goals. Anokhin and his successors have shown that the creative act cannot be localized in a single brain "center", but is configured as a temporary reorganization of the entire functional system in response to a discrepancy between the expected state and the real state (Anokhin, 1974). This discrepancy, far from being eliminated, is exploited as a driver for generating new solutions, making creativity a functional response to uncertainty rather than a cognitive luxury. This functional conception of creativity finds surprising resonances in pre-modern wisdom traditions, in which the creative act is conceived as a response to a structural lack of knowledge rather than as an expression of imaginative omnipotence. In Aramaic literature, the term *ḥiddush* (חידוש) indicates an interpretative innovation that does not break with tradition, but renews it in response to new conditions, configuring a form of constrained creativity that operates within recognized normative limits (b. Hagigah 3a). Similarly, in the Hebrew Bible, creative *ḥokmāh* does not coincide with arbitrary invention, but with the ability to "find ways" (*limtzo derekh*) in situations of epistemic opacity (*Ecclesiastes* 7:29). The classical Sunni tradition develops a similar conception through the concept of *ijtihād*, understood as a creative interpretative effort exercised in the absence of unambiguous textual prescriptions. *Ijtihād* is not arbitrariness, but the controlled production of new normative solutions on the basis of general principles and ethical purposes (*maqāṣid*), configuring a form of institutionalized decision-making creativity that operates under the sign of epistemic responsibility (al-Ghazālī, *al-Mustasfā*). In this perspective, creativity is inseparable from the recognition of limits and the awareness of the fallibility of

judgment. The Caucasian and Balkan traditions offer further symbolic layers of this idea. In Old Georgian, the term $\delta \alpha \beta \gamma \delta \epsilon$ (*goneba*) designates a faculty of creative discernment that allows one to orient oneself in uncoded situations, while in Old Romanian *născocire* indicates an invention that arises from necessity rather than whim (*Letopisețul Țării Moldovei*). In both cases, creativity is conceived as a pragmatic response to the insufficiency of existing models. Returning to the contemporary scientific context, the most recent Anglo-Saxon research has shown how decision-making creativity is strongly influenced by contextual and organizational factors. Cambridge studies show that environments characterized by error tolerance and interpretative plurality favor the emergence of creative solutions, while contexts with high evaluation pressure tend to inhibit cognitive exploration, reducing creativity to superficial variation (Amabile et al., 1996). These results indicate that creativity is not only individual property, but a systemic resource that can be cultivated or repressed by organizational structures. Social neuroscience has further clarified how creative processes are modulated by dynamics of social recognition and legitimation. Studies conducted at Yale and Berkeley show that the perception of social support increases connectivity between prefrontal and associative areas, facilitating the generation of unconventional ideas and their integration into collective decision-making (Kounios & Beeman, 2014). In the absence of such legitimacy, creativity tends to remain latent or self-censored, reducing the variety of decision-making space. In epistemological terms, creativity as a decision-making resource requires a radical revision of the normative models of rationality, which traditionally privilege coherence, stability and predictability. The creative decision introduces a dimension of discontinuity that cannot be evaluated exclusively ex ante by means of probabilistic criteria, but which requires an ex post evaluation of its ability to generate new functional balances. In this sense, creativity is placed on the border between rationality and contingency, operating as an opening device that makes the decision-making system capable of learning not only from mistakes, but also from production deviations. In conclusion, creativity as a decision-making resource must be understood as a cognitive and systemic function that allows human action to transcend the limits of existing models without dissolving into arbitrariness. The most advanced neuroscientific research confirms what the ancient wisdom traditions had already intuited: creativity is not an antagonist of rationality, but its adaptive extension in conditions of radical uncertainty. In this light, the creative decision emerges as an act of epistemic responsibility that takes the risk of innovation while recognizing

the fallibility of judgment, transforming the unknown from a threat into a space of possibility.

Conclusions

The conclusions that are imposed at the end of this theoretical itinerary cannot take the form of a pacified synthesis or a reductive balance, since the very object of the investigation — the human decision-making process in its cognitive, neurobiological, social and symbolic articulation — structurally resists any attempt at definitive closure, imposing rather an epistemic posture of reflective vigilance and conscious provisionality. The decision, as has emerged throughout the entire argumentative process, cannot be circumscribed within the boundaries of a unitary regulatory model, nor can it be adequately understood through the aggregation of isolated variables; instead, it manifests itself as an emergent event, located at the intersection of complex systems that operate on different time scales and levels of organization, from synaptic microdynamics to institutional macrodynamics, from the embodied memory of individual experience to the symbolic traditions that orient the meaning of collective action. In this perspective, decision-making rationality appears to be definitively emancipated from the Enlightenment ideal of integral transparency and deterministic prediction, to be relocated within a paradigm of limited, adaptive and intrinsically fallible rationality, whose strength does not lie in the elimination of uncertainty, but in the ability to operate responsibly within it. The most recent neuroscientific research conducted at Harvard, Yale and Berkeley confirms that the human brain is not an optimizing computer oriented to the maximization of abstract utility functions, but an embodied predictive system that builds continuously revisable models of the world, guided by prediction error signals and modulated by affective states that act as anticipatory markers of action (Friston, 2010; Schultz, 2016). This neural architecture makes the fallibility of judgment structurally inevitable, but at the same time provides the mechanisms through which error can be transformed into a resource for learning and adaptive reorganization. The integration of neuroscience with cognitive psychology and decision theory, developed in a particularly fruitful way in the Anglo-Saxon schools of Oxford and Cambridge, has further clarified how the decision is not a punctual act, but a process distributed over time, in which prediction, evaluation and action are intertwined in recursive cycles that reflect the dynamic nature of the environment. In this framework, planning emerges not as a promise of control, but as a regulatory practice that allows collective action to be coordinated while being aware of the structural unpredictability of outcomes

(Mintzberg, 1994; Tetlock & Gardner, 2015). The persistence of predictive biases and illusions of control, far from being simple correctable errors, is configured as an expression of a constitutive tension between the human need for meaning and the resistance of reality to be fully anticipated. The dialogue with the Russian neuroscientific tradition, in particular with the contributions from the University of Moscow and the Bekhtereva Institute in St. Petersburg, allows us to further radicalize this conclusion, showing how the decision must be understood as an emergent function of dynamic functional systems involving the whole organism. In this perspective, decision-making cognition is not confined to the brain in the localizationist sense, but is distributed along sensorimotor and emotional circuits that incorporate past experience and anticipate future action in a non-linear temporal continuum (Anokhin, 1974; Bekhtereva, 2004). The fallibility of judgment, therefore, is not a defect in implementation, but a necessary consequence of the biological architecture of prediction.

This awareness finds surprising consonances in the pre-modern wisdom traditions, which, while operating in symbolic and theological registers, have thematized with remarkable acuteness the epistemic limit of human action. In rabbinic Aramaic literature, the concept of *safek* (ספק) designates a condition of uncertainty that does not paralyze action, but directs it towards a creative prudence, in which judgment is always accompanied by the awareness of one's own reviewability (b. Berakhot 19a). Similarly, in the Hebrew Bible, the tension between *hokmah* and *bināh* articulates a conception of decision as situated discernment, which recognizes the plurality of possibilities and the impossibility of total foresight (*Ecclesiastes* 8:17). The classical Sunni tradition develops a sophisticated epistemology of fallibility through the distinction between *ẓann* (plausible conjecture) and *yaqīn* (certainty), attributing to the former a central role in daily decision-making practice. In *uṣūl al-fiqh*, most normative decisions are based on probabilistic estimates of plausibility, recognized as epistemically legitimate precisely by virtue of the impossibility of reaching an apodictic certainty in a contingent world (al-Ghazālī, *al-Mustasfā*). This approach strikingly anticipates the modern distinction between quality of decision-making and empirical outcome, showing that epistemic responsibility does not coincide with infallibility. Caucasian and Balkan traditions add further symbolic layers to this vision. In Old Georgian, the term *გონება* (*goneba*) indicates a faculty of discernment that integrates foresight and acceptance of the limit, while in Old Romanian the *chibzuință* designates a reflective weighting that orients the action while recognizing the unpredictability of historical outcomes (Neagoe Basarab,

Învățăturile către fiul său Teodosie). In both cases, the decision is conceived as a responsible act that lies between incomplete knowledge and the obligation to act. In the light of these convergences, the conclusions that are imposed can only take an openly fallibilist and systemic form. Human decision-making, far from being a problem to be solved once and for all through increasingly sophisticated normative models, is configured as a historically situated practice that requires a dynamic balance between analytical rigor, contextual sensitivity and adaptive creativity. The most advanced neuroscientific and cognitive research confirms that decision-making competence does not consist in eliminating uncertainty, but in knowing how to inhabit it, transforming it into a space for learning and continuous reorganization. In this sense, the main contribution of this work does not lie in the offer of an alternative prescriptive model, but in the proposal of an interpretative framework that recognizes the plurality of levels involved in decision-making and the need for a radical interdisciplinary dialogue. The decision emerges as a place of intersection between biology and culture, between neural prediction and symbolic narration, between probabilistic calculation and ethical responsibility. Assuming this complexity does not mean renouncing rationality, but redefining it as a reflective practice that integrates the limit as its own condition of possibility.

In conclusion, the "final conclusions" can only remain provisional, insofar as the decision itself is an open process that is renewed with each act of choice. The fallibility of judgment, far from being an obstacle to be removed, proves to be the foundation of an authentically human rationality, capable of learning, correcting and innovating in a structurally uncertain world. It is in this acceptance of the limit that the decision finds its highest epistemic and practical dignity.

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ENTREPRENEURIAL COMPETENCE, ETHICAL ECONOMY AND CREATIVE PROBLEM SOLVING: EDUCATION, GLOBAL CITIZENSHIP AND SUSTAINABLE DEVELOPMENT IN THE EUROPEAN AND INTERNATIONAL FRAMEWORK

Melina ALLEGRO¹

***¹Teseo Institute Foundation for Higher Education and Research, Corso
 Umberto I, 16, 84099 San Cipriano Picentino (SA), Salerno, Italy, Tel:
 (+39) 340-1660358, E-mail:allegromelina@gmail.com***

***¹School of Linguistic Mediation "Salerno" (UNISA): SSML Salerno, Via
 Giovanni Paolo II Street, Fisciano (SA), Salerno, Italy. Phone: +39 089 96
 1111, E-mail:allegromelina@gmail.com***

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Abstract

This interdisciplinary study reconceptualizes entrepreneurial competence as a meta-ethical cognitive capability that integrates creative problem solving, ethical economics, and global citizenship to foster sustainable development. Drawing on European Union frameworks for lifelong learning and the United Nations 2030 Sustainable Development Goals, the article argues that entrepreneurial competence extends beyond technical economic skills to include moral reasoning, narrative construction, and anticipatory decision-making. By combining insights from educational sciences, cognitive neuroscience, and moral economy traditions, the study demonstrates how responsible entrepreneurship arises from embodied, relational cognition, integrating creativity, ethical judgment, and temporal foresight. Emphasis is placed on the role of education in fostering cognitive and ethical skills that enable individuals to act responsibly in complex, interdependent global

systems. The article presents entrepreneurial competence as a crucial meta-competence for transforming knowledge into socially and morally sustainable action, highlighting its centrality for global citizenship, ethical innovation, and the development of sustainable economic practices.

Keywords: *entrepreneurial competence, ethical economy, creative problem solving, global citizenship, sustainable development, education, cognitive neuroscience, moral agency*

JEL Classification: A23; I25; M14; O15

Introduction

In the twenty-first century, education and economics are called upon to confront an unprecedented level of complexity, determined by the intertwining of global factors such as technological transformations, environmental crises, social inequalities and geopolitical instability. In this scenario, the traditional categories through which economic development, training and citizenship have been interpreted show obvious limits, making it necessary to rethink the concepts of competence, responsibility and action. The main international institutions, from the European Union to the United Nations, have progressively recognized that the sustainability of economic and social systems depends to a large extent on the quality of citizens' cognitive, ethical and creative skills. Within this framework, entrepreneurial competence emerges as one of the most relevant and, at the same time, the most ambiguous. If on the one hand it is often associated with the capacity for economic initiative and the creation of market value, on the other hand the most recent academic reflections highlight a broader dimension, which involves the ability to face complex problems, to make decisions in conditions of uncertainty and to act responsibly within interdependent systems. Entrepreneurial competence, in this perspective, is not reducible to a functional skill for the labour market, but is configured as a form of practical and social intelligence, deeply intertwined with the values, relationships and cultural context in which it is exercised. The European Framework of Key Competences for Lifelong Learning reflects this conceptual evolution, placing entrepreneurial competence in an educational vision that integrates knowledge, skills and attitudes. This approach is part of a broader international movement that recognizes the need to train subjects capable not only of adapting to change, but of interpreting and directing it. In this sense, entrepreneurship becomes a civic competence, since it implies the ability to take initiative responsibly, to assess the impact of one's actions and to actively

contribute to the economic and social life of communities. A central element of this reconceptualization is represented by problem solving competence, understood not as the mere application of standardized procedures, but as the ability to deal with new, ambiguous and unstructured situations. Research on lateral thinking and creative thinking has shown that solving complex problems requires the ability to reframe questions, question established patterns, and explore alternative paths. In the entrepreneurial field, this form of creative problem solving takes on an ethical value, since decisions do not only concern the effectiveness of the means, but also the desirability of the ends and the social consequences of the choices made. International reflection on ethical economics has highlighted how many of the contemporary crises derive from a reduction of economic action to short-term logics and from an artificial separation between economic rationality and moral responsibility. In this context, entrepreneurship can become a privileged space for recomposition, provided that it is supported by skills capable of integrating creativity, ethical judgment and systemic vision. Lateral problem solving makes it possible to imagine solutions that do not limit themselves to optimizing the existing, but that radically rethink production, distribution and consumption models, orienting them towards human well-being and sustainability. The United Nations 2030 Agenda provides a normative and value framework that further strengthens this perspective. The Sustainable Development Goals require a type of entrepreneurial competence capable of operating across national and sectoral boundaries, connecting local and global dimensions, and promoting social as well as economic innovation. In this perspective, educating for entrepreneurial competence means training global citizens who are able to recognize problems as opportunities for transformation, to act creatively within complex constraints and to contribute to the development of communities in a fair and responsible way.

Starting from these considerations, this paper proposes a reinterpretation of entrepreneurial competence as a creative ethical competence, based on lateral problem solving and oriented towards global citizenship. This reinterpretation makes it possible to overcome the opposition between economics and ethics, restoring to education a central role in the formation of subjects capable of thinking and acting in an entrepreneurial way not only for individual interest, but for the common good and the sustainable development of contemporary societies. In the epistemic landscape of the twenty-first century, marked by an unprecedented convergence between systemic crises, technological transitions and profound anthropological redefinitions, the notion of entrepreneurial competence emerges as one of the densest and at the same time most controversial theoretical nodes of the

global educational and economic discourse. Its centrality in supranational regulatory documents, in particular in the European framework of key competences for lifelong learning, can only be understood within a broader reconfiguration of the paradigms of rationality that have historically informed the relationship between subject, knowledge and action. In this context, entrepreneurship no longer presents itself as a mere instrumental function of economic action, but as a complex form of cognitive, ethical and creative agency, capable of operating in conditions of radical uncertainty and transforming contingency into planning possibilities.

The most recent international literature, which can be placed at the intersection of moral philosophy, cognitive science and the theory of complex systems, has progressively dismantled the implicit assumption that economic action can be reduced to an optimizing sequence of rational decisions oriented towards maximizing utility. Such reductionism, heir to a mechanistic conception of mind and action, is epistemologically untenable today in the light of neuroscientific evidence that shows how decision-making processes are intrinsically situated, emotionally modulated and profoundly dependent on shared structures of meaning. In this framework, entrepreneurial competence takes on the traits of a dynamic configuration of skills that include the cognitive regulation of uncertainty, the tolerance of ambiguity and the ability to creatively restructure problems, in ways that explicitly refer to lateral and divergent thinking. The very idea of problem solving, far from being a technical procedure applicable to stabilized contexts, is thus reconceptualized as a generative process, in which the formulation of the problem precedes and conditions every possible solution. This approach finds a solid foundation both in contemporary cognitive theories and in the most recent neuroscientific research conducted in the United States and in the Anglo-Saxon world, where longitudinal studies on neural plasticity and higher executive functions have shown how the ability to solve complex problems emerges from the nonlinear interaction between distributed neural networks, simultaneously involving simulation processes, moral evaluation and counterfactual imagination. In this sense, creative problem solving cannot be separated from the ethical dimension, since every act of cognitive restructuring implies a value stance with respect to the ends of the action. Within this theoretical framework, ethical economics is not configured as a regulatory corrective external to the market, but as a principle immanent in entrepreneurial action itself, to the extent that the latter is understood as a social practice endowed with meaning and responsibility. The traditions of thought that have placed the relationality of human action at the

center, from the Aristotelian philosophy of phronesis to the most recent elaborations of moral economy and institutional economy, converge in recognizing that economic action is always already inscribed in a horizon of meaning that orients its legitimacy. This intuition, which can also be traced back to ancient formulations that speak of just action such as *מתוקנת פעולה*, i.e. action rectified according to measure, finds an unexpected resonance today in moral neuroscience, which shows how ethical judgments are not secondary superstructures, but constitutive components of decision-making processes. Entrepreneurial competence, interpreted in this perspective, is therefore configured as a form of advanced practical intelligence, in which lateral thinking acts as a cognitive device capable of suspending dominant patterns and generating alternative configurations of meaning. This ability is not limited to producing economic innovation, but makes possible a reconfiguration of the relationships between individual and community, between local and global, between interest and responsibility. It is in this space that the economy ceases to be a separate sphere from citizenship and becomes one of its most complex and decisive forms. The horizon of global citizenship, as outlined in the main documents of the United Nations and in the most advanced theoretical elaborations of comparative education, provides the normative context within which this reconceptualization acquires full intelligibility. Global citizenship cannot be reduced to a set of intercultural knowledge or a generic cosmopolitan openness, but implies a deep competence in recognizing the structural interdependence of social, economic and ecological systems. In this perspective, entrepreneurial action becomes a specific way of participating in collective destiny, in which the ability to create creative problem solving translates into responsibility towards present and future generations. This first theoretical movement allows us to affirm that entrepreneurial competence, as it is progressively redefined today in the international debate, represents one of the privileged places in which epistemology, ethics and neuroscience of action are intertwined. It is not one competence among others, but a meta competence that organizes and directs the use of knowledge according to ends that are not given, but continuously negotiated and redefined. In this constitutive tension between possibility and limit, between creativity and responsibility, the deepest sense of entrepreneurship as an advanced form of education to complexity is played out

1. Literature Review

This paper is placed within an interdisciplinary theoretical horizon that intersects educational sciences, ethical economics, cognitive neuroscience, and

global citizenship studies, proposing a reconceptualization of entrepreneurial competence as a meta-ethical cognitive competence, capable of operating as an ordering principle of human action in contexts of systemic complexity, structural uncertainty, and global interdependence (Gibb, 2002; Rae, 2006). Starting from the regulatory framework of key competences for lifelong learning outlined by the European Union (European Commission, 2018) and placing it in critical dialogue with the Sustainable Development Goals of the United Nations 2030 Agenda (United Nations, 2015), the literature suggests that entrepreneurial competence cannot be reduced to a technical instrumental dimension oriented towards the creation of economic value, but must be interpreted as a dynamic configuration of cognitive processes, moral dispositions, and symbolic practices that enable a responsible transformation of social, economic, and cultural contexts (Fayolle & Gailly, 2015; Kassean, Vanevenhoven, Liguori, & Winkel, 2015).

The analysis assumes as its backbone the concept of creative problem solving, understood not as a solution procedure applicable to well-defined problems, but as a generative capacity for cognitive restructuring of reality, based on lateral thinking, the suspension of dominant interpretative schemes, and the production of new frames of meaning (Mumford, 2000; Puccio, Mance, & Murdock, 2011). In this perspective, problem solving is conceptualized as a neuro-ethical device, insofar as it simultaneously involves higher executive functions, neural networks of social cognition, and processes of moral evaluation, making creativity, decision-making, and responsibility inseparable (Beaty, Benedek, Kaufman, & Silvia, 2018; Dietrich, 2004).

Recent neuroscientific evidence, particularly from US and Anglo-Saxon research contexts, shows how sustainability-oriented entrepreneurial activity is associated with patterns of functional integration between default mode networks, cognitive control systems, and affective circuits, suggesting that responsible innovation emerges from a form of embodied and relational cognition rather than from disembodied rational calculation (Beaty et al., 2018; Boyer, 2008). Within this framework, ethical economics is reinterpreted not as a separate or corrective regulatory framework external to market logic, but as an immanent expression of a fully developed entrepreneurial competence, in which the ability to attribute value precedes and directs the production of economic value (Zamagni & Zamagni, 2017; Duflo & Banerjee, 2019). The literature shows how the traditions of moral economy, civil economy, and institutional economy converge in recognizing that economic action is always already inscribed in a symbolic and relational horizon,

and that the legitimacy of business decisions depends on their ability to generate trust, reciprocity, and social cohesion (Bruni, Gherardi, & Poggio, 2004).

Entrepreneurial competence is analyzed as an advanced form of moral agency, capable of mediating between individual interests and collective responsibilities through problem-solving practices oriented towards the common good (Kickul & Lyons, 2012; Neck & Greene, 2011). Particular attention is paid to the linguistic and narrative dimension of entrepreneurship, understood as a structural component of decision-making processes and not as a simple communicative tool. The neuroscience of language and the theories of embodied cognition show how the construction of narratives, metaphors, and counterfactual scenarios plays a decisive role in configuring economic choices and their social justifiability (Lounsbury & Glynn, 2001; Bruni et al., 2004). In this perspective, the entrepreneur is interpreted as a producer of meaning even before producing goods, and entrepreneurial competence as a discursive ability to articulate visions of the future that make action collectively intelligible and morally sustainable.

The article also integrates an in-depth reflection on the temporal dimension of entrepreneurial action, analyzing the role of prospective memory, imagination of the future, and intergenerational responsibility in complex decision-making processes. Neuroscientific research on mental simulation and future thinking shows that the ability to anticipate the long-term consequences of actions is crucial for developing sustainability-oriented forms of entrepreneurship (Suddendorf & Corballis, 2007; Boyer, 2008). Entrepreneurial competence is conceptualized as a capacity for temporal mediation, in which the present is constantly reread in light of possible futures and significant pasts, transforming uncertainty into a space of shared responsibility.

From an educational point of view, training in entrepreneurial competence represents one of the most powerful devices for developing global citizenship, understood not as abstract membership in a world community, but as a concrete ability to act responsibly within interconnected systems (Fayolle & Gailly, 2015; Kassean et al., 2015). Education in creative problem solving and lateral thinking is proposed as a training practice with high cognitive and ethical intensity, capable of developing individuals able to address global problems without reducing them to technocratic or sectoral solutions. In this perspective, entrepreneurship becomes a form of advanced civic participation, in which economic action is configured as a public act endowed with moral and political relevance.

Overall, the literature indicates that entrepreneurial competence emerges as a crucial junction for rethinking the relationship between education, economics, and

ethics in the twenty-first century. Far from being an ancillary or instrumental competence, it is interpreted as a transversal meta-competence that organizes the use of knowledge, directs decisions, and enables sustainable transformation of social systems. In this view, the economy is no longer an autonomous sphere regulated by impersonal laws, but a space for the exercise of human responsibility, where cognitive creativity and ethical judgment converge to construct forms of development capable of responding to global citizenship and planetary sustainability (Rae, 2006; Kickul & Lyons, 2012).

2. Cognitive architectures of entrepreneurial action and neuroscientific reconfiguration of creative problem solving

In the contemporary debate on advanced skills, entrepreneurship is progressively removed from a merely functionalist reading and relocated within a cognitive and epistemological paradigm that recognizes the centrality of complex, situated and morally oriented decision-making processes. The most recent neuroscientific research, developed in particular in the American and Anglo-Saxon academic environments, has shown how the decision-making act, far from being the result of a linear calculation of costs and benefits, emerges from the dynamic interaction between distributed neural networks, simultaneously involving executive functions, emotional systems and moral evaluation structures. In this framework, entrepreneurial competence is configured as a high-level cognitive orchestration capacity, in which creative problem solving takes on the role of the organizing principle of the action. Studies conducted at Harvard University and Yale University in the field of neuroeconomics and moral cognition have shown that the medial prefrontal cortex and limbic structures are decisively involved in choice processes that imply social and collective consequences. Such evidence undermines the idea of a clear separation between economic rationality and ethics, suggesting rather that moral evaluation constitutes an intrinsic dimension of intentional action. In this sense, entrepreneurship cannot be interpreted as a neutral skill, but as a form of embodied cognition that integrates perception, emotion, imagination and judgment. Creative problem solving, understood as the ability to cognitively restructure a problematic situation, is based on lateral thinking processes that allow us to overcome rigid conceptual configurations and generate new possibilities of meaning. Cognitive neuroscience has shown that these processes are associated with a flexible activation of default mode networks and central executive networks, whose interaction allows the simulation of alternative scenarios and the evaluation of their implications. This capacity for counterfactual

exploration, which some authors trace back to the Aristotelian notion of phronesis, represents one of the neurocognitive foundations of ethically oriented entrepreneurial action.

The relevance of these results is further strengthened by research developed at the University of California at Berkeley, where studies on creativity and emotional intelligence have highlighted the role of affective regulation in the generation of innovative solutions. Entrepreneurial creativity, in this perspective, is not the product of an isolated intuition, but the result of a dynamic balance between cognitive openness and executive control, between exploration and evaluation. This balance is essential when entrepreneurial action is confronted with problems that do not allow for standardized solutions, such as those posed by contemporary environmental, social and geopolitical challenges. A further theoretical contribution comes from the Russian tradition of cultural historical psychology and activity theory, developed in Moscow and St. Petersburg, where human action is conceived as a culturally mediated process oriented towards objects endowed with social significance. In this perspective, entrepreneurship can be interpreted as a specific form of transformative activity, in which the subject reorganizes his or her material and symbolic environment through cognitive and social tools. Creative problem solving thus becomes an act of mediation between the individual and the community, in which entrepreneurial competence manifests itself as the ability to read emerging needs and respond to them in an innovative and responsible way. This conception finds a suggestive consonance with some ancient formulations that describe wise action as a capacity for creative discernment. In the Hebrew biblical corpus, for example, the notion of *חָכְמָה* indicates a practical wisdom that combines knowledge, judgment and right action, while in Targumic Aramaic texts the idea of *פְּתָרֻן*, solution, refers to an interpretative act that transforms the opacity of reality into operational intelligibility. Similarly, in classical Arabic philosophy, the concept of *تدبير*, understood as rational and provident governance of action, emphasizes the ethical and community dimension of decision making. These traditions, although distant in time and space, converge in recognizing that the ability to solve complex problems is inseparable from a vision of the world oriented to the common good. In light of these considerations, entrepreneurial competence can be understood as an advanced cognitive configuration that integrates creative problem solving, lateral thinking and ethical evaluation, making possible economic action capable of responding to the needs of global citizenship. Such integration is not a mere educational objective, but a structural necessity in a world where economic decisions produce systemic effects on a planetary scale. In this sense, education in

entrepreneurial competence becomes a privileged place for the formation of responsibility, in which neuroscience, ethics and economics converge in the construction of subjects capable of inhabiting complexity without reducing it.

3. Post-utilitarian reconfiguration of ethical economics and neuro-moral status of entrepreneurial action

In the contemporary theoretical framework, ethical economics is increasingly configured as a post-utilitarian paradigm that radically questions the idea that economic action can be explained and governed exclusively through models of instrumental rationality. The most recent elaborations in the philosophical, economic and neuroscientific fields converge in recognizing that economic decisions are intrinsically charged with moral significance and that every productive, organizational or entrepreneurial choice implies an implicit evaluation of the ultimate ends of the action. In this perspective, entrepreneurial competence assumes an epistemological status that transcends the technical-functional dimension and is placed at the level of a meta-ethical competence, capable of directing the use of cognitive and emotional resources in highly complex contexts. The critique of the utilitarian paradigm, developed systematically in the traditions of moral economy and institutional economics, today finds empirical confirmation in the neuroscience of decision-making. Research conducted at Harvard, Yale and Berkeley has shown that the neural circuits involved in the evaluation of economic choices largely coincide with those activated in moral and social judgments, making the conceptual separation between economic calculation and ethical responsibility untenable. In particular, studies on moral decision making have highlighted the crucial role of the ventromedial prefrontal cortex and the anterior insula in the evaluation of equity, trust and cooperation, elements that constitute the invisible fabric of entrepreneurial action oriented towards the common good. This convergence between neuroscience and ethical economics makes it possible to reinterpret entrepreneurship as an embodied practice, in which the subject does not limit himself to reacting to external incentives, but actively constructs meanings and guidelines for action. The entrepreneur, in this sense, is not a mere maximizer of utility, but an agent capable of attributing value, in the strong sense of the term, to his choices. This attribution of value is not reducible to a subjective preference, but emerges from the interaction between cognitive dispositions, social norms and shared cultural horizons. Entrepreneurial competence thus becomes a form of expanded rationality, in which creative problem solving acts as a mediator between structural constraints and transformative possibilities. Ancient philosophical

traditions offer a surprisingly current interpretative key to understanding this dynamic. In ancient Hebrew wisdom texts, the distinction between *חכמה* and *ערמה* indicates a difference between good-oriented wisdom and unethical cunning, suggesting that not every ability to solve problems can be considered virtuous. Similarly, in classical Arabic reflection, in particular in the texts of al Fārābī and Avicenna, the concept of *عقلي عملي* refers to a form of practical intelligence that integrates knowledge, deliberation and ethical finality. These conceptions, although belonging to different historical contexts, converge in recognizing that the effectiveness of action cannot be separated from its moral justifiability. In the contemporary context, these intuitions find a sophisticated reworking in the theories of civil economy and the economy of reciprocity, which place the relationship as a fundamental category of economic action at the center. In this perspective, the company is interpreted as a social institution that produces not only goods and services, but also forms of bonding, trust and recognition. Entrepreneurial competence then manifests itself as the ability to read and govern complex relational networks, to anticipate the systemic effects of decisions and to generate shared value. Creative problem solving, in this framework, is not aimed at optimizing a single objective, but at the composition of plural interests within a shared ethical horizon. A relevant contribution to this reconceptualization comes from the Anglo-Saxon schools of Oxford and Cambridge, where reflection on applied ethics and political economy has highlighted how economic institutions are intrinsically normative. Entrepreneurial choices, as acts that shape opportunities, distributions of resources and forms of inclusion or exclusion, participate in the construction of the social order. In this sense, entrepreneurial competence can be understood as a form of economic citizenship, in which individual action takes on a public and political value. The Russian tradition, in particular the contemporary developments of activity theory and cultural neuropsychology in Moscow and St. Petersburg, further reinforces this view, emphasizing how goal-oriented action is always mediated by symbolic and social tools. Entrepreneurship, from this point of view, represents a specific form of transformative activity, in which the subject reorganizes systems of meaning and social practices through creative problem solving processes. This reorganisation is never neutral, as it implies a redefinition of collective priorities and the ways in which we cooperate. In the light of these theoretical convergences, ethical economics can be understood not as a marginal or alternative sector, but as the result of a fully developed entrepreneurial competence, capable of integrating creativity, moral judgment and systemic responsibility. In this perspective, entrepreneurial action becomes one of the most sophisticated

forms of participation in social life, in which the ability to solve complex problems translates into a concrete contribution to human development and the sustainability of communities.

4. Entrepreneurial competence, global citizenship and systemic architecture of sustainable development

In the most advanced international debate, global citizenship is increasingly interpreted as a simple geographical extension of national citizenship and more and more as a systemic competence that implies the ability to understand, inhabit and transform complex networks of economic, social, cultural and ecological interdependence. In this sense, entrepreneurial competence assumes a paradigmatic function, since it represents one of the most concrete forms through which the subject enters into an active relationship with global complexity, translating visions, values and intentions into practices that materially affect the systems of collective life. Entrepreneurship, far from being confined to the sphere of private initiative, thus becomes a mode of exercising citizenship, in which economic action is configured as a public act endowed with ethical and political relevance. The theoretical elaborations developed in the Anglo-Saxon context, in particular at the universities of Oxford and Cambridge, have contributed significantly to clarifying how global citizenship requires skills that go beyond mere normative or legal knowledge, involving instead forms of moral reasoning, the ability to anticipate systems and sensitivity to the long-term consequences of decisions. In this perspective, entrepreneurial competence is presented as a responsible design capacity, in which creative problem solving is not oriented towards solving isolated problems, but towards managing structural tensions between economic growth, social equity and environmental sustainability. The United Nations 2030 Agenda constitutes the global regulatory framework within which this reconceptualization acquires systemic coherence. The Sustainable Development Goals cannot be understood as sectoral goals, but as an expression of an integrated vision of human development, in which economic, social and environmental dimensions are intrinsically interconnected. In this context, entrepreneurial competence emerges as an indispensable cognitive and moral resource, since it allows to face problems that do not admit linear solutions and that instead require the ability to coordinate, adapt and social innovation. Creative problem solving thus becomes a tool for mediating between potentially conflicting objectives, allowing you to explore solutions that combine efficiency and justice. The most recent research in neuroscience, particularly in the United States, has strengthened this view by showing how the

ability to think in systemic terms and to take multiple perspectives is associated with specific neural activation patterns involving social cognition and empathy networks. Longitudinal studies have shown that exposure to complex decision-making contexts favors the development of greater integration between executive networks and socio-affective networks, suggesting that entrepreneurial competence can be educated as a form of relational intelligence. In this sense, entrepreneurship education is not limited to transmitting operational tools, but contributes to the training of individuals capable of recognizing the other as an integral part of their decision-making horizon. This perspective finds an interesting resonance in some ancient philosophical and religious traditions that have placed responsibility towards the community at the center of human action. In the Aramaic texts of wisdom literature, the idea of *שותפות*, understood as participation and co-responsibility, suggests that individual action acquires meaning only within a broader relational framework. Similarly, in medieval Georgian thought, the concept of *სამართლიანობა*, justice, is closely linked to the ability to maintain the balance between individual interests and the collective good. These conceptions, although belonging to distant historical contexts, anticipate in symbolic form the current elaborations on sustainability as a dynamic balance between systems. In the contemporary context, entrepreneurial competence can be interpreted as a form of operational translation of these principles, capable of making the economy a space for the exercise of global citizenship. The entrepreneur, in this sense, is not simply an economic actor, but a subject who participates in the construction of possible worlds through decisions that affect the distribution of resources, life opportunities and the quality of social relationships. Creative problem solving then becomes a practice of responsibility, in which the ability to imagine alternatives is accompanied by awareness of the consequences. The elaborations coming from the Russian schools of Moscow and St. Petersburg offer a further contribution to this vision, emphasizing how human development is the result of culturally mediated processes of collective activity. In this perspective, entrepreneurial competence can be seen as an advanced form of activity oriented towards the transformation of social contexts, in which the subject acts not only to satisfy immediate needs, but to redefine the very conditions of coexistence. Education in this competence therefore implies the formation of a systemic awareness, capable of recognizing the interconnections between local and global levels and directing action towards long-term goals. In light of these considerations, entrepreneurial competence is one of the fundamental hubs through which education can contribute to the achievement of the goals of the 2030 Agenda. It represents a form of know-how that integrates

creativity, ethical judgment and systemic vision, making possible an economy at the service of global citizenship and sustainable development. In this sense, entrepreneurship is not simply a tool for growth, but a way of responsible participation in building the common future.

5. Advanced education, neural plasticity, and entrepreneurial design as a cognitive ethical device

In the most recent scientific debate, education in entrepreneurial competence is progressively redefined as a training process with a high cognitive density, in which neuroscience, learning theory, moral philosophy and development economics converge. This convergence reflects a profound epistemological transformation, which recognizes that complex skills cannot be reduced to discrete sets of skills, but must be understood as dynamic configurations of neural processes, cognitive dispositions and value orientations. In this framework, neural plasticity plays a central role, as it provides the biological foundation of the educational possibility of developing advanced forms of creative problem solving and lateral thinking, structural elements of contemporary entrepreneurial competence (Doidge, 2007; Kolb & Whishaw, 1998; Pascual-Leone et al., 2005). Neuroscientific research conducted in the United States, in particular at Harvard, Yale and Berkeley, has shown how learning in complex and unstructured contexts favors a functional reorganization of neural networks involved in higher executive functions, social cognition and prospective simulation. Neuroimaging studies have shown that coordinated activation of the dorsolateral prefrontal cortex, anterior cingulate cortex and default mode networks is associated with the ability to generate innovative solutions to open problems, suggesting that entrepreneurial creativity emerges from the integration of cognitive control and imagination (Beaty et al., 2016; Miller & Cohen, 2001; Immordino-Yang, 2016). This integration is particularly relevant when entrepreneurial action is oriented towards social and collective ends, since it implies the ability to anticipate the ethical consequences of decisions. Education, in this perspective, is not a simple context of knowledge transmission, but an environment of neurocognitive modeling, in which exposure to authentic and morally significant problems contributes to the development of an ethically oriented entrepreneurial competence. Theories of experiential and transformative learning have emphasized how deep learning occurs when the subject is called upon to restructure his or her interpretative schemes in the face of situations that undermine established expectations. In the entrepreneurial field, this cognitive restructuring translates into the ability to redefine problems, rather than

just solving them, according to a logic of lateral thinking that breaks the cause-effect linearity typical of traditional models (Mezirow, 2000; Kolb, 1984; De Bono, 1992). Educational neuroscience has also shown how emotional and value involvement in the learning process is a determining factor for the consolidation of complex skills. Longitudinal studies have shown that learning associated with ethical and social meanings activates deeper and more lasting memory systems, strengthening the ability to transfer acquired skills to new and unpredictable contexts. In this sense, entrepreneurial competence is fully developed only when education integrates cognitive and ethical dimensions, favoring a form of problem solving that is not neutral, but oriented towards responsibility and sustainability (Immordino-Yang & Damasio, 2007; Haidt, 2001; Narvaez, 2014). A significant contribution to this line of research comes from the universities of Oxford and Cambridge, where studies on moral education and the formation of practical judgment have highlighted the role of reflective deliberation in the construction of decision-making competence. In these contexts, entrepreneurship is interpreted as an educational practice that trains the subject to move between norms, values and contingencies, developing a capacity for discernment that recalls the Aristotelian tradition of *phronesis*, reinterpreted in the light of contemporary cognitive sciences (Flyvbjerg, 2001; Searle, 2010; Archer, 2012). This discernment manifests itself as ethical problem solving skills, in which the solution is not given by the application of a rule, but by the contextual evaluation of the consequences. Russian theoretical traditions, particularly those developed in Moscow and St. Petersburg in the field of cultural psychology and activity theory, offer an additional level of depth to this analysis. According to these approaches, the development of higher cognitive functions is inseparable from the social and cultural contexts in which the action takes place, and learning is always mediated by symbolic tools and collective practices. Entrepreneurial competence, in this perspective, can be interpreted as an advanced form of mediated activity, in which creative problem solving becomes an act of transformation not only of the material environment, but also of the social relations that constitute it (Engeström, 2001; Leont'ev, 1978; Luria, 1976).

This vision finds a surprising resonance in some ancient formulations that conceive education as a process of integral transformation of the person. In the Aramaic wisdom texts, the idea of חנוך, education as initiation into a responsible form of life, suggests that authentic learning implies a conversion of gaze and action. Similarly, in classical Arabic philosophy, the concept of تربية refers to a process of cultivation of rational and moral faculties, oriented towards the realization of the common good. These conceptions, although not comparable to

contemporary neuroscientific models, anticipate the idea that competence, and in particular entrepreneurial competence, is inseparable from a deep ethical formation. In the light of these theoretical and empirical convergences, education in entrepreneurial competence can be understood as a complex training device, which operates simultaneously on the cognitive, neural and ethical levels. Creative problem solving and lateral thinking are not simple accessory skills, but constitute the backbone of an entrepreneurial agency capable of orienting the economy towards human and sustainable development goals. In this sense, neural plasticity is not only a biological condition of learning, but the material prerequisite for a cultural transformation that restores to the economy its civic function and to global citizenship its operational dimension.

6. Social innovation, universities of excellence and the transition to a systemic responsibility economy

In the most recent international academic debate, social innovation is increasingly interpreted as the outcome of complex cognitive and ethical configurations, in which entrepreneurial competence operates as a generative principle capable of transforming collective needs into sustainable projects. This interpretation, supported by a growing body of interdisciplinary research, makes it possible to overcome the traditional dichotomy between technological innovation and social innovation, recognizing that both require an advanced capacity for creative problem solving, rooted in forms of lateral thinking and oriented by criteria of moral responsibility. In this framework, the economy of responsibility is configured as an emerging paradigm that redefines the boundaries of entrepreneurial action, placing it within a horizon of value that includes sustainability, social justice and the resilience of systems. Universities of excellence, particularly those in the United States and the Anglo-Saxons, have played a decisive role in the development of this paradigm, promoting research and training models that integrate neuroscience, behavioral economics and sustainability studies. At Harvard and Yale, research on responsible innovation has shown how social impact-oriented business practices are associated with specific cognitive configurations that foster cooperation, empathy, and the assessment of long-term consequences. These studies show that entrepreneurial competence cannot be separated from a capacity for systemic reading of contexts, in which creative problem solving becomes a tool for mediating between divergent interests and collective objectives (Porter & Kramer, 2011; Mazzucato, 2018; Shiller, 2017). Research conducted at the University of California at Berkeley has further

investigated the link between social innovation and moral cognition, showing how exposure to learning contexts oriented towards social justice favors the development of greater ethical sensitivity in business decisions. Experimental studies have found that participation in social innovation projects is associated with increased activity in neural networks involved in social cognition and empathic processing, suggesting that responsible innovation is not only a cultural phenomenon, but also a specific neurocognitive process (Keltner, 2016; Zaki, 2019; Decety & Cowell, 2014). In the Anglo-Saxon context, the universities of Oxford and Cambridge have contributed to redefining the concept of economic value, introducing theoretical models that integrate ethics, political economy and environmental sustainability. The research developed in these contexts underlines how entrepreneurial innovation must be evaluated not only in terms of efficiency or growth, but also in relation to its ability to strengthen democratic institutions and promote forms of social inclusion. In this perspective, entrepreneurial competence is configured as a form of practical rationality oriented towards systemic responsibility, in which creative problem solving takes on a normative as well as an operational function (Raworth, 2017; Sen, 2009; Sandel, 2020).

A theoretical contribution of particular importance comes from the Russian schools of Moscow and St. Petersburg, where the tradition of activity theory and cultural psychology has provided conceptual tools for understanding innovation as a collective and historically situated process. In this perspective, social innovation is not the result of an isolated individual act, but the result of a reorganization of shared practices and meanings. Entrepreneurial competence, understood as creative problem solving skills, thus becomes a device for social transformation, through which subjects participate in the redefinition of the material and symbolic conditions of collective life (Engeström, 2015; Veresov, 2016; Luria, 1976). This vision finds a suggestive consonance in some formulations present in the ancient philosophical and juridical traditions, which conceive the economy as an integral part of the moral order. In Aramaic legal texts, the concept of תקנה indicates a reform oriented towards the common good, while in medieval Arabic reflection the term مصلحة refers to the idea of public interest as a criterion of legitimacy of action. Similarly, in the modern Romanian tradition, Dimitrie Gusti's thought emphasizes the community dimension of development, anticipating some of the current elaborations on social innovation. These references, although belonging to different historical contexts, converge in recognizing that entrepreneurial action acquires meaning only when it is oriented towards responsibility towards the community. In the light of these theoretical and empirical convergences, the

transition to an economy of responsibility can be interpreted as the result of a fully developed entrepreneurial competence, capable of integrating creativity, ethical judgment and systemic vision. Social innovation, in this perspective, does not represent a marginal sector of the economy, but the place where entrepreneurship manifests its highest function, i.e. the ability to generate sustainable development through creative problem solving oriented towards the common good. In this sense, universities of excellence play a crucial role as laboratories of cognitive and ethical experimentation, contributing to the training of entrepreneurial subjects capable of operating responsibly in an interdependent world.

7. Neuro-ethical synthesis of entrepreneurial competence, language, culture and configuration of global entrepreneurial citizenship

In the theoretical framework that emerges from the integration of cognitive sciences, ethical economics and the philosophy of education, entrepreneurial competence can be understood as a complex neuro-ethical structure, in which decision-making, linguistic and symbolic processes contribute to the construction of an agency capable of operating in highly complex global contexts. The most advanced neuroscientific research has shown that human decision making is never a purely computational act, but an intrinsically narrative and culturally situated process, in which language plays a constitutive function in the construction of meaning and in the evaluation of alternatives of action. In this sense, entrepreneurship cannot be separated from the symbolic systems through which subjects interpret the world and attribute value to their choices (Lakoff & Johnson, 1999; Bruner, 1990; Shiller, 2017). Studies conducted at Harvard and Yale in the field of neuroethics have shown how moral judgments emerge from the interaction between neural networks responsible for social cognition and linguistic systems that allow the formulation and sharing of implicit norms. Entrepreneurial competence, in this perspective, manifests itself as the ability to articulate complex decisions within narrative frameworks that make the action intelligible and legitimate in the eyes of the community. This narrative ability is not a simple communicative tool, but an essential component of creative problem solving, as it allows to cognitively restructure problems and to imagine alternative scenarios oriented towards the future (Immordino-Yang, 2016; Greene, 2013; Haidt, 2012).

Language neuroscience has further shown how the use of metaphors and narrative structures activates specific brain areas involved in mental simulation and empathy, suggesting that creative entrepreneurial thinking is deeply rooted in embodied language processes. Berkeley's research on embodied cognition has

shown that the understanding of abstract concepts, such as value, risk or responsibility, depends on the activation of sensorimotor and affective schemas, making evident the link between language, body and ethical decision (Barsalou, 2008; Gallese, 2007; Glenberg, 2010). In this sense, entrepreneurial competence is configured as a capacity for symbolic translation between concrete experience and abstract design. A theoretical contribution of particular importance comes from the universities of Oxford and Cambridge, where studies on moral language and public deliberation have highlighted how discursive practices are central to the construction of global citizenship. In this perspective, entrepreneurial action is interpreted as a form of discursive participation in the public sphere, in which economic decisions take on a communicative and normative dimension. Entrepreneurial competence thus becomes an advanced linguistic competence, capable of negotiating meanings, building consensus and directing collective action towards shared goals (Habermas, 1984; Sen, 2009; Dryzek, 2010). Ancient cultural traditions offer historical depth to this interpretation, showing how language has always been considered a tool for mediating knowledge and ethics. In wisdom Aramaic texts, the term *מִמְרָא* indicates a word that acts, capable of transforming reality through meaning, while in classical Arabic philosophy the concept of *بيان* refers to expressive clarity as a condition for right action. Similarly, in the medieval Georgian tradition, language is conceived as a space of responsibility, in which the word binds the action of the subject to the community. These conceptions anticipate the contemporary idea that entrepreneurial competence implies a discursive as well as operational responsibility. Russian neuroscientific research, developed in Moscow and St. Petersburg, has helped to clarify how language and thought are inseparable in the processes of action regulation. Studies by Luria and his successors have shown how higher linguistic functions play a crucial role in controlling behavior and planning actions oriented towards complex goals. In this perspective, creative problem solving can be interpreted as a process of semantic reorganization, in which the subject uses language to build new structures of meaning capable of guiding entrepreneurial action in uncertain contexts (Luria, 1976; Vygotsky, 1986; Akhutina, 2003). This integration of neuroscience, language and ethics makes it possible to outline a conception of global entrepreneurial citizenship as an advanced form of cognitive and symbolic participation in sustainable development processes. The entrepreneur, in this sense, is not simply an economic actor, but a producer of meaning who contributes to the construction of collective narratives oriented towards the future. Creative problem solving thus becomes a discursive practice, in which the ability to imagine alternatives is

intertwined with the responsibility of making them communicable and shareable. In the light of these considerations, entrepreneurial competence can be understood as a neuro-ethical synthesis in which language, culture and cognition converge in the production of economically effective and morally justifiable actions. This synthesis represents one of the theoretical foundations of contemporary global citizenship, in which sustainable development is not the result of isolated technical interventions, but the result of discursive and decision-making practices that involve the entire human community. In this sense, entrepreneurship literacy plays a strategic role in training individuals capable of thinking, speaking and acting responsibly within an interconnected world.

8. Temporality, prospective memory and intergenerational responsibility in entrepreneurial competence

In the contemporary theoretical lexicon, entrepreneurial competence is increasingly articulated along an extended temporal dimension, in which memory, anticipation and intergenerational responsibility constitute structuring axes of economic and educational action. The most advanced research in cognitive neuroscience has shown how the ability to project oneself into the future, to simulate possible scenarios and to evaluate long-term consequences depends on a sophisticated integration between episodic memory systems, default mode networks and executive functions, suggesting that entrepreneurial planning is a form of complex temporal cognition rather than a simple instrumental planning. In this perspective, creative problem solving takes on the character of an anticipatory practice, in which counterfactual imagination allows for the exploration of alternative sustainability-oriented futures (Schacter, Addis, & Buckner, 2007; Szpunar, 2010; Addis, Wong, & Schacter, 2007). US universities, in particular Harvard and Yale, have contributed decisively to clarifying the link between prospective memory and ethical decision making, showing how the ability to consider the future impact of one's actions is related to the activation of neural circuits involved in moral cognition and emotional regulation. These results suggest that education in entrepreneurial competence, when oriented towards sustainability, must train not only operational skills, but also a temporal sensitivity capable of including future generations in the present decision-making horizon (Hare, Camerer, & Rangel, 2009; Greene et al., 2004; Immordino-Yang et al., 2012). In the Anglo-Saxon context, the reflections developed at Oxford and Cambridge on intergenerational responsibility and temporal justice have provided a regulatory framework of reference for interpreting entrepreneurial action as a

practice ethically linked to the future. Long-term theories of justice underline how contemporary economic decisions participate in the construction of opportunities or vulnerabilities for subjects not yet present, making it necessary to have entrepreneurial competence capable of integrating extended temporal evaluations and operating in conditions of radical uncertainty (Rawls, 1971; Gardiner, 2011; Caney, 2014). The Russian tradition, in particular the developments of cultural neuropsychology in Moscow and St. Petersburg, offers a further conceptual contribution, highlighting how memory is not a static archive, but a dynamic process of reorganization of the past in function of the future. In this perspective, entrepreneurship can be interpreted as a form of temporally oriented activity, in which the subject uses symbolic and cultural tools to transform past experience into shared planning (Luria, 1976; Zinchenko, 2002; Veresov, 2016). This vision finds a profound resonance in ancient philosophical and legal traditions, where time is conceived as an ethical dimension of action. In ancient Hebrew texts, the concept of זכרון does not indicate a simple memory of the past, but an act of responsibility towards the future, while in classical Arabic reflection the term أمانة refers to a trust that crosses generations. Similarly, in the Romanian tradition, Lucian Blaga's thought insists on cultural responsibility as a form of temporal continuity, anticipating some of the current elaborations on sustainability as the custody of the possible. These references show how entrepreneurial competence, understood in a broad sense, has always been linked to an ethical conception of time. In the light of these convergences, entrepreneurial competence can be understood as a capacity for temporal mediation, in which creative problem solving makes it possible to transform the uncertainty of the future into a space of shared responsibility. Education in this competence therefore implies the formation of subjects capable of thinking beyond the immediate, of integrating memory and anticipation and of directing economic action towards forms of development that respect planetary limits and the needs of future generations. In this sense, global citizenship takes on a temporal dimension that reinforces the link between entrepreneurship, ethics and education.

Conclusions

In the light of the theoretical itinerary developed, entrepreneurial competence emerges as a cognitive, ethical and cultural configuration of extraordinary complexity, in which creative problem solving, lateral thinking, language, memory and temporal responsibility converge in the production of an agency capable of operating in interdependent global contexts. The interdisciplinary analysis

conducted, integrating contributions from neuroscience, ethical economics, moral philosophy and educational sciences, makes it possible to definitively overcome a reductive conception of entrepreneurship as a mere functional ability to the market, restoring to it a civic and educational value of the first order. Neuroscientific evidence shows that business decisions are inherently situated, emotionally modulated, and linguistically mediated, making the separation between economic rationality and ethics untenable. In this sense, entrepreneurial competence can be interpreted as an advanced form of practical intelligence, in which the ability to solve complex problems is accompanied by awareness of the social, environmental and intergenerational consequences of action. This interpretation is firmly anchored in international regulatory frameworks, in particular in the United Nations 2030 Agenda, which requires skills capable of integrating innovation, justice and sustainability. From an educational point of view, the article argues that training in entrepreneurial competence represents one of the most powerful devices for the development of global citizenship. Educating in creative problem solving and lateral thinking means training individuals capable of imagining alternatives, negotiating meanings and assuming responsibilities in a world characterized by structural uncertainty. In this perspective, entrepreneurship becomes a practice of mediation between the individual and the community, between the present and the future, between economics and ethics.

In conclusion, entrepreneurial competence, as reinterpreted here, is not simply a response to the needs of the global market, but an educational and cultural paradigm through which to rethink the relationship between human development and sustainability. It represents one of the fundamental junctions for the construction of societies capable of facing the challenges of the twenty-first century, transforming complexity into opportunities for shared growth and the economy into a space for the responsible exercise of global citizenship.

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MODERATING EFFECTS OF EDUCATIONAL QUALIFICATION AND WORK EXPERIENCE ON THE RELATIONSHIP BETWEEN HUMAN RESOURCE ACCOUNTING AND FINANCIAL PERFORMANCE

O.J. AKINTAYO¹, A. OLAGUNJU²

¹*Federal Polytechnic Offa, Department of Accountancy,
 Offa, Kwara State, Nigeria, E-mail: janettayo2012@gmail.com*

²*Osun State University, Department of Accounting, Banking and Finance,
 Osogbo, Osun State, Nigeria, Phone: +08107976419, E-mail:
 adebayo.olagunju@uniosun.edu.ng*

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Abstract

The rising influence of demographic factors in measuring the relationship between human resource accounting and financial performance has constituted a significant problem to modern organizations; including the consumer-goods firms. The study investigated the moderating effects of the relationship between human resource accounting and financial performance in consumer-goods firms in Nigeria. The study adopted the descriptive ex-post facto. The researchers utilized secondary data for the study, which include the textbooks; journals, internet facilities and annual reports of the selected consumer-good firms. The correlation statistics and Regression Analysis was used for data analysis at 0.05 alpha levels. Findings revealed that educational qualification has weak impact and work experience had significant moderating effect on relationship between human resource accounting and financial performance of the selected consumer-goods firms. The study concluded that educational qualification, except work experience are significant factor in the consideration of relationship between human resource accounting and financial performance in selected consumer-good firms. The study

recommended that organizations should invest more on human resources; but not overly depend on these demographics but rather evaluate employees based on performance and potential.

Keywords: *human resource accounting; financial performance, educational qualification, work experience, consumer-goods firms*

JEL Classification: M41, M12, J24, J31, G32

INTRODUCTION

Background to the Study

The issue of organizational profitability has served as focus of attention among the researchers in Management Sciences, using the cost-benefit approach in the recent times. It has been observed that most of the knowledge-based organizations had invested heavily on human resource, especially on recruitment and selection; training and development, and compensation and rewards for the purpose of enhancing financial performance, but yielded has yielded poor or otherwise financial performance.

In today's knowledge-based economy, human resource is considered a vital component of an organization's success. Most importantly, Human Resource Accounting (HRA) has emerged as a crucial aspect of organizational management, focusing on the valuation and reporting of human resources as a key asset. The concept of HRA was first introduced by Hermanson (1964) cited in Shafee & Tahmasebi (2021); Salman, Saleem, & Ganie (2023), and has since gained significant attention in the field of accounting and human resource management.

Human Resource Accounting (HRA) has gained significant attention in recent years due to its potential to enhance organizational performance and financial reporting (Ogodor, & Olaniyi, (2022); Lev & Gu, 2016). HRA involves the recognition, assessment, and financial reporting of human resources as valuable assets. Human Resource Accounting (HRA) involves the identification, measurement, and reporting of human resources as assets in financial statements (Wright; Pietri, & Megginson, 2019 & Flamholtz, 1971). This approach recognizes that human resources are a critical component of an organization's wealth and a key driver of financial performance.

Research has shown that HRA can have a positive impact on financial performance by enhancing employee productivity, organizational effectiveness;

improving decision-making, and promoting strategic human resource management (Bontis et al., 2000; Edvinsson & Malone, 1997). However, the present study assumes that most potential factors that may influence the relationship between HRA and financial performance include the educational qualification and work experience of employees. This is because educational qualification and work experience are essential components of human capital, which can impact employee productivity and organizational performance. Studies have shown that employees with higher educational qualifications and more work experience tend to be more productive and contribute more to organizational success (Hitt et al., 2001 & Becker, 1964).

Despite the importance of educational qualification and work experience in human capital, there is limited research on the moderating effect of these variables on the relationship between HRA and financial performance. However, the moderating effect of these variables on the relationship between HRA and financial performance remains unclear, which has informed the need for this study.

Statement of the Problem

In the recent times, the problem of financial performance in modern business organization, including the consumer-goods firms, has become a polemic issue among the researchers. Human resource has often been described by organizational behaviourists as the most valued asset in knowledge-based work organizations. Therefore, accounting for the economic values that human resource attracts to organizations, including the consumer-goods firms cannot be underestimated.

Recent studies have shown that HRA can have a positive impact on financial performance by improving employee productivity, innovation, and decision-making (Ozolina & Lace, 2020; Sardo & Serrasqueiro, 2018).

Despite the growing importance of human resource accounting (HRA), there is dearth of research on the relationship between human resource accounting (HRA) and financial performance as moderated by educational qualification and work experience in consumer-goods firms in Nigeria. Moreover, existing studies have yielded mixed results. Some studies have found a positive relationship between HRA and financial performance (Bullen, 2017, Cherian & Farouq, 2020, and Dawson, 2021, Bontis et al., 2000; Chen et al., 2005), while others have reported no significant relationship (Isaac, et al., 2019, Kirfi & Abdullahi, 2020 and Kodwani, & Tiwari, 2019, Abeysekera, 2006; Brennan, 2001). This spark controversy has suggested that these mixed findings on the relationship between HRA and financial performance may be influenced by various factors, including

organizational characteristics, industry type, and employee demographics (Ekoyi; Okechukwu, Ogbu, Joy, Nicholas, Chukwudi, Chima & Anthony, 2023; Al-Dhamari et al., 2020 & Abeysekera, 2006).

However, various studies, such as Shafee & Tahmasebi (2021), Salman, Saleem, & Ganie (2023), have been carried out on the influence of some other moderating variables in measuring relationship between human resource accounting and financial performance like demographic factors (years of working experience; gender and educational qualifications) on the financial performance (Mueller, 2019).

The findings of these researchers portrayed some differential portraits of the interaction of work experience; gender and educational qualifications. Moreover, when work performance is analyzed in connection to individuals' personality, educational qualifications and skills, knowledge, competence and spirituality, some competing viewpoints emerge. A group of scholars argued that there was no link among the variables (Amirul & Kamruzzaman, 2013; Bader, 2017, Bassey & Arzizeh, 2020); while another group agreed that there was a positive interaction and relationship among them (Ezejiofor; John-Akamelu, & Iyidiobi, 2020; Fariborz & Rajashekar, 2021). The inconsistent findings on the relationship between HRA and financial performance as well of limited research efforts in ascertaining the relevance of the level of education and work experience had highlight a significant knowledge gap in the existing literature. These findings therefore require further empirical investigation to established the true nature of the relationship and for possible generalization. Against this foregoing, the study investigated the moderating effect of educational qualification and work experience on the relationship between human resource accounting and financial performance in the listed consumer-goods firms in South-West, Nigeria.

Research Questions

The following research questions were formulated for the study:

- (1) Does educational qualification moderate the relationship between HRA and financial performance?
- (2) Does work experience moderate the relationship between HRA and financial performance?

Objectives of the Study

The broad objective of the study is to investigate the moderating effects of educational qualification and work experience on the relationship between HRA and financial performance.

Specifically, the objectives of the study are to:

- (i) determine moderating effect of educational qualification on the relationship between HRA and financial performance
- (ii) examine moderating effect of work experience on the relationship between HRA and financial performance

Hypotheses for the Study

The following hypotheses were formulated for the study:

H₀₁: There is no significant moderating effect of educational qualification and work experience on the relationship between human resource accounting and financial performance.

H₀₂: There is no significant controlling effect of firms' size and business environment on the relationship between human resource accounting and financial performance.

LITERATURE REVIEW

Conceptual Review

Human Resource Accounting (HRA) is a concept that has gained significant attention in recent years due to its potential to enhance organizational performance and financial reporting (Lev & Gu, 2016). HRA involves identifying, measuring, and reporting human resources as assets in financial statements (Flamholtz, 1971). Educational qualification and work experience are essential components of human capital that can impact employee productivity and organizational performance (Becker, 1964).

Theoretical Review

The theoretical framework for this study can be based on the Human Capital Theory (Becker, 1964) and the Resource-Based View (RBV) Theory (Barney, 1991). The Human Capital Theory posits that employees' skills, knowledge, and experience have economic value for organizations (Becker, 1964). The RBV Theory suggests that organizations' internal resources, including human resources, are critical to achieving sustainable competitive advantage (Barney, 1991).

Relationship between Theories and Study

Both the Human Capital Theory and the RBV Theory provide a framework for understanding the relationship between human resource accounting, financial performance, educational qualification, and work experience. The Human Capital Theory highlights the importance of investing in employees' development, while the RBV Theory emphasizes the strategic importance of internal resources, including human resources. By applying these theories, organizations can better understand the role of human resources in achieving financial performance and make informed decisions about investments in human capital.

Empirical Review

Various researchers had investigated the impact of human resource accounting on organizational performance and reported a significant relationship between Hra and financial performance Shafee & Tahmasebi (2021), Salman, Saleem, & Ganie (2023). In the same vein, Flamholtz (1971) and Lev and Gu (2016) further found that human resource accounting can provide valuable information for decision-making and improve organizational performance.

Recent studies have investigated the relationships between HRA, financial performance, educational qualification, and work experience. Al-Dhamari et al. (2020) and Alekhya and Lakshmi (2020) found that HRA has a positive impact on firm performance, while Ozolina and Lace (2020) as well as Hitt et al. (2001) reported that educational qualification and work experience can impact employees' productivity and organizational performance in professional service firms. Similarly, Sardo and Serrasqueiro (2018) reported that intellectual capital, which includes human capital, has a positive impact on financial performance in European companies. However, Abeysekera (2006) found no significant relationship between human resource accounting and financial performance in Sri Lankan companies. Sajuyigbe, Ikotun, and Obi (2020) found that human resource capital has a significant impact on organizational performance in Nigerian banks. Similarly, Viswanath (2023) conducted a systematic review of HRA in Indian companies and found that HRA practices can lead to improved firm performance.

These findings support the Human Capital Theory and the RBV Theory, which suggest that human resources are valuable asset that can contribute to organizational performance. By applying these theories, organizations can develop strategies to leverage their human resources and achieve financial performance.

METHODOLOGY

Research Design

The study adopted the quantitative research design, specifically the ex-post facto correlational design, to examine the relationship between human resource accounting, financial performance, educational qualification, and work experience. The ex-post facto research design was appropriate for the study because it does not give room for manipulation of data and variable of interest.

Area of the Study

The study focused on the consumer-goods companies listed on the Nigerian Stock Exchange (NSE). These companies operate in all the geo-political zones in Nigeria, which include the South West; South East, South-South, North East, North West and North Central.

Population for the Study

The population of the study consisted of all companies listed on the Nigeria Stock Exchange (NSE), comprising various industries such as consumer-goods.

Method of Data Collection

The study employed the use of secondary data for the study. In essence, the study utilized the secondary data drawn from review of annual reports and financial statements of companies listed on the listed stock exchange (NSE). Also, the study benefitted from analysis of existing literature on human resource accounting, financial performance, educational qualification, and work experience.

Research Instrument

The study utilized a data extraction sheet to collect relevant data from annual reports and financial statements in selected consumer-goods firms in Nigeria.

Method of Data Analysis

The study utilized both descriptive and inferential statistical analysis techniques for the study. The descriptive statistics (mean, standard deviation, correlation analysis) was used to summarize and describe the data. Also, the inferential statistics (regression analysis) was used to test hypotheses generated for the study. The data analysis was conducted using statistical software such as SPSS statistical package at 0.05 alpha levels.

RESULTS

Testing of Hypotheses

There is no significant moderating effects of educational qualification and work experience on the relationship between human resource accounting and financial performance.

Table 1: OLS Estimation Test Result

Dependent Variable: Financial performance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.02E+10	1.02E+10	-0.992971	0.3441
HRA	14.66386	20.99797	0.698347	0.5009
HRA*EDU_QUAL	6.389733	12.86496	0.496677	0.6302
HRA*WORK_EXP	-15.44029	7.271054	-2.123529	0.0597
R-squared	0.683609	Mean dependent var		-9.59E+09
Adjusted R-squared	0.588691	S.D. dependent var		5.22E+10
S.E. of regression	3.34E+10	Akaike info criterion		51.53941
Sum squared resid	1.12E+22	Schwarz criterion		51.72199
Log likelihood	-356.7758	Hannan-Quinn criter.		51.52251
F-statistic	7.202140	Durbin-Watson stat		1.195988
Prob(F-statistic)	0.007361			

Source: Author's computation using E views, 2025

Estimation Command:

The Table 1 is the result of the Ordinary Least Squares (OLS) panel regression, showing the moderating effect of educational qualification and work experience on the relationship between human resource accounting and financial performance.

The coefficient for HRA (Human Resource Accounting) is 14.66, indicating a positive relationship with financial performance. However, the p-value (0.5009) is well above the 0.05 significance threshold, implying that the relationship is statistically insignificant.

Interaction of HRA and Educational Qualification (HRA*EDU_QUAL):

This interaction term has a positive coefficient (6.39), suggesting a potential enhancing effect of educational qualification on the relationship between HRA and financial performance. Nevertheless, the p-value of 0.6302 also indicates that this effect is not statistically significant.

Interaction of HRA and Work Experience (HRA*WORK_EXP):

This term shows a negative coefficient of -15.44, suggesting that increased work experience might weaken the impact of HRA on financial performance. The p-value (0.0597) is marginally above the conventional 0.05 level but may be considered significant at the 10% level, indicating a weak or borderline moderating effect.

R-squared (0.684) and Adjusted R-squared (0.589). These values indicate that approximately 68.4% of the variation in financial performance is explained by the model, and 58.9% after adjusting for degrees of freedom. This reflects a reasonably good model fit.

F-statistic (7.202) with p-value (0.0074). This result shows that the overall model is statistically significant at the 5% level, indicating that at least one of the explanatory variables is significantly related to financial performance. Based on the regression output, educational qualification does not significantly moderate the relationship between human resource accounting and financial performance. However, work experience shows a weak but potentially meaningful moderating effect, with a p-value that borders on statistical significance at the 10% level.

The positive coefficient indicates that human resource accounting—capturing investments in recruitment, training, compensation, etc.—has a direct and positive association with financial performance. However, the high p-value suggests this relationship is not statistically significant, and thus no strong inference can be made.

Discussion of Findings

Hypothesis one stipulated that there is no significant moderating effect of educational qualification on relationship between HRA and financial performance. According to Flamholtz (1971), HRA is expected to improve organizational efficiency and profitability by quantifying the economic value of employees. Yet, several empirical studies, such as Wright; Pietri & Megginson (2019); Ogodor and Olaniyi (2022) and Ozolina & Lace (2020), have noted that HRA's impact often becomes more evident when moderated by contextual variables, like education or experience, or when applied over the long term. Moderating Effect of Educational Qualification (HRA*EDU_QUAL) Coefficient = 6.39, $p = 0.6302$. This positive interaction coefficient implies that higher educational qualifications might enhance the effectiveness of human resource accounting on financial performance. However, the lack of statistical significance means this effect cannot be reliably confirmed. Therefore, the null hypothesis one is partially rejected, following that it

holds for educational qualification but does not fully hold for work experience, which may have a moderating influence.

This finding resonates with studies like Wright & McMahan (2011) and Becker (1993), who argue that education raises the absorptive capacity of employees to utilize HR investments effectively. Nonetheless, Alao et al. (2023) note that the mere possession of educational credentials does not guarantee productivity unless accompanied by practical experience and organizational support. Thus, while the direction of the relationship supports human capital theory, the evidence here suggests that educational qualification alone does not significantly enhance the returns on HRA.

Hypothesis two stipulated that there is no significant moderating effect of work experience on relationship between HRA and financial performance. The finding shows that this negative coefficient suggests that as work experience increases, the positive effect of HRA on financial performance may diminish. Although not significant at the 5% level, the p-value is below 0.10, indicating a marginal or weak level of significance. Over-experienced staff may resist change or new HR initiatives, reducing the impact of such investments (Ogunbiyi-Davies, Alao, Aremu, and Olalere, 2023). Alternatively, tenured employees may not benefit equally from general HR investments, especially if such initiatives are designed with newer staff in mind (Ojo & Adelopo, 2018).

This finding suggests that experience can moderate the effectiveness of HR policies, but in potentially counterintuitive ways. It supports the notion by Zhou et al. (2018) cited in Omotayo; Anthonia, Hezekiah, Odunayo, Opeyemi, & Odion (2020) that work experience must be continuously refreshed with skill development to yield productivity gains. The model explains 68.4% of the variation in financial performance, which reduces to 58.9% after accounting for the number of predictors—still a reasonably good fit for social science research. The significant F-statistic confirms that at least one of the explanatory variables is significantly related to financial performance, supporting the overall validity of the regression model.

According to Gujarati and Porter (2009), an R^2 above 0.60 is generally acceptable in economic and behavioural studies where human factors are involved. The F-test indicates that the model is useful for explanatory purposes, even if some individual predictors are not statistically significant.

Commenting on the moderating effects of educational qualification and work experience on relationship between human resource accounting and financial performance, the results of the analysis revealed a nuanced understanding of how

educational qualification and work experience moderate the relationship between Human Resource Accounting (HRA) and financial performance. The finding from the analysis indicate that educational qualification does not significantly moderate this relationship, while work experience demonstrates a marginally significant, negative moderating effect at the 10% significance level but not 5% significance level. This suggests that increased work experience may slightly weaken the positive influence of human resource accounting on financial outcomes.

Several recent studies provide both support and contradiction to these findings. Ekoyi, Okechukwu, Ogbu, Joy, Nicholas, Chukwudi, Chima, & Anthony (2023) and Ozolina & Lace (2020) found that work experience significantly enhances the relationship between HRA and firm performance in Nigerian SMEs. They argued that experienced employees are better positioned to leverage organizational resources effectively, contradicting the negative moderating effect observed in this study.

On the other hand, Oladele (2020); Oyedele (2019), in their study on listed manufacturing companies in Nigeria, reported that educational qualification significantly strengthened the HRA and performance link, highlighting the value of formal education in improving resource reporting and utilization. This contrasts with the current finding where educational qualification is not a significant moderator.

Another is, Choudhury and Barman (2023), they examined Indian financial institutions and found no significant moderating role for either work experience or educational qualification, aligning closely with the results of this study, particularly regarding educational qualification. Shafee & Tahmasebi (2021); Salman, Saleem, & Ganie (2023), Mohammed and Yusuf (2022) emphasized that the positive impact of HRA is contingent upon employee adaptability and openness to innovation, which may not always correlate with higher years of experience or educational attainment. This supports the finding that experience might sometimes have a diminishing effect if not managed properly.

Conclusion

This study has established the moderating effects of educational qualification, except work experience on the relationship between human resource accounting (HRA) and financial performance of manufacturing firms in South-West, Nigeria.

However, the study established positive weak moderating effect of work experience on the relationship between human resource accounting and financial performance. In essence, educational qualification and work experience are not

significant factors in the consideration of the relationship between HRA and financial performance.

Meanwhile, given the unique challenges facing the Nigerian manufacturing sector, such as infrastructural deficiencies, inflationary pressures, fluctuating exchange rates, and regulatory volatility, human capital becomes an even more critical differentiator, thus the skilled; knowledgeable, motivated, experienced and innovative employees can help organizations navigate these external challenges more effectively, creating resilience and adaptive capacity.

Recommendations

Based on the findings of the study, the following recommendations are made:

- i. Companies should consistently allocate resources to employee training and development programmes. Training not only improves employees' skills but also translates into better financial returns for the organization over time.
- ii. Since educational qualifications and work experience did not significantly moderate the relationship, organizations should not overly depend on these demographics but rather evaluate employees based on performance and potential.

Contribution to Knowledge

This study has contributed to knowledge by providing insights into the mediating role of educational qualification and work experience in the relationship between HRA and financial performance, which could help organizations understand how to optimize their human capital to achieve better financial outcomes.

The study has highlighted the importance of investing in employee education and training, as well as the role of work experience in enhancing the effectiveness of HRA practices and financial performance.

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EARNINGS MANAGEMENT AND FIRM GROWTH IN EMERGING MARKETS: AN EMPIRICAL INVESTIGATION

Saheed Akande SHITTU¹

¹*University of South Africa, Department of Financial Governance, School of Applied Accountancy, College of Accounting Sciences, 13 Preller Street, Muckleneuk Ridge, Pretoria 0001, South Africa, Telephone: +2348034309458, E-mail: shitusa@unisa.ac.za*

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Abstract

This study examines how Earnings Management Practices (EMP), measured by Discretionary Accrual (DA) and real EMP, affect the growth of firms in emerging markets with a particular emphasis on South Africa. The study uses secondary data of 127 non-financial listed companies in the period 2013-2023, and panel least squares regression was employed to analyze the data obtained. The findings revealed that the positive influence of Discretionary accruals (DA) on firm growth is very high, which implies that DA tends to be more effective in reporting higher growth, which could be as a result of easier earnings presentation. Conversely, Real EMP has negative effects on the growth of firms, which implies that manipulations of operations, including the production change of postponement, reduce the growth prospects in the long term. Also, the growth was found to be affected by firm size, leverage, and free cash flow, with the latter being less likely to grow fast and more likely to have leverage. This paper is relevant to the existing literature since it outlines the various impacts of DA and real EMP on growth in the emerging markets as part of closing a research gap and provides policy guidelines to improve corporate governance and transparency in the emerging markets.

Keywords: corporate governance, discretionary accrual, earnings management practices, emerging markets, firm growth, real earnings management

JEL Classification: G30; M41; D22; L25

1. Introduction

Over the past few decades, companies in the emerging markets have encountered increased pressure to record good growth and fulfill the expectations of the investors. The growth, be it in terms of revenue expansion, asset base, market share, or any other measure, has become more and more a defining characteristic of corporate success (Tanko, 2025; Quadri et al., 2025; Ojodu et al., 2025). Concurrently, these companies are in institutional settings that tend to be less stringent than those in developed economies: less robust investor protection, greater information asymmetry, less mature governance structures, and less stable macroeconomic policies. In that, the ability of the managers to make decisions on financial reporting as well as operational decisions discretionally can be important. There are two well-known earnings management practice (EMP) techniques, which are accrual-based and real EMP. Accrual-based is the type of manipulation that is made using the accounting decisions such as Discretionary Accruals (DA) that have no direct impact on cash flows in the short run. Real EMP is the manipulation of real operating activities such as reducing discretionary expenditures and overproduction and accelerating revenues, which have a direct influence on cash flows (Truong, 2025). The interaction between earnings management and growth of firms is a subject of specific interest in the emerging markets. On the one hand, growth opportunities can encourage managers to earn management to signal performance, evade regulatory attention, or finance their activities externally. Equally, aggressive earnings management, particularly real management, may deter the long-term growth of the firm through decreased investment, misplaced operational decisions, or destroyed credibility. Furthermore, these tensions can be exacerbated by the emerging markets due to less effective oversight, greater agency issues, and more unstable environments (Ali *et al.*, 2024; Tosun, 2025).

Hence, the need to investigate the nature of DA and real EMP in influencing the growth path taken by firms in emerging market environments emerges. The insights about this relationship have significant implications as regards corporate governance, regulatory policy, investor decision-making, and growth strategy in such contexts. Although the relationship between EMP and performance (in terms of profitability and firm value) or financial reporting quality has been well-researched, there are still some important gaps according to which this study is motivated: Although there are a lot of studies on earnings management and

performance (in terms of profitability and firm value) or quality of financial reporting, there is a lack of attention paid towards the growth aspect of firms, i.e., how AEM and REM affect the growth of the firms in terms of assets, sales, market share, or growth rate in the emerging markets (Alghemary et al., 2024; Bansal, 2024; Alagbe et al., 2025). Likewise, most of the studies tend to consider earnings management as a homogenous variable: either accrual or real, but not necessarily differentiating the various impacts of both on growth. Since the mechanisms of AEM and REM are also different, it is reasonable to expect that their contribution to growth differs. Also, in emerging markets, institutional (governance, transparency, investor protection) and firm-level (size, leverage, growth opportunities) characteristics can mediate the relationship between earnings management and growth, although empirical research is still scattered. Beyond this, a large part of the empirical research has covered developed markets or has looked at performance or firm value (Tabassum et al., 2014; Okafor et al., 2018; Anderson *et al.*, 2024; Anh & Hung, 2025). instead of growth itself; the emerging market firms, with their different regulatory and ownership and risk structures, may act differently. This suggests a research gap, particularly in emerging markets. Moreover, as growth is at the core of strategic ambitions of firms, which are particularly applicable to emerging markets (catch-up, expansion, and scaling have been dominant factors in such markets), the implications of earnings management on growth have not been well studied. These gaps are indicative of the fact that there is a need to conduct an empirical study that specifically examines the influence of DA versus real EMP on firm growth in the emerging market conditions and which is adjusted by the factor of institutional governance and firm characteristics. The remainder of the paper is as follows: An introduction is given at the beginning, followed by a review of the literature, the creation of hypotheses, a theoretical and empirical evaluation, and methodology in Section 3. Empirical findings and debate are covered in Section 4. The study's conclusion and its theoretical and practical implications are in section 5 of the paper.

2. Literature Review and Study Hypotheses Development

2.1. Discretionary Accrual Earnings Management Practices and Firm Growth

Discretionary accruals EMP is the managerial discretion in accrual accounting decisions, including adjustment of estimates and revenue/expense recognition deferrals/acceleration without directly changing underlying operating cash flows. They are determined by managerial decisions (judgments, estimates, and policy decisions) and not necessarily by the rules of mechanical recognition. Managers

can employ them to control earnings, indicate performance, or transfer profits across periods. One of the strategic outcomes that has been researched in the literature of finance and accounting is the growth of a firm (Shittu et al., 2024; Addah, 2025; Oginni et al., 2025; Sibiya 2025). The connection between DA and firm growth has been a source of interest: is an increased level of DA associated with growth? However, there is a limit on it, particularly in emerging markets (Mlawu et al., 2025). Huang *et al.* (2025) explores if and how U.S. export limitations affect the earnings management of sanctioned Chinese enterprises. The study finds that resorts that boost earnings management owing to export limits tend to encounter deteriorating profitability and slower sales growth in the long run. Moreover, likewise, Tosun (2025) investigated whether a government policy can inadvertently encourage earnings management. The study discovered that while firm-level growth expectations rise following the reforms, firms increase anomalous accruals. Similarly, Tian *et al.* (2024) found an indirect impact on the relationship between corporate strategy differences and DA EMP. In addition, Gokhale and Pillai's (2024) systematic review of earnings management in emerging economies shows that firm-level and country-level factors are important. Furthermore, Mansah (2024) also discovers a negative correlation between growth opportunities and accrual earnings management of firms. Similarly, Anton and Carp (2020) studied young, high-growth firms and observed that DA has a negative impact on the growth of firms. The presence of a negative relationship in their outcomes indicates that where there is lower protection of the investors and higher information asymmetry, DA can harm instead of contributing to growth. The other study by Ashok and Wu (2015) tests the conditions of growth as a determinant of the pricing of DA. They discover that when these DA are positive in high-growth companies, they are priced more (i.e., they carry more weight by investors) as compared to low-growth companies. Most of the reviewed literature was focused on firm value, financial performance, or reporting quality. However, less research has been conducted on direct connections to firm growth, particularly in emerging markets. Thus, the study proposed the hypothesis below.

H1: Discretionary accruals positively and significantly affect firms' growth in the emerging markets.

2.2 Real Earnings Management Practices and Firms' Growth

Real EMP affects actual investment decisions by changing production costs or recognition of revenue. It can be used by the managers as an indicator to the market that there is a favorable prospect of growth or performance, particularly in areas where the information asymmetry is high. Real EMP also can be used to change

growth capacity, not only reported growth. As an illustration, an investment of low-end (reduced discretionary expenditure) or high-level (overproduction) firms can harm the increase of the underlying operations (Shittu & Oladipo, 2025). In case the performance and credibility of the firm are boosted with the help of the REM, the firm can get financing, aid expansion, and thus grow faster. But in case a real EMP disrupts operational efficiency, resources are misallocated, CAPEX or marketing is delayed, inventory is overproduced, underlying growth potential could be affected negatively, and future growth would be limited or even reversed. Nguyen et al. (2024) present compelling evidence that corporate governance quality limits earnings management as evaluated by real EMP. Specifically, compared to their counterparts, private companies (non-SOEs), companies with large foreign ownership and low concentrated ownership, and high-growth companies exhibit a stronger negative correlation between corporate governance quality and earnings management. Al Begali and Phan (2023), in their study, examine earnings management in emerging markets during the COVID-19 context and discover that real EMP has been employed, whereas the paper focuses less on growth results, as such, and more on the pandemic shock. The research conducted by Shah and Wan (2024) identifies that financial integration at higher levels is closely related to higher REM. Tabassum et al. (2014) carried out GLS research on Pakistani companies that practiced real EMP and discovered that such firms had poor future financial performance. Having reviewed previous studies on earnings management, it was observed that there is limited empirical research on real EMP and firm growth, especially in emerging markets.

H2: Real earnings management has negative and significant effect on firms' growth in emerging markets.

2.3 Theoretical review

The life cycle theory of the firm was being employed to underpin the study. The theory was first formulated by Edith Penrose in 1959. The theory is concerned with the growth and development of firms over time, implying that firms experience different phases of development, including start-up, growth, maturity, and ultimate decline. The life cycle theory of the firm argues that firms undergo various phases of life cycle, which are startup, growth, maturity, and decline (Penrose, 1959). There are also differences in the financial strategies and the management practices between these stages, and young and growing firms may have more aggressive earnings management to indicate prospects of good growth. The aggressiveness of the earnings management of firms might fade and be replaced by more sustainable growth practices as the company matures (Lastari & Aeni, 2019). The theory

highlights the fact that the growth of a firm depends on internal resources, capabilities, and the managerial ability of the firm to manage growth opportunities. It further examines the way in which the firm's adaptation to external challenges and opportunities varies with its development, with the emphasis on the strategic choices of the firm made in the various life cycle phases.

3. Methodology

Ex-post factor research design was employed in this study. Listed firms in South Africa were the population of the study, while 127 non-financial listed firms were purposefully selected based on availability of data for the study period from 2013 to 2023 across 10 sectors as shown in Table 1 below. Secondary data collected were analyzed using panel least square regression.

Table 1: Selected Firms According to Sectors

Sectors	Number of selected firms
Agriculture	3
Conglomerate	8
Consumer goods	18
Construction & real estate	10
Health care	9
ICT	2
Industrial goods	10
Manufacturing	7
Natural resources	25
Oil & gas	1
Services	34
Total	127

Table 2: Measurement of Study Variables

Variables		Abbreviation	Measurement	Sources
Dependent	Firm growth	FG	Equity book value divided by equity market value	Mensah et al. (2024)
Independent	Discretion accrual	DA	Total accrual minus non-discretionary accrual	Kothari et al. (2005)
	Real earnings management	REM	Abnormal operating cash flow plus abnormal production costs minus abnormal discretionary expenses	Rowchowdhury (2006)
Control	Firm size	FS	Natural log of total asset	Shittu et al. (2023)
	Leverage	LEV	Total liabilities divided by total asset	
	Free cash flow	FCF	Cash flow from operation to total asset	Onaolapo and Shittu (2022)

Model Specification

This study adapted the model from the work of Anh and Hung (2025), which was specified to capture firm growth and earnings management variables as well as control variables, as shown in figure eqn below.

Study model is given as follows:

$$FG = DA + REM + FS + LEV + FCF \quad (1)$$

Thus econometric form of model is as follows:

$$FG_{it} = \alpha + \beta_1 DA_{it} + \beta_2 REM_{it} + \beta_3 FS_{it} + \beta_4 LEV_{it} + \beta_5 FCF_{it} + \varepsilon_{it} \quad (2)$$

α is the intercept in this study, i is cross-sectional, t is time identifier, ε is a model error term, and $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = coefficients for the respective determinants

4. Results

4.1 Descriptive statistics

Table 3 presents descriptive statistics of the study. The mean standard deviation values of 53.053 and 17.525, respectively, indicate Firm Growth (FG). The growth of the firm is also not very high and falls within the range of 10.548 to 99.261. It is symmetric with a skew value of 0.005 that indicates that there are no outliers or excessive skewness in the growth data in the firm and shows that it is normally distributed with a kurtosis value of 2.543. This means that there is an overall homogeneity in the growth of firms. The policy makers ought to aim at ensuring stable growth environments and decreasing volatility, this could be achieved by ensuring that the firm has good conditions to grow, which could be by availing capital and minimizing obstacles to business entry and operation. On the same note, the discretionary accrual shows a 0.039, 0.191, 2.347, and -1.884 value of mean, standard deviation, maximum, and minimum, respectively. These have a large variance, with some of the firms showing extremely high or negative values, which implies that some of the firms are in the practice of using aggressive earnings management. The fact that the skewness is positive at 1.213 and the kurtosis is high at 53.947 indicates that the skewness of discounted accruals in the firms is relatively small, with few firms in the high category. This brings up the point of greater regulation of financial reporting and accounting standards. The policymakers may think about tightening the financial reporting to prevent the manipulation or reporting of profits.

In addition, the mean and standard deviation values of real earnings management are 0.138 and 0.575, respectively. It also indicates that there is a high dispersion with a negative value of -2.364 as the minimum and a very high value of 2.890 as the maximum, indicating that it is possible that the firms are taking real actions (including delaying expenses or manipulation of production) in an attempt to affect reported earnings. The positive skew of 0.171 and the high kurtosis of 5.713 show that although low REM is reported by many firms, there are firms that practice high levels of earnings manipulation. This requires a greater implementation of accounting standards, especially in the areas of real earnings management. Moreover, the firm size data is very diverse, and the smallest firms have very low scores of the figures of 0.203, and the largest ones are 69.822, 17.716, and 10.193 of the mean and standard deviation, respectively. The skewness equals 1.355, and the kurtosis equals 5.209, indicating that there are more small firms than large firms; there are just a few large firms that dominate the distribution. Mean and standard deviation values stand at 5.576 and 0.806,

respectively, to gain leverage. The leverage ratio is consistent among the firms, with 3.2 being the lowest value and 7.5 being the highest value, and the distribution seems to be relatively normal. This implies that the companies in the sample are likely to borrow moderate levels of debt. The value of skew (0.036) and kurtosis (2.349) suggests that the distribution is rather normal and almost symmetric. Free cash flow shows 6.595, 0.853, 8.672, 4.308, 0.240, and 2.533 for mean, standard deviation, maximum, minimum, skewness, and kurtosis, respectively. This means that the situation is relatively stable, with the majority of firms having intermediate values of free cash flow. The distribution is also slightly positively skewed, which means that there are some firms with much higher cash flows than others.

Table 3: Descriptive Statistics

Variables	Mean	St.Dev	Maximum	Minimum	Skewness	Kurotisis
FG	53.053	17.525	99.261	10.548	0.005	2.543
DA	0.039	0.191	2.347	-1.884	1.213	53.947
REM	0.138	0.575	2.890	-2.364	0.171	5.713
FS	17.716	10.193	69.822	0.203	1.355	5.209
LEV	5.576	0.806	7.563	3.233	0.036	2.349
FCF	6.595	0.853	8.672	4.308	0.240	2.533

Where FG= Firm growth, DA= Discretionary accrual, REM= Real earnings management, FS= Firm size, LEV= Leverage, FCF= Free cash flow

4.2 Correlation analysis

As shown in Table 4, the correlation analysis shows the relations between the firm growth and earnings management and different financial measures. The relationship between discretionary accrual and firm growth shows a weak positive (0.070) relation. This implies that discretionary accruals do not significantly affect the growth of firms. But in the real earnings management, the correlation with firm growth is very low (-0.150). This indicates that the more firms grow, the less they are likely to practice real earnings management and vice versa. Equally, the firm size indicates a weak negative (-0.151) relationship with firm growth. The negative relationship implies that the bigger the company, the slower the growth, or the other way round. Similarly, the correlation between the firm's growth and leverage is moderate (-0.273), indicating that firms with an increased level of debt are less likely to grow. In addition, the negative relationship between the free cash flow and

the firm growth is weak (-0.284), and this implies that growth is slow in firms with high free cash flow. This may indicate that companies with huge cash holdings may not be putting the money to good use in order to spur growth. Rather, they could be focusing on the returns to the shareholders or stashing cash in reserve against any eventuality instead of putting resources in an expansionary project.

Table 4: Correlation Matrix

Variables	FG	DA	REM	FS	LEV	FCF
FG	1.000					
DA	0.070	1.000				
REM	-0.150	0.058	1.000			
FS	-0.151	-0.011	0.201	1.000		
LEV	-0.273	0.016	-0.056	-0.194	1.000	
FCF	-0.284	0.001	-0.064	-0.146	0.947	1.000

Where FG= Firm growth, DA= Discretionary accrual, REM= Real earnings management, FS= Firm size, LEV= Leverage, FCF= Free cash flow

4.3 Results of panel least square regression

The study employed panel least squares regression analysis. To enable the research to be robust, cross-sectional and time series analyses were combined in studying 127 non-financial listed companies over an eleven-year period (2013-2023). It was found that the R^2 value of 0.144 of the Ordinary Least Square Regression (OLS) pooled regression shows that independent variables together explained about 14 percent of systematic variation of firm value in the pooled companies during the period of interest, as it is shown in Table 5 below. This implies that company growth in South Africa cannot be attributed to control variables (firm size, leverage, and free cash flow) and earnings management. The proportion of the growth of firms that cannot be explained is caused by other independent variables that can influence the growth of companies, yet which were omitted due to the scope of this research. Overall, the OLS regression model is statistically significant at the level of 1 percent of the F-statistic value of 46.96 and P-value of 0.00. It is an indication that the regression model is sound and appropriate to make statistical inferences. Also, table 5 shows the mean value of the variance inflation factor of 4.62, which is below the standard rate of 10. This implies that multicollinearity does not exist and all independent variables should not be dropped out of the model. Further, Table 5 indicates that OLS results have

the issue of heteroscedasticity since the probability value was significant at 1 percent [7.02(0.008)]. As is clear in the heteroscedasticity, the firms in our sample are not homogeneous. A strong or panel regression model is thus needed to achieve the influence of each firm's heteroscedasticity towards the results. The results of the panel regression in Table 5 are discussed below.

The results revealed differences in the quantity of insignificant variables, signs, and coefficients. The panel regression was a fixed effect that was estimated assuming that there was no association between the explanatory variables and the error term. The Hausman test, based on the null hypothesis that the random effect model is preferable over the fixed effect model, was employed to make a choice between the two results of the panel regression estimates. The probability value of the Hausman test is 0.854, which shows we should reject the alternative hypothesis and accept the null hypothesis. This implies that to come up with valid conclusions and recommendations, the analysis must employ findings of random effect panel regression, and it was necessary to comment on the results of the random effect. Since the random model is statistically significant at the level of 1, the F-statistic and Wald-statistic value of 50.00 (0.00) confirm that the given model can be used to make conclusions. With respect to the coefficient of determination (R-squared). It was established that independent variables in the random effect model have a combined effect of 14.5 percent on the systematic variation in the growth of firms (FG).

Discretionary Accrual (DA) (random effect = 4.195 (0.007)) as an independent variable to Firm Growth (FG) appears to have a positive and significant effect on firm growth. This therefore means we should accept hypothesis 1 (H1: Discretionary accruals positively and significantly affect the firms' growth in the emerging markets). This highlights the importance of having better corporate governance systems in these markets to restrict the possibility of manipulating earnings. This observation means that those companies that practice earnings management, especially those that manipulate accruals, will record higher growth. This may be because the firms are adjusting their earnings using accrual methods to smooth the earnings and appear more lucrative and stable, thus accessing more investment and growth prospects. These results align with the research findings of Mensah et al. (2024) and differ from the work of Nozarpour and Norouzi (2015). However, Real Earnings Management (REM) (random effect = -1.688 (0.052) as an independent variable to firm growth (FG)) appears to have a negative and significant effect on firm growth. Hence, we should accept hypothesis 2 (H2: real earnings management is detrimental to the firms' growth in emerging markets).

The negative influence suggests that the dependency on REM practices would make a firm unsuccessful in investing in the sustainable growth programs, which would decrease the overall growth potential of the firm. This could show that any firm that is involved in REM might be compromising long-term profitability for short-term financial objectives. These results support the findings of Anton and Carp (2020) and do not agree with the empirical findings of Ashok and Wu (2015). Regarding the control variables, Firm size (random effect = 0.0247 (0.689)) and leverage (random effect = 0.597 (0.707)) appear to have a positive and insignificant influence on firm growth. However, free cash flow (random effect = -7.151 (0.000)) has a negative influence on firm growth, which implies that the higher the level of free cash flow, the slower the growth of the firm. This may be because companies that have a lot of cash in their hands do not invest it back into their company, or they utilize the cash to make shareholder dividends and do not invest the cash in expansion.

Table 5: Effect of Discretionary Accrual and Real Earnings Management on Firm Growth in Emerging Markets

	(1)	(2)	(3)	(4)
	Regression	Linear regression	Random effect model	Fixed effect model
DA	7.213*** (0.002)	7.213** (0.013)	4.195*** (0.007)	4.504*** (0.003)
REM	-4.241*** (0.000)	-4.241*** (0.000)	-1.688* (0.052)	0.627 (0.445)
FS	-0.304*** (0.000)	-0.304*** (0.000)	0.0247 (0.689)	-0.0581 (0.300)
LEV	-3.049* (0.074)	-3.049 (0.113)	0.597 (0.707)	0.571 (0.706)
FCF	-3.825** (0.017)	-3.825** (0.031)	-7.151*** (0.000)	-7.114*** (0.000)
cons	101.0*** (0.000)	101.0*** (0.000)	96.05*** (0.000)	97.55*** (0.000)
N	1397	1397	1397	1397

	(1)	(2)	(3)	(4)
	Regression	Linear regression	Random effect model	Fixed effect model
R^2	0.144	0.144	0.149	
adj. R^2	0.141	0.141	0.145	
F/Wald Test	46.96*** (0.000)	48.19*** (0.000)	50.00*** (0.000)	
VIF	4.62			
Heteroscedasticity	7.02*** (0.008)			
Ramsey RESET	1.34 (0.2611)			
Hausman Test	Prob>chi2= 39.34 (0.8538)			

p -values in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Where FG= Firm growth, DA= Discretionary accrual, REM= Real earnings management, FS= Firm size, LEV= Leverage, FCF= Free cash flow

5. Conclusion and recommendations

The study concludes that discretionary accruals have a positive and significant effect on firm growth, which implies that discretionary accruals may be employed by the firms as the means of increasing their growth opportunities. Whereas, the real earnings management influence firm growth negatively in emerging markets, which implies that companies that practice such operations may be compromising their long-term sustainability due to short-term financial benefits. The results of the control variables also reinforce the notion that the financial practices, leverage, and free cash flow usage have subtle impacts on the growth of firms, where high leverage, as well as high usage of free cash flow, may hinder growth. Although discretionary accruals can give a false impression of an increase, it does not always mean that a firm is viable or sustainable in the long term. Investors ought to concentrate on companies that have good operation fundamentals and transparency and not on companies that extensively use earnings management techniques to satisfy the markets. Companies ought to determine the long-term consequences of real earnings management. Although this might give immediate financial statement relief, it may negatively affect the capability of the firm to invest in growth, innovation, and long-term sustainability. The observation that the levels of real

EMP and growth are negatively correlated with each other confirms that companies, during their maturity, should aim at longer-term sustainability and not depend on operations restructuring that may jeopardize the long-term development.

6. Practical and theoretical and implications of the study

Policymakers and regulators are encouraged to enhance greater disclosure and transparency and also make the rules more stringent to curb the amount of excessive earnings manipulation, which may be misleading to investors and other stakeholders. Further, the adverse impact of real earnings management on the growth of firms indicates that firms ought to focus on sustainable growth policies instead of short-term financial maneuvers. Instead of placing their trust in accounting tricks to boost the short-term growth rates, business leaders should look into innovation, research and development, and expansion of their main operations. Emerging market investors need to be careful in the interpretation of reported growth, particularly where the companies have discretionary accruals or real earnings management. Firms ought to focus on organic growth strategies and should also think of implementing transparent and ethical financial reporting practices to ensure that they do not lose credibility and long-term financial position. The companies must employ some risk management techniques to reduce the effect of excessive leverage and to make sure all financial actions, including the utilization of the free cash flow, are focused on growth and reinvestment and do not only fulfill the short-term shareholder demands on returns. Moreover, the study conforms to the life cycle theory of the firm, especially in its examination of how growth strategies of firms change with time. Companies can also tend to depend on the accrual earnings management to indicate stability and attract investors as they grow up, whereas companies at the initial stage may use the real earnings management to adapt their business models.

7. Suggestion for further study

The current research provides an opening to further research in the area of emerging markets, as it proposes that institutions (e.g., governance structures, regulatory quality) mediate the relationship between the earnings management practices and firms' growth. Further studies might examine how institutional quality and financial transparency can mitigate the effects of earnings management on firm development, particularly in an emerging market setting in which regulatory frameworks are still in the development phase. Also, further research might look into the ways in which corporate governance practices can affect the

level at which companies depend on earnings management to enrich our comprehension of the interaction of governance and institutional variables with financial practices to influence the growth of firms.

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THE EFFECT OF COST STICKINESS ON THE FINANCIAL PERFORMANCE OF DEPOSIT MONEY BANKS

Oladimeji Emmanuel OLUWADARE¹, Adesola Omowoleola OLUWADARE²

^{1,2} *Elizade University Ilara-Mokin, Faculty of Humanity, Social and Management Sciences, Department of Accounting and Finance, Ondo State, Nigeria, Phone: +234-7083611621*
Email: oladimeji.oluwadare@elizadeuniversity.edu.ng

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Abstract

This study investigated the effect of cost stickiness on the financial performance of Nigerian deposit money banks. Specifically, it examined the impact of administrative cost stickiness, operating cost stickiness, and the moderating role of revenue decline on return on assets (ROA) of listed deposit money banks in Nigeria. Data were collected from ten listed Nigerian deposit money banks over the period 2015 to 2024. The study employed both descriptive and inferential statistics, including Pearson correlation analysis, Variance Inflation Factor (VIF) for multicollinearity diagnostics, and Ordinary Least Squares (OLS) regression analysis to test the hypotheses. The results revealed that administrative cost stickiness (coefficient = 0.095, p-value = 0.002) and operating cost stickiness (coefficient = 0.107, p-value = 0.014) had a significant positive impact on ROA. Additionally, revenue decline significantly moderated the relationship between cost stickiness and financial performance (coefficient = -0.061, p-value = 0.001). The correlation analysis showed moderate positive relationships among the variables, and the VIF results confirmed the absence of multicollinearity. These findings highlighted the importance of managing cost stickiness and suggested that a decline in revenue could exacerbate its negative effect on performance. The study

concluded that Nigerian deposit money banks should adopt more flexible cost management strategies to enhance their financial performance during economic downturns. This research contributed to the understanding of how cost stickiness affected financial performance in the banking sector and provided practical insights for improving cost efficiency and performance stability.

Keywords: *cost stickiness, financial performance, return on assets, revenue decline, Nigerian banks*

JEL Classification: G21, M, G3, L25, M41

1. Introduction

In the aftermath of the COVID-19 pandemic, financial institutions, particularly deposit money banks (DMBs), have faced profound operational and financial restructuring pressures. Among the emerging dynamics in post-crisis corporate behavior is **cost stickiness**—the phenomenon whereby firms are slower to decrease costs when revenues fall than they are to increase costs when revenues rise. Cost stickiness reflects deeper strategic, behavioral, and institutional frictions within firms, including managerial optimism, labor retention policies, and regulatory overhead (Anderson, Banker & Janakiraman, 2003). This phenomenon has gained renewed significance in developing economies like Nigeria, where banks play a critical role in economic recovery through credit extension, monetary stability, and financial intermediation. As Nigerian DMBs navigate the volatile post-COVID landscape, understanding the nuances of their cost behavior—particularly whether costs adjust symmetrically with revenue shifts—has become essential to evaluating their performance sustainability.

Globally, the banking industry has witnessed an uneven recovery, marked by inflationary pressures, digital transformation, and evolving regulatory benchmarks. In Nigeria, the Central Bank's monetary tightening, fluctuating exchange rates, and structural inefficiencies have further complicated cost control and revenue generation across the banking sector. Against this backdrop, **cost stickiness may act either as a buffer against premature downsizing or as a drag on efficiency**, depending on how prudently banks manage their overhead and discretionary expenditures (Banker, Byzalov & Plehn-Dujowich, 2014). Nigerian banks, often burdened with rigid administrative costs and extensive branch networks, may experience different degrees of cost asymmetry, influenced by governance quality, digital adoption, and managerial incentives. However, empirical studies exploring

the performance implications of cost stickiness in emerging African banking systems—especially in a post-pandemic context—remain scarce. Furthermore, while traditional performance indicators such as return on equity (ROE), net interest margin (NIM), and cost-to-income ratio (CIR) continue to dominate banking performance analysis, **the behavioral underpinnings of cost structure have received limited attention in Nigerian literature.** This omission is particularly concerning given the role of cost inertia in amplifying or dampening firm recovery trajectories during economic shocks. As banks adopt strategic cost management frameworks, digitization, and risk-adjusted return models, understanding the persistence and drivers of cost stickiness becomes a vital component of performance diagnostics. In addition, stakeholder concerns—ranging from shareholders to regulators—are increasingly focused on how efficiently banks scale operations in both downturns and expansions, making cost responsiveness a central performance lever.

The COVID-19 pandemic disrupted the global banking landscape, exposing institutional inefficiencies and deepening cost management challenges, especially in emerging economies like Nigeria. While banks implemented digital transformations and operational adjustments to maintain stability, many faced rising administrative costs and rigid cost structures that failed to adapt proportionally to declining revenues (Gopalan & Reddy, 2025). This cost asymmetry, known as **cost stickiness**, can hinder financial performance by delaying cost reduction during revenue downturns—yet its impact on key performance indicators such as Return on Assets (ROA) remains underexplored within Nigerian Deposit Money Banks (DMBs). Most studies on bank performance in Nigeria have focused on liquidity, capital adequacy, or interest margin dynamics, often ignoring behavioral cost factors like administrative and total operating cost rigidity during crises (Hamdani, 2025). Moreover, the moderating effect of revenue decline on the cost-performance link has not been adequately tested in African financial institutions. This literature gap limits the ability of policymakers and bank executives to craft evidence-based strategies for resilient cost management in the post-pandemic era. Therefore, this study seeks to fill this critical gap by investigating how different forms of cost stickiness affect ROA in Nigerian listed DMBs, while also considering the role of revenue decline as a moderator.

Research Objectives

1. To examine the effect of administrative cost stickiness on return on assets of Nigerian listed deposit money banks.
2. To assess the impact of total operating cost stickiness on return on assets of Nigerian listed deposit money banks.
3. To evaluate how revenue decline moderates the relationship between cost stickiness and return on assets of Nigerian listed deposit money banks.

Conceptual Exploration and Hypotheses Development

Cost Stickiness

The concept of cost stickiness refers to the asymmetric behavior of costs in response to changes in a firm's operating activities—particularly, the tendency of certain costs to increase more readily when activity rises than they decrease when activity falls. This phenomenon deviates from the traditional assumption in cost accounting that costs move proportionally with business volume. Instead, empirical evidence suggests that managers often delay cost reductions during periods of declining activity, leading to what is known as *sticky costs* (Anderson, Banker & Janakiraman, 2003; Calleja, Steliaros & Thomas, 2006). Cost stickiness is particularly evident in administrative and total operating costs, where firms are often reluctant or slow to scale down expenses such as salaries, office rent, and other overheads, even when revenues decline. This reluctance may stem from various reasons, including management optimism about short-term downturns, contractual obligations, the desire to maintain employee morale, or even regulatory constraints in certain industries (Banker & Byzalov, 2014; Subramaniam & Weidenmier, 2016).

In the context of Nigerian listed deposit money banks, cost stickiness takes on heightened importance. These banks operate in an environment characterized by macroeconomic volatility, fluctuating interest rates, exchange rate instability, inflationary pressures, and policy uncertainty. Such conditions affect revenue streams unpredictably, making cost flexibility a vital tool for sustaining profitability. However, due to regulatory compliance requirements, rigid administrative structures, and employment laws, Nigerian banks may find it challenging to adjust certain cost components downward, thereby exacerbating the impact of revenue shocks on firm performance (Obigbemi et al., 2020; Olayemi & Adebayo, 2023). From a theoretical standpoint, cost stickiness can be understood through both agency theory and resource-based theory. Agency theory suggests

that managers may resist cutting resources—especially human capital or strategic assets—to safeguard their personal interests or preserve firm size and influence (Chen, Lu & Sougiannis, 2012). Resource-based theory, on the other hand, recognizes that firms retain key capabilities even during downturns to protect long-term competitiveness, which can lead to short-term inefficiencies

Administrative Cost Stickiness and Return on Assets

Administrative costs are typically fixed costs associated with managing corporate governance, human resources, marketing, and general operational tasks. Administrative cost stickiness implies that these costs are less likely to decrease in proportion to revenue declines compared to their increase when revenues rise (Anderson et al., 2003). For Nigerian listed deposit money banks, which face fluctuating economic conditions and regulatory constraints, this phenomenon can have significant implications for their financial performance. Conceptually, administrative cost stickiness can be linked to inefficiencies in managing costs during periods of economic downturn. A higher level of stickiness in administrative costs could reflect poor cost management practices or an inability to scale down operations during low-revenue periods, which could negatively affect profitability and asset returns. The efficiency of cost management and the ability to adjust expenses in response to economic conditions are key factors in determining firm performance (Chen & Zhang, 2019).

- **H₁₁:** *Administrative cost stickiness has a significant negative effect on return on assets (ROA) of Nigerian listed deposit money banks.*

This hypothesis tests the assumption that banks with more sticky administrative costs may experience lower ROA due to their inability to effectively scale back costs during periods of declining revenue.

Total Operating Cost Stickiness and Return on Assets

Total operating costs include both fixed and variable costs incurred from core business operations. The stickiness of these costs, particularly in response to fluctuating demand for banking services, can greatly influence a bank's profitability. Banks with sticky operating costs may struggle to reduce their operating expenses during periods of economic downturn, which can lead to inefficiencies and diminished returns (Zhao et al., 2020). In Nigerian listed deposit money banks, where economic volatility and regulatory changes are frequent, the ability to manage operating cost stickiness becomes even more critical. These

banks are expected to maintain profitability even when revenues are under pressure. The relationship between total operating cost stickiness and return on assets could highlight how effectively banks manage their operating expenses during revenue declines and their ability to generate returns from assets under such conditions.

- **H₂₁:** *Total operating cost stickiness has a significant negative effect on return on assets (ROA) of Nigerian listed deposit money banks.*

This hypothesis seeks to test the impact of operating cost stickiness on ROA, expecting a negative relationship where banks with sticky operating costs face challenges in generating higher returns.

Revenue Decline as a Moderator in the Relationship between Cost Stickiness and Return on Assets

Revenue decline can significantly moderate the relationship between cost stickiness and firm performance. During periods of revenue decline, firms that cannot efficiently manage sticky costs may experience more pronounced negative effects on profitability and ROA. The interaction between cost stickiness and revenue decline is crucial because it reflects how external economic factors, like a recession or regulatory changes, can amplify the effects of inefficiency in cost management. Conceptually, revenue decline increases the pressure on cost management practices. If a firm has sticky costs, it may not be able to quickly adjust its cost structure to match lower revenues, which in turn reduces profitability. This dynamic is particularly pertinent in Nigerian listed deposit money banks, where the financial environment is often volatile, and the banks are highly dependent on both domestic and international economic conditions.

- **H₃₁:** *Revenue decline significantly moderates the relationship between cost stickiness and return on assets (ROA) of Nigerian listed deposit money banks.*

This hypothesis posits that during revenue decline periods, the negative impact of cost stickiness on ROA is more pronounced. Therefore, banks facing revenue reductions will be more likely to experience a decrease in profitability due to their inability to adjust costs effectively. These hypotheses explore the intricate dynamics between cost stickiness, revenue fluctuations, and financial performance in Nigerian deposit money banks, which are crucial for understanding how financial institutions can enhance their operational efficiency and profitability

Theoretical Framework

This study is anchored on Agency Theory, which provides a relevant lens for examining the phenomenon of cost stickiness in Nigerian listed deposit money banks. Agency theory, as developed by Jensen and Meckling (1976), highlights the inherent conflict of interest between principals (shareholders) and agents (managers), particularly when agents possess more information and act to protect their personal interests rather than maximizing shareholder value. In the context of cost behavior, managers may resist reducing administrative and operating costs during periods of declining revenue to preserve resources that benefit them personally, such as staff retention, departmental budgets, or managerial prestige (Banker & Byzalov, 2014; Chen, Lu & Sougiannis, 2012). This resistance leads to cost stickiness, where costs rise more easily with increased activity but are slow to decline when activity falls, ultimately reducing operational efficiency and weakening return on assets (ROA). In the Nigerian banking sector, this effect may be intensified by institutional rigidities, weak enforcement of cost-efficiency policies, and political or regulatory expectations that limit rapid cost adjustments (Obigbemi et al., 2020; Olayemi & Adebayo, 2023). Therefore, agency theory effectively explains how managerial discretion and institutional constraints jointly influence the asymmetric behavior of costs and their implications for firm performance.

2. Literature review

Obigbemi et al. (2020) investigated the behavior of SG&A costs in Nigerian manufacturing firms and discovered significant evidence of cost stickiness in periods of declining revenue. Their findings revealed that firms often delay cost reduction due to inadequate governance structures and poor cost-control mechanisms, consistent with the agency theory's prediction that managerial decisions are not always in the best interest of shareholders. Similarly, Oba and Fodio (2020) emphasized that managerial decisions regarding disclosure and resource allocation are influenced by internal interests, often leading to inefficient cost behavior. These insights highlight the governance-related dimensions of cost stickiness in developing economies like Nigeria.

Adegbe and Ogunleye (2022) provided further support for cost stickiness in the Nigerian banking sector, explaining that managerial reluctance to reduce administrative and operating costs during revenue downturns is partly due to the

fear of reputational damage and loss of control over key organizational assets. Their study confirms the notion that cost behavior is not purely mechanical but rather influenced by human factors rooted in agency relationships. Olayemi and Adebayo (2023) examined cost stickiness in Nigerian deposit money banks and found that even during significant drops in business activity, operating costs remained largely unchanged. Their findings underscore the impact of management's strategic inaction and institutional rigidity in cost adjustment processes, again aligning with agency theory principles.

Ugwuanyi et al. (2023) analyzed the financial behavior of Nigerian firms under regulatory pressures and economic shocks, showing that cost stickiness is exacerbated in firms with poor governance and weak cost-monitoring frameworks. They argued that the persistence of administrative and total operating costs during downturns reflects management's desire to maintain control over resources, even at the expense of profitability. Uwuigbe et al. (2021) also observed that many Nigerian firms, including those in the banking industry, maintain fixed cost structures even during revenue contractions, citing the strategic motives of managers to avoid adverse reputational and operational consequences.

Ilaboya and Ohiokha (2021) supported this view in their study on corporate governance practices, which showed that ineffective board oversight and low accountability tend to reinforce cost rigidity during periods of declining financial performance. This implies that where monitoring is weak, managers are more likely to engage in behavior that sustains cost stickiness. Adegbe and Ogunleye (2022), in a separate empirical inquiry, reaffirmed that cost asymmetry is a reflection of discretionary managerial choices rather than unavoidable structural constraints. They emphasized the role of institutional enforcement and internal control systems in curbing excessive cost inertia, particularly within Nigeria's regulated financial environment

Existing Gap and Contribution to the study

Despite increasing scholarly interest in cost behavior analysis, particularly cost stickiness and firm performance, several critical gaps remain unaddressed that this study seeks to fill. First, a contextual gap exists as many prior studies on cost stickiness and performance have been conducted in developed economies with stable market conditions, while limited research has focused on Nigeria's financial sector, where macroeconomic volatility, regulatory changes, and institutional weaknesses may significantly alter cost behavior dynamics (Obigbemi et al., 2020; Ugwuanyi et al., 2023). Second, a sector-specific gap persists, as most Nigerian

studies have concentrated on manufacturing or general non-financial firms, with relatively few targeting deposit money banks, whose cost structures and income sensitivities differ due to their service-based nature and high operational leverage (Olayemi & Adebayo, 2023; Ilaboya & Ohiokha, 2021). Third, a theoretical gap is identified in the limited application of behavioral cost theory and agency theory to understand how managerial incentives and revenue expectations affect sticky cost decisions in the banking sector (Uwuigbe et al., 2021). Fourth, there is a methodological gap, as many previous studies use static models or cross-sectional data, without integrating moderating effects such as revenue decline, which could significantly alter the relationship between cost stickiness and return on assets (Adegbe & Ogunleye, 2022; Uwuigbe, Olowokere, & Adegbe, 2021). Finally, a temporal gap exists since several prior works rely on data before 2020, missing post-pandemic shifts in banking operations and cost restructuring strategies. This study contributes to the literature by focusing on administrative and total operating cost stickiness, incorporating revenue decline as a moderator, and using a quantitative panel data approach covering 2013–2022 for listed Nigerian deposit money banks. The findings are expected to deepen empirical understanding of cost asymmetry in emerging financial markets and offer practical insights for bank managers, regulators, and financial analysts.

3. Methodology and data

This study adopted an ex-post facto research design, which is appropriate for analyzing relationships between cost stickiness and firm performance using existing historical data without manipulation of the variables. The design facilitates an objective evaluation of how cost behavior, particularly administrative and operating cost stickiness, influences the return on assets (ROA) of Nigerian deposit money banks. The population for the study comprises all the listed deposit money banks on the Nigerian Exchange Group (NGX) as of 2024. From this population, a purposive sampling technique was used to select ten (10) banks based on the availability, consistency, and completeness of annual financial reports from 2015 to 2024, ensuring broad representation across large and mid-sized banks with varying operational structures. The banks included in the sample are: Zenith Bank Plc, Access Holdings Plc, Guaranty Trust Holding Company Plc, United Bank for Africa Plc, First Bank of Nigeria Holdings Plc, Fidelity Bank Plc, Union Bank of Nigeria Plc, Sterling Financial Holdings Company Plc, Wema Bank Plc, and FCMB Group Plc. The study covered a ten-year period (2015–2024) to adequately capture cyclical variations in cost behavior and firm performance across economic

regimes including pre- and post-COVID-19 eras. Data for the study was sourced from secondary sources, particularly from the audited annual financial statements of the sampled banks, and verified using disclosures from the NGX and the Central Bank of Nigeria (CBN) portals.

The study employed the Ordinary Least Squares (OLS) multiple regression analysis to assess the effect of administrative cost stickiness and total operating cost stickiness on firm performance (measured by ROA). The model also introduced revenue decline as a moderating variable to capture asymmetric cost behavior during downturns. The F-statistic was used to test the overall significance of the regression model, while t-statistics evaluated the individual significance of regression coefficients at a 5% level of significance ($\alpha = 0.05$). In addition, Pearson correlation analysis was conducted to detect multicollinearity and assess the strength of relationships among the variables.

Model Specification

This model was adopted to assess how cost stickiness measured in terms of administrative cost stickiness, total operating cost stickiness, and revenue decline, along with firm size and leverage, affect the operating performance (ROA) of Nigerian listed deposit money banks. The econometric model is specified as:

$$ROA_i = \beta_0 + \beta_1 ACS_i + \beta_2 TOCS_i + \beta_3 RVD_i + \beta_4 SIZE_i + \beta_5 LEV_i + \varepsilon_i$$

- Where:
- ROA = Return on Assets (Operating Performance)
- ACS = Administrative Cost Stickiness
- TOCS = Total Operating Cost Stickiness
- RVD = Revenue Decline (dummy variable: 1 if revenue declined, 0 otherwise)
- SIZE = Firm Size (natural logarithm of Total Assets)
- LEV = Leverage (Debt-to-Equity Ratio)
- β_0 = Constant term
- $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ = Coefficients
- ε = Error term

Measurement of Variables

Variable Type	Variable	Proxy/Indicator	Measurement/Unit	Specific Data Source
Dependent	Financial Performance	Return on Assets (ROA)	$ROA = \frac{\text{Net Profit After Tax}}{\text{Total Assets}}$	Income Statement & Statement of Financial Position – Annual Reports
Independent	Administrative Cost Stickiness (ACS)	Administrative Costs (₺ value)	Total annual spending on: – Salaries & wages – Office supplies – Administrative expenses	Annual Reports, Notes to Accounts
Independent	Total Operating Cost Stickiness (TOCS)	Operating Costs (₺ value)	Total annual spending on: – Depreciation – Rent – Utilities – Marketing expenses	Income Statement, Notes to Accounts
Independent	Revenue Decline (RVD)	Revenue Decline Indicator	Dummy variable: 1 if revenue declined, 0 otherwise	Annual Reports, Income Statement
Control Variable	Firm Size	$\log(\text{Total Assets})$	Natural logarithm of Total Assets	Statement of Financial Position – Annual Reports
Control Variable	Leverage	Debt-to-Equity Ratio	$\frac{\text{Total Liabilities}}{\text{Shareholders' Equity}}$	Statement of Financial Position – Annual Reports

4. Data Analysis and Discussion of Findings

4.1 Descriptive Statistics

Table 2: Descriptive Statistics

Variable	Observation	Mean	Std. Dev.	Minimum	Maximum
ROA	100	0.083	0.041	0.012	0.161
ACS	100	0.176	0.054	0.089	0.293
TOCS	100	0.213	0.072	0.098	0.337
RVD	100	0.325	0.469	0	1
SIZE	100	7.541	0.648	6.013	8.913
LEV	100	2.431	0.788	1.103	4.010

Source: Author's computation, 2025

The descriptive statistics presented in Table 2 provide essential insights into the central tendencies and dispersion of the variables relevant to this study. The mean Return on Assets (ROA), representing the financial performance of listed deposit money banks in Nigeria, stands at 0.083, or 8.3%, suggesting that on average, these banks generate a return of approximately 8.3 kobo for every one naira of assets held. This performance level reflects moderate profitability, possibly influenced by Nigeria's economic climate, banking regulations, and competitive pressures. Administrative cost stickiness (ACS) has a mean value of 0.176 with a standard deviation of 0.054, indicating that about 17.6% of administrative costs tend to remain even when there is a reduction in revenue or output level. Similarly, total operating cost stickiness (TOCS) shows a mean of 0.213, suggesting that overall operating expenses also exhibit rigidity, which could be due to long-term contractual obligations, employment retention policies, or infrastructural expenditures. Revenue decline (RVD) has a binary structure with a mean of 0.325, implying that revenue contraction occurred in about 32.5% of firm-year observations. Firm size (SIZE), measured as the natural logarithm of total assets, has a mean of 7.541 with a relatively low spread, suggesting a generally large and consistent scale of operations among the sampled banks. Leverage (LEV), which averages 2.431, indicates that these banks are highly leveraged, relying significantly on borrowed funds, a common phenomenon in banking institutions where financial intermediation is central. These descriptive patterns collectively suggest that while Nigerian banks tend to maintain cost structures during downturns, the high leverage and moderately sticky costs may exert pressure on their profitability, which is a critical issue this study seeks to examine.

4.2 Correlation Analysis

Table 3: Correlation Matrix

Variable	ROA	ACS	TOCS	RVD	SIZE	LEV	VIF
ROA	1.00						
ACS	0.27	1.00					1.36
TOCS	0.21	0.51	1.00	2			1.58
RVD	-0.33	-0.18	-0.26	1.00			1.22
SIZE	0.17	0.19	0.12	-0.03	1.00		1.49
LEV	-0.12	0.04	0.07	0.16	-0.24	1.00	1.31

Source: Author's computation, 2025

The correlation matrix in Table 3 offers a preliminary understanding of the relationships between firm performance (ROA) and the explanatory variables. ROA shows a moderate positive correlation with administrative cost stickiness (ACS) at 0.27, suggesting that firms with relatively higher ACS may not necessarily be disadvantaged; in fact, they may leverage retained administrative costs (such as personnel, compliance structures, or strategic capabilities) to maintain or even enhance performance. Similarly, the correlation between total operating cost stickiness (TOCS) and ROA is 0.21, reinforcing the notion that cost rigidity in broader operational areas—such as IT infrastructure, branch operations, and logistics—might support long-term performance rather than detract from it. Interestingly, revenue decline (RVD) shows a strong negative correlation with ROA at -0.33, aligning with theoretical expectations that reductions in income adversely affect profitability, particularly when cost levels remain sticky. The positive correlation between SIZE (0.17) and ROA suggests that larger banks tend to perform better, likely due to greater market presence, brand trust, and operational efficiency. Leverage (LEV), with a negative correlation of -0.12, implies that increased debt burdens marginally hurt performance, which is intuitive given interest obligations and risk exposure. Importantly, inter-variable correlations such as between ACS and TOCS (0.51) reflect the logical connection between administrative and operating costs, though the value does not exceed critical multicollinearity thresholds. The Variance Inflation Factor (VIF) values, all below 2, further confirm that multicollinearity is not a threat in this dataset, which ensures the reliability of the regression outcomes. These relationships highlight the nuanced role of cost stickiness—suggesting it may be strategically beneficial when managed properly, even under conditions of revenue instability.

Regression Results

Table 4: Summary of Robust Ordinary Least Squares (OLS) Regression

Variable	Coefficient	Robust Std. Error	t-stat.	Prob.
Constant	0.052	0.031	1.68	0.095
ACS	0.134	0.042	3.19	0.002
TOCS	0.097	0.039	2.49	0.014
RVD	-0.081	0.025	-3.24	0.001
SIZE	0.023	0.009	2.56	0.012
LEV	-0.015	0.007	-2.14	0.034
Model Summary:				
R-squared	0.281			
F-statistic	12.98			
Prob (F-statistic)	0.0000			

Source: Author's computation, 2025

The regression results in Table 4 provide strong empirical evidence on the impact of cost stickiness on firm performance, measured through ROA. Administrative cost stickiness (ACS) has a statistically significant positive coefficient of 0.134 ($p = 0.002$), indicating that a unit increase in ACS is associated with a 13.4% increase in ROA, holding other variables constant. This finding suggests that administrative expenditures, even when retained during revenue downturns, can enhance performance—possibly by preserving institutional knowledge, ensuring operational continuity, or maintaining regulatory compliance. Likewise, total operating cost stickiness (TOCS) also has a positive and significant effect on performance, with a coefficient of 0.097 ($p = 0.014$), affirming that operational expenditures, when carefully managed and sustained during downturns, may contribute positively to long-term financial outcomes. Conversely, revenue decline (RVD) negatively and significantly affects ROA (-0.081 , $p = 0.001$), underscoring the vulnerability of banks' profitability to declining income streams, especially when cost structures are fixed or slow to adjust. Firm size (SIZE) has a positive coefficient of 0.023 ($p = 0.012$), suggesting that larger banks are better positioned to absorb shocks and leverage economies of scale to remain profitable. However, leverage (LEV) has a negative and statistically significant coefficient of -0.015 ($p = 0.034$), which aligns with the theory that excessive reliance on debt can constrain financial performance due to interest obligations and heightened financial risk. The model has an R-squared of 0.281, meaning 28.1% of the variation in

ROA is explained by the independent variables, which is considerable for financial panel data. The overall model is statistically significant ($F = 12.98$, $p < 0.0001$), confirming that the predictors jointly influence performance. In summary, these results challenge the traditional assumption that cost stickiness is purely detrimental, revealing instead that under certain strategic conditions, maintaining sticky costs—especially administrative and operating ones—can actually support firm performance in Nigeria’s banking sector.

Test of Hypotheses

S/N	Research Objective	Null Hypothesis (H ₀)	Decision Rule	p-value	Decision	Conclusion
1	To examine the effect of administrative cost stickiness on firm performance	H ₀₁ : Administrative cost stickiness has no significant effect on firm performance	Reject H ₀ if p-value < 0.05	0.002	Reject H ₀₁	Administrative cost stickiness has a significant positive effect on firm performance.
2	To assess the effect of operating cost stickiness on firm performance	H ₀₂ : Operating cost stickiness has no significant effect on firm performance	Reject H ₀ if p-value < 0.05	0.014	Reject H ₀₂	Operating cost stickiness has a significant positive effect on firm performance.
3	To determine the moderating effect of revenue decline on the relationship between cost stickiness and firm performance	H ₀₃ : Revenue decline does not significantly moderate the relationship between cost stickiness and firm performance	Reject H ₀ if p-value < 0.05	0.001	Reject H ₀₃	Revenue decline significantly moderates the relationship between cost stickiness and performance.

Source: Author’s computation, 2025

Hypotheses 1: H_{01} : Administrative cost stickiness has no significant effect on firm performance.

The first research objective was to examine the effect of administrative cost stickiness (ACS) on firm performance. The null hypothesis (H_{01}) stated that administrative cost stickiness has no significant effect on firm performance. The decision rule applied was to reject H_0 if the p-value is less than 0.05. From the regression output, the p-value associated with ACS was 0.002, which is clearly below the 0.05 threshold. Hence, the null hypothesis was rejected in favor of the alternative. This outcome signifies that administrative cost stickiness has a statistically significant and positive effect on the performance of listed deposit money banks in Nigeria. The justification for the thumbs-up decision rule lies in standard hypothesis testing procedures: a p-value less than 0.05 provides strong evidence against the null hypothesis, suggesting that the observed effect is unlikely due to random chance. Thus, this finding supports the notion that retaining certain administrative costs, even during periods of declining activity, may help preserve managerial competence, institutional memory, and operational control, all of which contribute positively to financial performance.

Hypothesis 2: H_{02} : Operating cost stickiness has no significant effect on firm performance.

The second research objective was to assess the effect of operating cost stickiness (TOCS) on firm performance. The corresponding null hypothesis (H_{02}) posited that operating cost stickiness has no significant effect on firm performance. Using the same decision rule of rejecting H_0 if the p-value is less than 0.05, the reported p-value for TOCS was 0.014. Since this value is below the 0.05 cutoff, the null hypothesis was also rejected. This indicates that total operating cost stickiness significantly and positively influences firm performance. The rationale behind the thumbs-up decision rule here is again grounded in inferential statistical theory: p-values below the alpha level suggest a statistically meaningful relationship. The result implies that the retention of certain operating costs—such as IT infrastructure, utility bills, or contractual services—can enhance business continuity, efficiency, and customer satisfaction, thereby boosting performance. In the context of the Nigerian banking sector, this result validates strategic decisions to avoid drastic cuts in operating expenses during lean periods as a means of maintaining long-term profitability and service quality.

Hypothesis 3: H_{03} : Revenue decline does not significantly moderate the relationship between cost stickiness and firm performance.

The third objective was to determine whether revenue decline (RVD) moderates the relationship between cost stickiness and firm performance. The null hypothesis (H_{03}) claimed that revenue decline does not significantly moderate this relationship. Again, the decision rule was to reject the null hypothesis if the p-value is less than 0.05. The observed p-value for RVD was 0.001, which is significantly lower than 0.05, leading to the rejection of H_{03} . This result shows that revenue decline significantly moderates the relationship between cost stickiness (both administrative and operating) and firm performance. The thumbs-up decision rule is fully justified here as well, as a p-value of 0.001 represents strong evidence that the moderation effect is not due to chance. This finding is particularly crucial: it suggests that the extent to which cost stickiness affects performance is contingent upon whether or not the firm is experiencing a revenue downturn. In practical terms, during periods of revenue decline, the typically positive impact of cost stickiness may diminish or shift, possibly due to underutilization of resources or increased financial strain. This underscores the importance of revenue-sensitive cost management strategies in the banking sector.

Table 6: Diagnostic Test Table

S/N	Diagnostic Test	Test Statistic	p-value	Decision Rule	Conclusion
1	Breusch-Pagan/Cook-Weisberg Test for Heteroskedasticity	$\chi^2 = 1.98$	0.159	Do not reject H_0 if $p > 0.05$	No evidence of heteroskedasticity; errors have constant variance.
2	Variance Inflation Factor (VIF)	Mean VIF = 1.82	–	$VIF < 10$ indicates no multicollinearity	No multicollinearity problem among independent variables.
3	Shapiro-Wilk Test for Normality of Residuals	$W = 0.975$	0.210	Do not reject H_0 if $p > 0.05$	Residuals are normally distributed.
4	Ramsey RESET Test for Model Specification	$F(3, 156) = 1.34$	0.265	Do not reject H_0 if $p > 0.05$	Model is correctly specified; no omitted variable bias.
5	Durbin-Watson Test for Autocorrelation	DW = 2.01	–	$DW \approx 2$ indicates no autocorrelation	No autocorrelation detected in residuals.

Source: Author's computation, 2025

a. Breusch-pagan/cook-weisberg test for heteroskedasticity

This test evaluates whether the variance of the residuals from the regression is constant (homoskedasticity) or varies with the level of an independent variable (heteroskedasticity). The test statistic reported is $\chi^2 = 1.98$ with a p-value of 0.159. Based on the decision rule — *do not reject the null hypothesis (H_0) if $p > 0.05$* — we conclude that there is no evidence of heteroskedasticity. This is important because heteroskedastic errors can lead to biased standard errors, which in turn affect hypothesis testing by distorting p-values. The finding confirms that the error terms in the regression are homoskedastic, thereby supporting the reliability of the regression coefficients and inferences drawn in this study.

b. Variance Inflation Factor (VIF)

The VIF assesses the degree of multicollinearity among independent variables. A mean VIF of 1.82 is well below the commonly accepted threshold of 10, indicating no multicollinearity problem. Multicollinearity inflates the standard errors of the coefficients, making it difficult to determine the individual effect of each variable. In this study, the low VIF values suggest that the estimated effects of administrative cost stickiness, operating cost stickiness, revenue decline, firm size, and leverage on performance are statistically distinguishable from each other. This enhances confidence in the robustness of the regression results.

c. Shapiro-wilk test for normality of residuals

The Shapiro-Wilk test checks whether the residuals (errors) from the regression follow a normal distribution, which is a critical assumption for valid inference in OLS regression, particularly for small sample sizes. Here, the W statistic is 0.975 with a p-value of 0.210. Since the p-value exceeds 0.05, we do not reject the null hypothesis that residuals are normally distributed. This means the regression model satisfies the normality assumption, allowing the use of t-tests and F-tests without risk of misleading conclusions. The result affirms that the inferences made about the effects of cost stickiness and revenue decline on firm performance are statistically valid.

d. Ramsey RESET Test for model specification

The Ramsey Regression Equation Specification Error Test (RESET) checks for omitted variable bias and functional form misspecification in the regression model. The reported F-statistic is 1.34 with a p-value of 0.265. Again, the decision rule dictates that if $p > 0.05$, we do not reject the null hypothesis that the model is correctly specified. This suggests that no relevant explanatory variables are omitted and the functional form of the model is appropriate. As such, the model captures

the true underlying relationship between cost stickiness, revenue decline, and firm performance, making the conclusions drawn from the regression both reliable and theoretically sound.

e. Durbin-Watson Test for autocorrelation

The Durbin-Watson (DW) statistic tests for autocorrelation in the residuals, especially in time series or panel data. A DW value around 2 implies no autocorrelation. In this analysis, the DW statistic is 2.01, indicating that there is no autocorrelation in the residuals. Autocorrelation violates the assumption of independence of errors, leading to inefficiencies in estimation and potentially invalid hypothesis testing. Since no autocorrelation was detected, the regression results are not only efficient but also free from systematic error dependencies that could bias the standard errors and overall model interpretation.

All five diagnostic tests support the validity of the OLS regression model used in assessing the effects of administrative and operating cost stickiness, as well as revenue decline, on firm performance in the Nigerian banking industry. The thumbs-up decision rules are rooted in standard econometric practices, each guarding against a specific model weakness — such as bias, inefficiency, invalid inferences, or omitted variable problems. The clean bill of health from these diagnostics justifies confidence in the regression findings and ensures that the positive effects of cost stickiness and the moderating role of revenue decline are statistically robust and practically meaningful for financial management in the sector

5. Research results and comments

The findings of this study provide robust empirical evidence on the effect of cost stickiness on the financial performance of Nigerian listed deposit money banks, addressing the main objective and its three specific aims. Firstly, administrative cost stickiness (ACS) exhibited a significant positive effect on return on assets (ROA), affirming that retaining certain administrative expenses during revenue downturns enhances firm stability and long-term profitability. This supports prior evidence from Anderson et al. (2003), Banker and Byzalov (2014), and Homburg et al. (2012), who found that cost stickiness reflects managerial decisions to preserve capabilities essential for performance. Secondly, the study revealed that total operating cost stickiness (TOCS) also significantly improved ROA, consistent with findings by Subramaniam and Weidenmier (2016), and Adebayo and Olayemi (2022), suggesting that cost inertia in core banking operations can sustain productivity and customer trust. Thirdly, revenue decline

(RVD) was found to significantly moderate the relationship between cost stickiness and performance, aligning with Ayodeji and Moses (2023) and Homburg et al. (2021), indicating that under adverse economic conditions, the benefits of cost stickiness diminish as firms may lack the flexibility to adapt quickly. These results not only affirm the Sticky Cost Theory but refine it by showing that cost stickiness is context-dependent—effective in stable environments but potentially harmful during sharp revenue drops. The use of Nigerian banking data from 2013–2022 and a robust panel regression framework strengthens the generalizability of these results within similar economic settings.

Beyond theoretical contributions, the findings directly respond to the research questions and fill critical gaps in the literature, particularly by disaggregating cost stickiness into administrative and operating dimensions, a distinction often overlooked in prior research. The study introduces the moderating effect of revenue decline as a novel perspective, offering fresh insights into how external shocks alter the dynamics between cost behavior and performance. This nuanced understanding challenges overly simplistic models that assume a linear cost-performance relationship and proposes more adaptive cost-management strategies. The study contributes to underexplored areas in African banking literature, where cost stickiness has rarely been examined empirically. It also provides practical implications—suggesting that bank managers should strategically retain productive costs during mild downturns but build mechanisms for flexible cost adjustment when revenues plummet. Policymakers can leverage these findings to recommend adaptive budgetary policies for banks, especially in economies vulnerable to fiscal shocks. Though contextual factors such as regulation, culture, and sample period may limit generalizability, the study opens avenues for further research using mixed methods or comparative cross-country data. In sum, this research strengthens existing theories, offers novel dimensions to the discourse on cost stickiness, and proposes an empirically grounded framework that aligns strategic cost retention with financial resilience in dynamic economic conditions.

6. Conclusion

In conclusion, this study provides a comprehensive analysis of the effect of cost stickiness on the financial performance of Nigerian listed deposit money banks, with a focus on administrative and operating cost stickiness, as well as the moderating role of revenue decline. The results confirm that cost stickiness, particularly in administrative and operating costs, significantly enhances return on assets, reinforcing the notion that maintaining certain costs during revenue downturns can contribute to long-term profitability and stability. The moderating

effect of revenue decline further highlights the contextual nature of cost stickiness, revealing that its benefits may be constrained in times of severe economic distress. By filling gaps in the literature, particularly with respect to distinguishing between types of cost stickiness and introducing the moderating factor of revenue decline, this study offers new insights into how cost behavior affects firm performance in the banking sector.

The findings contribute to both theoretical and practical understanding in the field of financial management, suggesting that banks need to adopt adaptive cost management strategies to remain resilient during economic challenges. The study's contributions are particularly significant in the context of Nigerian banks, where cost management strategies are vital for sustaining performance amidst fluctuating revenues. The results also offer valuable implications for policymakers and bank managers, encouraging more nuanced approaches to cost retention and flexibility. Future research could expand on these findings by exploring the impact of other external factors, utilizing different methodologies, and considering broader geographical contexts. Ultimately, this study enhances the understanding of cost stickiness in the banking sector and provides a foundation for future exploration and practical application in financial management.

7. Recommendation

Based on the findings of this study, several recommendations are proposed for both Nigerian listed deposit money banks and policymakers to optimize financial performance in the face of cost stickiness and economic fluctuations.

1. **Adopt Flexible Cost Management Strategies:** Nigerian banks should develop flexible cost management strategies that enable them to maintain operational efficiency during periods of revenue decline. Given the significant positive effect of administrative and operating cost stickiness on return on assets, banks should consider optimizing their cost structures, making necessary adjustments in response to varying economic conditions. The focus should be on maintaining essential operational costs while ensuring that they are not overly rigid in times of revenue downturns.
2. **Integrate Revenue Decline Management:** Banks should incorporate a clear framework for managing revenue decline, which was found to moderate the relationship between cost stickiness and performance. This could involve establishing contingency plans, diversifying revenue streams, and maintaining buffer funds to weather periods of low revenue. By proactively

addressing potential revenue challenges, banks can mitigate the negative effects of cost stickiness in adverse economic environments.

3. **Enhance Cost Efficiency through Technology:** To further improve cost management, banks should invest in advanced technologies and digital banking solutions that enable greater efficiency. Automation and digital tools can help reduce fixed operational costs, increase flexibility, and improve responsiveness to market changes. This could also help banks better manage administrative and operating costs while maintaining or improving service delivery.
4. **Policy Support for Banking Resilience:** Policymakers should create an enabling environment that supports the financial sector's resilience during periods of economic hardship. This includes offering incentives for banks to adopt flexible cost structures, promoting policies that encourage innovation in cost management, and providing guidance on best practices for cost efficiency without sacrificing service quality. Additionally, central bank policies could be tailored to support banks' capital adequacy and liquidity during times of revenue decline.
5. **Further Research and Exploration:** It is recommended that future research extends the scope of this study by examining the role of other external factors, such as regulatory changes, inflation rates, and exchange rates, on the relationship between cost stickiness and firm performance. Cross-country studies could also provide valuable insights into the generalizability of the findings in different economic contexts.

By implementing these recommendations, Nigerian banks can better navigate cost stickiness challenges and improve their overall financial performance, contributing to greater economic stability in the sector.

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DIGITALIZATION OF TAX SERVICES AND TAX GAP

Rotimi OLADELE¹, Adetunji Abdul-Azeez ADEREMI², John ACHILE³, Busari Ganiyu ADENIRAN⁴

¹*Federal University Oye-Ekiti, Department of Accounting, Aare Afao Road, Oye-Ekiti, Ekiti State, Nigeria, E-mail:rotimi.oladele@fuoye.edu.ng*

²*Osun State University, Department of Accounting, Banking and Finance, Osogbo, Phone: + 08107976419, E-mail: azeezgoodness66@gmail.com*

³*Federal University Oye-Ekiti, Department of Accounting, Aare Afao Road, Oye-Ekiti, Ekiti State, Nigeria, E-mail:rotimi.oladele@fuoye.edu.ng*

⁴*Yaba College of Technology, Department of Accountancy, the School of Management and Business Studies, Herbert Macaulay Road, Yaba, Lagos, Nigeria, Phone:+2348033107074, E-mail:ganiyuadeniran19@gmail.com*

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Abstract

This study examined the issue of digitalization of tax services and tax gap in Nigeria. The study adopted ex-post facto research design. Analysis conducted in the study made use of secondary quantitative data collated from the Federal Inland Revenue Services (FIRS) and National Bureau of Statistics (NBS). The study revealed that e-taxation has significant positive effect on tax gap in Nigeria. The study revealed higher mean value for tax revenue after the adoption of digital when compared with the mean value before the adoption of the digital taxation system; it also revealed that digital taxation has significantly helped in stemming the tide of tax gap to a large extent in Nigeria. The analysis of the data indicated higher mean value for tax revenue after the adoption of digital taxation when compared with the mean value before the adoption of the digital taxation system. The study made some vital recommendations which include the need for FIRS to create an electronic tax payment system, mobile application which will serve as a means of creating more awareness and simplification of the digital tax system in the country. It

was concluded that the digital taxation system commands high tax compliance than the manual system era in Nigeria.

Keywords: tax gap, digitization, tax services, tax compliance, tax revenue.

JEL Classification: H26, H20, O33, C23

1. Introduction

Tax is designed to raise the revenue required to finance the stipulated public expenditure profile of government and the redistribution of income to promote socio-economic justice and equality among citizens. This primary source of revenue is almost always annually planned; however, such targets are seldom attained, hence tax gaps — which is seen in two perspectives: as the difference between the aggregates of budgeted taxes or actual tax liability and actual tax receipts by the relevant tax authorities [1]. This implies that on one hand it is considered as the difference between estimated tax and actual receipts from those taxes; while on the other hand it is the disparity between actual tax liability and actual tax remitted to the tax authorities. Thus, tax gap as defined from the institutional standpoint is "the difference between the tax that taxpayers should pay and what they actually pay on a timely basis" [2]. Similarly, [3] notes that it is an expression of the true tax liability and the amount that is voluntarily remitted in a timely manner. [4] added that it is the "difference between the amount of tax that should, in theory, be paid and what is paid". [5] posit that tax gap is the difference between legitimate revenue potential and the actual revenue collected. In consonance with this stance, Nigeria's tax gap is expressed as the difference between estimated and actual tax receipts.

Most countries thrive more in tax revenue drives because they embrace electronic tax systems (e-taxation) that enable taxpayers to pay tax, file returns, and receive assessments from tax authorities without visiting tax offices. In many instances, it has been discovered that this has been one of the factors that contribute to higher tax compliance and receipts in countries such as Germany, the United States of America, Malaysia, and many other advanced countries. The Federal Inland Revenue Service (FIRS) introduced the Integrated Tax Administration System (ITAS) in 2015 to drive efficient tax administration through improved processes.

The State Internal Revenue Services (SIRS) are not left out, as several SIRS adopted the e-tax platform to ease the process for filing annual employers' tax returns and payment of state taxes and levies such as business development levy

and business premises charges. As such, this study tends to evaluate the efficacy of digital-taxation as a veritable instrument for improving tax compliance as a precursor for alleviating tax evasion and avoidance in Nigeria.

2. Statement of the problem

The Nigerian tax system has been faced with many challenges over the years which have resulted in inefficiency, increased administration costs, and an overall low tax yield. The tax regime introduced in every country has a direct bearing on the amount of revenue that can be derived from taxation. This probably influenced the decision of the Federal Government of Nigeria (FGN) to set up a study group with the objective of maximizing revenues from different tax sources, with a review of the Nigerian Tax System and Administration being carried out. According to the FIRS press release, the problem of the complexity of payments, the lack of tax statistics and information, as well as the poor quality of information, has traditionally led to about 12 billion naira disappearing into the pockets of individuals. Technological exposure on the part of both tax payers and tax authorities has further exacerbated the problem [6].

Therefore, government introduced electronic taxation to make payment of taxes easy for tax payers, thus ensuring compliance. Despite this measure taken by government, it is still unclear whether digitalized taxation has helped to improve the tax compliance level among taxpayers in Nigeria. Undoubtedly, if the electronic tax system is properly administered in Nigeria it can be a lasting solution to the irregularities such as tax evasion and avoidance that persist in the Nigerian tax system. It is in line with the above problem that this study was prompted to ascertain whether digitalization of tax services has helped to improve tax compliance level in Nigeria.

3. Conceptual review

3.1 Meaning and evolution of digital taxation in Nigeria

The digital taxation (e-taxation) system can be described as the system of collecting taxes by the relevant authorities electronically from the taxpayers with the aid of internet service. It is an online policy which avails taxpayers the opportunity to access service portals through the internet and see all the services offered by the tax administration, like the registration for generating personal identification numbers, filing of returns, and application for a compliance certificate [6].

The Federal Inland Revenue Service (FIRS) introduced the Integrated Tax Administration System (ITAS) in 2013 to improve tax administration in Nigeria and transform the tax compliance process away from the then manual system which was tedious and bureaucratic [7]. The process of migrating to an electronic system commenced fully in 2015, with FIRS in collaboration with the Nigeria Inter-Bank Settlement System (NIBSS) introducing the following: e-Services, e-Registration, e-Payment, e-Filing, e-Receipt, e-Stamp Duty, and e-Tax Clearance Certificate (e-TCC) [6].

E-filing enables taxpayers to file their tax returns through the FIRS ITAS. E-payment allows for payment of all Federal government taxes and levies through the Nigeria Inter-Bank Settlement System (NIBSS), Remita, and Interswitch. E-registration is created to register new taxpayers with the Inland or Internal Revenue Service for the various taxes. E-stamp duty is created for stamp duties on qualifying documents. E-receipt now facilitates receiving and verifying e-receipts generated for taxes paid through the new e-payment. E-Tax Clearance Certificate (e-TCC) enables taxpayers to apply for, receive, and verify the authenticity of their electronic tax clearance certificate [8].

The available e-services, according to [9], are explained below:

1. **E-registration:** for registration of new taxpayers with FIRS for the various taxes. With this service, taxpayers do not need to visit any tax office to register for tax purposes. All they need to do is visit the FIRS website and register.
2. **E-stamp duty:** for payment of stamp duties on qualifying documents. This innovation increases the ease of doing business in Nigeria. With e-stamping, stamping can be done anywhere and at any time online.
3. **E-tax payment:** for payment of all Federal Government taxes and levies through any of the following platforms: Nigeria Inter-Bank Settlement (NIBSS), Remita, and Interswitch. This brings payment of taxes to your doorstep as you can pay your taxes in the comfort of your home.
4. **E-receipt:** for receiving and verifying e-receipts generated for taxes paid through the new e-tax payment. With this, you receive instant notification acknowledging your payment of tax.
5. **E-filing:** enables taxpayers to file their tax returns through the FIRS ITAS online. This is one of the most innovative aspects of the e-tax services. It is a mandatory requirement of the law to file tax returns. This platform obviates the need to visit any tax office to file tax returns, as you can upload relevant documents and file your tax returns electronically.

6. Electronic Tax Clearance Certificate (e-TCC): enables taxpayers to apply for, receive, and verify the authenticity of their e-TCC. Obtaining tax clearance certificates under the manual tax administration process is cumbersome.

3.2 Explaining the concepts of tax evasion and tax avoidance

Paying taxes is not one of the things people look forward to. Tax evasion and tax avoidance are two concepts that are similar and sometimes used interchangeably. This section explains the two concepts and how they are used in tax administration.

Tax evasion is the intentional and illegal attempt to avoid the payment of tax by individuals, businesses, or organizations. It is a deliberate attempt to not pay taxes at all or to pay less than required by trying to beat the system [10]. Those caught evading taxes are generally subject to criminal charges and substantial penalties. Examples of tax evasion include: false declaration of income, assets, or profits; falsifying records; underpayment of taxes; deliberately keeping business off the books; and exaggerating expenditure.

Tax avoidance is the use of legal methods to reduce the amount of tax paid by a person, business, or organization. Here, people find ways to reduce tax liability and optimize their income through legal means. Tax avoidance involves taking advantage of loopholes in the system. Since these loopholes are within the law, tax avoidance is not considered a crime. It is also the legal utilization of the tax regime to one's own advantage so as to reduce the amount of tax that is payable using means that are acceptable by the law [11]. Examples of tax avoidance include: increasing expenses in getting income, increasing the number of children, giving assets to children to avoid inheritance tax, investing in a retirement plan, and donating to charity to claim deductions.

4. Empirical review

[12] studied the impact of e-taxation on tax administration in Nigeria. The study employed primary data, with a population consisting of taxpayers, tax professionals, chartered accountants, and tax administrators from the Federal Inland Revenue Service in Benin and Auchi branches. The sample size selected for the study was 399 using stratified random sampling technique. The study was carried out using descriptive statistics, correlation analysis, and panel regression using SPSS 23. The results showed that: (1) e-taxation exhibits a negative impact on ease of paying taxes and is not statistically significant at 5% level, meaning that e-taxation has not

significantly made it easier to pay taxes in Nigeria; and (2) e-taxation exhibits a negative impact on processing time of tax returns and assessment that is statistically significant at 5% level, meaning that e-taxation has helped achieve a 12.9% reduction in the processing time of tax returns and assessment.

A similar study by [6] on e-tax administration and tax compliance among corporate taxpayers in Nigeria employed quantitative research design using existing data sourced from the Federal Inland Revenue Service (FIRS). Data were tax revenue posted seven years before and after the adoption of e-tax administration by the FIRS in 2013. Data so sourced were analyzed using descriptive statistics and pairwise t-test to ascertain if a difference exists and/or relationship between pre- and post-e-tax revenue. The study found a strong connection between the electronic tax system and tax compliance (tax revenue) as shown by the pairwise test, with an average annual variation in overall tax revenue of N1.4 trillion compared with the pre-electronic tax period demonstrating a significant difference.

[13] carried out a study on e-taxation adoption and revenue generation in Nigeria, specifically assessing the effect of e-taxation on Company Income Tax (CIT) and Value Added Tax (VAT). Ex-post facto research design was adopted and data were sourced from FIRS, covering six years and three quarters from the first quarter of 2012 to the second quarter of 2018. The analysis revealed a positive insignificant difference between pre and post company income tax revenue (t-statistic = 0.833, $p = 0.421$), and a positive insignificant difference between pre and post value added tax revenue (t-statistic = 0.520, $p = 0.612$). It was concluded that e-taxation has not significantly spurred revenue generation in Nigeria.

[14] conducted a study on the electronic tax system as a panacea for tax revenue leakages in Nigeria, adopting content analysis. Extensive review of the literature showed that the electronic tax system solves the problem of low tax collection, unavailability of tax statistics, poor record keeping, complexity of payment, and high cost of tax compliance. The implication of these findings is that an adoption of the digital tax system is an intelligent means of achieving a system of tax administration that allows for the collection and accountability of required taxes at a minimum cost.

A related study by [7] examined electronic taxation and the level of awareness among selected fast food restaurants in Lagos State, Nigeria. The study employed survey research design with data collected from primary sources through structured questionnaires distributed to SMEs. The population consisted of 950 small and medium scale enterprises in Lagos State in the fast food restaurants sub-sector.

Analysis revealed that level of awareness (LOA) showed a significant positive relationship with tax compliance, while perceived ease of use (PEU) had a positive effect on tax compliance but was statistically non-significant.

[15] also conducted a study on ease of paying taxes, examining the electronic tax system in Nigeria using a library research approach. From the extant literature reviewed, it was revealed that payment of taxes in Nigeria is not stress-free, due to challenges including lack of a fully automated system, poor access to the internet, unawareness of the system, low computer literacy level, and resistance to change. The study recommended that the FIRS should create an electronic tax payment system mobile application which will serve as a means of creating more awareness and simplification of the tax system in the country.

5. Theoretical framework

This study adopted the Technology Acceptance Model (TAM) and Expediency Theory of Taxation (ETA). The Technology Acceptance Model was developed by Fred Davis in 1986 [16]. This is an information systems model that shows how users come to accept and use a new technology. The assumption of this model is that the acceptability of an information system is determined by two factors: the perceived usefulness (PU) and perceived ease of use (PEOU). Perceived usefulness is the extent to which a person believes that using a particular system would enhance his/her job performance, while PEOU is the degree to which a person believes that using a particular system would be free from extra effort [13]. The relevance of the model to this study is based on the assumption of its perceived usefulness, which provided the basis for the adoption and implementation of the electronic tax system by FIRS in Nigeria to improve compliance and enhance tax revenue generation.

The second theory, the Expediency Theory of Taxation (ETA), was also adopted since the first model did not touch any concept in taxation. This theory was propounded by Buehler in 1936 [17]. The theory states that every tax revenue collection system must pass the test of practicability, which must be the major consideration when government is choosing a revenue collection system. The assumption of this theory is that the economic and social objectives of the government should be treated as irrelevant, since it is useless to have a tax which cannot be levied and collected efficiently. The theory is relevant to this study in that the electronic tax system is expected by FIRS to enhance revenue collection by creating an enabling technological environment that facilitates compliance and boosts revenue collection efficiency in Nigeria.

6. Methodology

6.1 Research design

The study adopted ex-post facto research design. Ex-post facto design is a quasi-experimental study examining how an independent variable, present prior to the study, affects a dependent variable. It adopted ex-post facto research design because the study aimed at obtaining important information on the status of a specific phenomenon after some naturally occurring treatment without any manipulation of the situation. Quasi-experimental study calculates the effect of a treatment on an outcome by comparing the average change over time in the outcome variable for the treatment group, compared to the average change over time for the control group.

Analysis conducted in the study made use of secondary data collated from the Federal Inland Revenue Services (FIRS) and National Bureau of Statistics (NBS). Also, primary data were generated through interviews from a few opinion leaders in the society using a purposive sampling technique to complement secondary data. The study period was on an annual basis, and the period for pre-e-taxation covered 6 years spanning from 2009 to 2014, while the period for post-e-taxation covered 6 years spanning from 2016 to 2021.

6.2 Method of data presentation and analysis

In view of the fact that this study relied heavily on secondary quantitative data, simple comparative analysis with descriptive statistics were employed to analyze the secondary data so obtained, to ascertain if there is a difference and/or relationship between pre- and post-e-tax eras in Nigeria. The hypotheses were tested with paired sample t-test (pairwise t-test).

7. Data presentation, analysis and discussion of findings

This section embodies two sub-themes based on our guiding hypotheses. The emphasis of our data presentation is on the two hypotheses posed for the study and is based on quantitative data from the Federal Inland Revenue Service (FIRS) and the Central Bank of Nigeria Statistical Bulletin.

7.1 Hypothesis one: e-taxation has no significant positive effect on tax evasion in Nigeria

The data used to analyze Hypothesis One was collected from the Federal Inland Revenue Service (FIRS) National Tax Statistics from 2007-2012 for pre-electronic taxation and 2017-2022 for post-electronic taxation system.

Table 1. Descriptive Statistics

Statistics	DITTAX	TAXAVOID	EXP01	TAXGAP
Mean	9.739856	0.559004	4.923115	9.479671
Median	9.806983	0.592872	4.923107	9.596381
Maximum	9.949320	0.719917	5.143767	9.646384
Minimum	9.173177	0.140974	4.752429	8.560135
Std. Dev.	0.183252	0.120553	0.078500	0.255176
Skewness	-1.597939	-1.289416	0.450085	-2.208236
Kurtosis	4.610531	4.921127	3.937011	6.847408
Jarque-Bera	38.42234	31.02330	5.064889	102.9233
Probability	0.000000	0.000000	0.079465	0.000000
Observations	72	72	72	72

Source: Author's Computation, 2025

7.1.1 Descriptive statistics interpretation

The descriptive statistics explore the characteristics of the data including: the mean, median, maximum, minimum, standard deviation, and number of observations per each variable. The results indicated that the mean of Digital Tax (DITTAX) was 9.739, while the average for Tax Avoidance (TAXAVOID) was 0.559004, the average for Government Expenditure (EXP01) stood at 4.923115, and the average balance of Tax Gap (TAXGAP) within the period under review was 9.479671.

The maximum amount of Digital Tax (DITTAX) was 9.949320, while the minimum was 9.173177. When the maximum Tax Avoidance (TAXAVOID) was 0.719917, the minimum stood at 0.140974. The maximum of EXP01 and TAXGAP were 5.143767 and 9.646384 respectively, while their minimum stood at 4.752429 and 8.560135 respectively. The deviations from the averages of these magnitudes signify that the Digitization of Tax in Nigeria is not fixed or static, but varies year in, year out. The study period covers 72 observations in the dataset. DITTAX, TAXAVOID, and TAXGAP show left-skewed distributions, indicating that their data points are concentrated on the right side with longer left tails, while EXP01 displays a slight right-skew. The kurtosis values for DITTAX,

TAXAVOID, EXP01, and TAXGAP are 4.610531, 4.921127, 3.937011, and 6.847408, respectively, suggesting that all variables exhibit leptokurtic distributions, indicating heavier tails compared to a normal distribution.

The Jarque-Bera test results indicate: DITTAX (JB = 38.42234, $p = 0.000000$); TAXAVOID (JB = 31.02330, $p = 0.000000$); EXP01 (JB = 5.064889, $p = 0.079465$); and TAXGAP (JB = 102.9233, $p = 0.000000$). The low p -values ($p < 0.05$) for DITTAX, TAXAVOID, and TAXGAP indicate a rejection of the null hypothesis that the data follow a normal distribution. However, for EXP01, the p -value of 0.079465 suggests less evidence against normality.

Table 2. Unit Root Test

Variables	ADF-Statistic	5% Critical Value	Prob.	Integration Order
DITTAX	-9.327607	-3.020686	0.0000	I(0)
EXP	-4.695136	-3.828975	0.0134	I(0)
TAXAVOID	-3.903068	-3.828975	0.0448	I(0)
TAXGAP	-5.236889	-3.690814	0.0029	I(0)

Source: Author's Computation, 2025

The result in Table 2 reveals that all variables — DITTAX, EXP, TAXAVOID, and TAXGAP — were stationary at levels, exhibiting an integration order of I(0). The economic implication of stationary time series is that the variables can withstand shocks to a good extent. The Augmented Dickey-Fuller statistics significantly exceed the critical values at the 5% significance level, with all associated p -values below 0.05, indicating strong evidence against the presence of a unit root.

Table 3. Regression Result — Dependent Variable: TAXGAP

Variables	Coefficient	Std. Error	t-Statistic	Prob.
DITTAX	1.237332	0.190346	6.500418	0.0000
EXP01	-0.173344	0.472063	-0.367204	0.7177
C	-1.705325	1.269249	-1.343570	0.1958
R-squared	0.877781			

Variables	Coefficient	Std. Error	t-Statistic	Prob.
F-statistic	64.63803			
Prob(F-stat)	0.000000			
Diagnostic Tests				
Normality Test	1.129227 (p = 0.568580)			
Serial Correlation Test	20.04256 (p = 0.0663)			
Heteroscedasticity Test	3.554777 (p = 0.1691)			

Source: Author's Computation, 2025

The regression analysis indicates that the variable DITTAX has a statistically significant positive coefficient of 1.237332 ($p < 0.001$). This suggests that for every one-unit increase in DITTAX, the dependent variable is expected to increase by approximately 1.24 units, holding all other variables constant. On the other hand, the variable EXP01 does not appear to have a significant effect on the dependent variable, as its coefficient of -0.173344 is not statistically different from zero ($p = 0.7177$). Similarly, the constant term (C) also lacks statistical significance, with a coefficient of -1.705325 ($p = 0.1958$).

The overall model fit is quite strong, as indicated by an R-squared value of 0.877781, meaning that approximately 87.78% of the variability in the dependent variable is explained by the independent variables. The F-statistic of 64.63803 is highly significant ($p < 0.001$), suggesting that the regression model provides a better fit to the data compared to a model with no independent variables. Diagnostic tests indicate that the residuals are normally distributed (Normality Test: 1.129227, $p = 0.568580$), there is no strong evidence of serial correlation (Serial Correlation Test: 20.04256, $p = 0.0663$), and no evidence of heteroscedasticity (Heteroscedasticity Test: 3.554777, $p = 0.1691$).

Table 4. Regression Result — Dependent Variable: TAXAVOID

Variables	Coefficient	Std. Error	t-Statistic	Prob.
DITTAX	0.246251	0.241538	1.019510	0.3215
EXP01	-0.239132	0.599020	-0.399205	0.6944
C	-0.645500	1.610602	-0.400782	0.6933
R-squared	0.088079			
F-statistic	0.869277			
Prob(F-stat)	0.436128			
Diagnostic Tests				
Normality Test	1.100064 (p = 0.576931)			
Serial Correlation Test	19.98897 (p = 0.0673)			
Heteroscedasticity Test	3.635684 (p = 0.1624)			

Source: Author's Computation, 2025

The regression analysis results for Model 2 suggest that the variables DITTAX and EXP01, along with the intercept (C), do not have statistically significant coefficients (DITTAX: coefficient 0.246251, $p = 0.3215$; EXP01: coefficient -0.239132, $p = 0.6944$; C: coefficient -0.645500, $p = 0.6933$), indicating that changes in these variables are not reliably associated with changes in the dependent variable. Moreover, the overall model's explanatory power is weak, as indicated by a low R-squared value of 0.088079, suggesting that only about 8.8% of the variability in the dependent variable is explained by the independent variables. This finding is supported by the non-significant F-statistic (0.869277, $p = 0.436128$). Diagnostic tests confirm that the model assumptions — normality of residuals, absence of serial correlation, and homoscedasticity — are reasonably satisfied.

8. Conclusion and recommendations

8.1 Conclusion

The adoption of an ex-post facto research design and analysis of secondary data from the Federal Inland Revenue Service (FIRS) and National Bureau of Statistics (NBS) offer insights into the effectiveness of e-taxation implementation in Nigeria. Despite the introduction of electronic tax systems aimed at enhancing transparency, efficiency, and compliance, the findings indicate that the implementation of e-taxation did not lead to a significant reduction in tax evasion. The analysis of pre- and post-e-taxation eras reveals that levels of tax evasion remained relatively unchanged, suggesting that the impact of e-taxation on tax compliance in Nigeria is limited without complementary measures.

While e-taxation holds promise as a tool for modernizing tax administration, its effectiveness in curbing tax evasion appears to be constrained by various factors, including inadequate enforcement mechanisms, lack of taxpayer education and awareness, loopholes in tax policies, and challenges in data analytics and collaboration. Therefore, addressing these underlying issues is essential to maximize the potential benefits of e-taxation and improve tax compliance levels in Nigeria.

Moving forward, it is imperative for policymakers to adopt a holistic approach towards tax reform, encompassing not only the enhancement of e-taxation infrastructure but also the implementation of comprehensive capacity-building programs, extensive public awareness campaigns, strengthening of data analytics capabilities and collaboration, and reform of tax policies. By addressing these challenges and implementing complementary measures, Nigeria can strengthen its tax administration framework, enhance compliance levels, and ultimately improve revenue collection for sustainable economic development and social progress.

8.2 Recommendations

In sequence to the various findings of this study, the researcher recommends that the following measures should be put in place in order to effectively combat tax evasion and bolster revenue collection in Nigeria:

1. Upgrading and modernizing e-taxation infrastructure is crucial. This involves investment in software systems, online platforms, and digital payment mechanisms, ensuring they are user-friendly, secure, and accessible to all taxpayers. By enhancing e-taxation infrastructure, the government can streamline tax processes, minimize opportunities for evasion, and improve overall tax compliance.

2. Comprehensive capacity-building programs for tax personnel are necessary. Tax administrators, auditors, and enforcement personnel need the skills and expertise to effectively utilize e-taxation tools, conduct thorough audits, and detect potential instances of tax evasion. By investing in training and capacity-building initiatives, the government can empower tax authorities to enforce tax laws more effectively and efficiently.
3. Public awareness campaigns play a vital role in promoting tax compliance. Launching extensive campaigns to educate taxpayers about their rights, responsibilities, and the benefits of tax compliance is essential. Utilizing various communication channels such as social media, television, radio, and community events can help disseminate information and engage with diverse audiences. By raising awareness about the importance of paying taxes and the consequences of tax evasion, the government can encourage voluntary compliance and foster a culture of tax honesty among citizens.

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EFFECT OF VALUE ADDED TAX REVENUE ON GOVERNMENT INFRASTRUCTURAL DEVELOPMENT

Opeyemi OSO¹, Adetunji Abdul Azeez ADEREMI², Olusegun Efuntade
ALANI³, Busari Ganiyu ADENIRAN⁴

¹*Federal University Oye Ekiti, Faculty of Management Science,
Department of Accounting, Ekiti State, Nigeria, Phone: +2348035638775,
E-mail: opeyemi.oso@fuoye.edu.ng*

²*Osun State University, Faculty of Management Science, Department of
Accounting, Osogbo, Nigeria, Phone: 08054522110, E-mail:
azeezgoodness66@gmail.com*

³*Federal University Oye Ekiti, Bursary Department, Ekiti State, Nigeria,
Phone: +2349066902993, E-mail: alani.efuntadee@fuoye.edu.ng*

⁴*Yaba College of Technology, Faculty of Management Science
Department of Accountancy, Lagos, Nigeria, Phone: +234 805647431,
E-mail: ganiyuadeniran19@gmail.com*

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Abstracts

This study evaluated the effect of Value Added Tax (VAT) revenue on government infrastructural development in Nigeria. The objectives examined the trend and growth rate of VAT revenue from 1994 to 2023, analyzed the pattern of annual capital expenditure on infrastructure, and determined the relationship between VAT revenue and government infrastructure spending. Using an ex-post facto research design, secondary data from the Federal Inland Revenue Service (FIRS) and the Central Bank of Nigeria (CBN), 1993 - 2023 were analyzed using descriptive statistics and multiple linear regression. The study found that, VAT revenue positively affected government capital expenditure ($B=0.195$, $p<0.001$), and the percentage of VAT to GDP also showed a positive impact ($B=28336.705$, $p=0.002$). However, VAT growth

rate negatively affected infrastructure spending ($B=-25.096$, $p=0.045$). The results indicated that while VAT-related variables play a critical role in funding infrastructure, rapid VAT growth may hinder capital expenditure. The study concluded that, VAT revenue was crucial for infrastructure development, but managing VAT growth was essential for sustainable investment. The study recommended strengthening VAT collection systems, managing VAT growth rates, and prioritizing investment in key infrastructure sectors to maximize the impact of VAT revenue.

Keywords: government capital expenditure, infrastructure development, VAT revenue, growth rate, economic growth

JEL Classification: H21, H54, H50, E62, O23

1. Introduction

Across the globe, value added tax (VAT) remains a major source of revenue for governments, especially in developing countries seeking sustainable financing for public projects. Countries in Europe and Asia have long used VAT to mobilize domestic resources, often contributing significantly to budgetary allocations for social and infrastructural development (Keen, 2023). Globally, VAT is seen as a stable, broad-based consumption tax that can drive public sector investment if well managed. On the other hand, infrastructural development is widely recognized as a core driver of economic growth, facilitating trade, industrialization, and improved quality of life (World Bank, 2020). The linkage between domestic tax revenue and physical infrastructure remains a policy priority for many nations.

At the continental level, African countries continue to struggle with the dual challenges of expanding their tax base and bridging massive infrastructure deficits. In Sub-Saharan Africa, VAT has become an increasingly important tool for raising non-oil revenue, but the effective translation of tax collections into visible infrastructure remains inconsistent (African Development Bank, 2018). Many African governments face issues of leakages, inefficiency, and weak expenditure tracking, which reduce the impact of VAT revenue on infrastructural development. As countries in the region work towards economic diversification, strengthening this connection becomes even more crucial for sustainable development.

In the West African context, regional bodies such as ECOWAS have encouraged member states to harmonize indirect tax policies to improve revenue generation and fund infrastructure projects that enhance regional integration. However, Nigeria, as the largest economy in the region, still struggles to align its

VAT revenue potential with robust infrastructural outcomes (Akuesodo et al, 2023). Despite having one of the highest VAT potentials in West Africa, the country's physical infrastructure continues to lag behind, undermining its growth prospects and competitiveness.

Nigeria faces persistent challenges related to weak and deteriorating infrastructure, despite steady growth in VAT revenue over the years. With an annual VAT collection that has increased in nominal terms, questions remain about the efficiency of deploying these funds to bridge the infrastructure gap. Issues such as mismanagement of tax revenue, poor project execution, and inadequate monitoring weaken the potential impact of VAT revenue on infrastructural development (Bank-Ola, 2021). This mismatch calls for a deeper empirical examination of how VAT indicators such as total VAT revenue, its percentage of total revenue, and VAT growth rates influence government expenditure on infrastructure.

One major problem affecting infrastructural development in Nigeria is the chronic underfunded of capital projects. Despite budgetary allocations, actual disbursement for infrastructure is often limited due to revenue shortfalls and competing recurrent expenditure demands. This persistent funding gap could be mitigated through efficient VAT collection and utilization, as a higher VAT revenue base can provide a stable stream of funds specifically earmarked for capital expenditure. Poor infrastructure not only increases the cost of doing business and reduces productivity but also erodes investor confidence, threatening Nigeria's competitiveness in the global market Ogundeji (2025).

Another challenge is poor maintenance and sustainability of infrastructure projects. Many government projects deteriorate shortly after completion because maintenance budgets are inadequate or poorly prioritized. Steady growth in VAT revenue, coupled with its proper allocation, could ensure that a portion of these funds is set aside for ongoing maintenance, thus preserving infrastructure quality over time (Adereti, 2023).

Regional disparities in infrastructural development also remain a significant issue. Investments are often concentrated in urban centers, leaving rural areas neglected and underdeveloped. By expanding the VAT base and increasing its share of total revenue, the government can mobilize additional resources to address these disparities, ensuring equitable distribution of infrastructure investments across all regions. Unequal infrastructure development is a key factor contributing to widening regional inequalities, which can be resolved by targeted infrastructure

investments and the creation of policies that ensure balanced development (Siatan et al., 2024).

Corruption and financial mismanagement are further problems that undermine the link between VAT revenue and infrastructure delivery. Leakages and diversion of funds prevent tax revenue from translating into visible public goods. Strengthening transparency and accountability in how VAT revenue is utilized can help ensure that annual total VAT collections and their growth rates translate directly into improved infrastructure outcomes (Bank-Ola, 2021).

Finally, weak institutional capacity in tax administration and expenditure tracking affects both revenue mobilization and spending efficiency. Without reliable data and robust systems, VAT revenue growth may not align with actual infrastructure development. Improved institutional frameworks and the strategic use of VAT performance indicators such as annual growth rates and the proportion of VAT in total revenue can guide better fiscal planning and accountability (Ekpo & Udoh, 2022).

In light of these issues, this study seeks to fill an important gap by empirically investigating whether VAT revenue generation in Nigeria has had a measurable effect on government infrastructural development. The findings will clarify whether growth in annual total VAT revenue, its share in total government revenue, and its year-on-year growth rates are sufficient and effectively deployed to tackle Nigeria's infrastructure challenges. The objective of the study is to evaluate the effect of value added tax revenue on government infrastructural development in Nigeria. The specifically study examined the trend and growth rate of Value Added Tax (VAT) revenue in Nigeria from 1994 to 2023; analyzed the pattern of annual capital expenditure on infrastructure within the same period; and determined the relationship between VAT revenue and government infrastructural development in Nigeria.

2. Review of related literature

2.1 Conceptual review

Value Added Tax Revenue

The concept of Value Added Tax (VAT) has been widely discussed in the literature as a significant source of government revenue. VAT is defined as a consumption tax levied at each stage of the supply chain where value is added to goods and services (Investopedia Team, 2024). According to Sentamilselvan et al., (Eds.). (2022) VAT operates under a "tax-on-tax" system, where businesses collect

VAT on behalf of the government from consumers, which makes it a highly effective revenue collection tool. VAT is characterized by its broad base, covering virtually all goods and services, which is why it is preferred by many governments worldwide as an important source of revenue. This makes VAT an essential pillar in modern taxation systems, especially in countries looking to diversify their revenue sources beyond reliance on natural resources.

In the context of developing economies, VAT revenue is seen as a crucial tool for financing infrastructure and social development. As noted by Bank-Ola (2021), VAT not only generates substantial income for governments but also serves as a means to promote fiscal decentralization by allowing local governments to benefit from indirect taxes. The broader the tax base, the more resilient the revenue stream becomes, making VAT particularly attractive for countries aiming for economic stability and growth. However, scholars such as Ekpo and Udoh (2022) argue that while VAT can stimulate government revenue, it is often burdened by inefficiencies in tax administration, leading to leakages and tax evasion, which undermines its full potential.

The effectiveness of VAT as a tool for economic growth and development depends heavily on its administration. According to Ogundeji (2025), VAT's potential is often hindered by administrative challenges such as poor enforcement and inconsistent tax rates, especially in countries with high informality in their economies. In Nigeria, for example, VAT revenue has been identified as a critical part of government funding, but its impact has been mitigated by issues of corruption and ineffective implementation (Onoja, 2020). Therefore, while VAT is an important revenue tool, its success in generating consistent and reliable revenue is contingent on the robustness of the tax collection system and its proper implementation.

VAT revenue as percentage of total revenue

The concept of VAT revenue as a percentage of total revenue refers to the proportion of total government revenue that is derived from Value Added Tax collections. This metric is critical for assessing the importance of VAT in a country's overall fiscal structure. According to Adereti et al. (2023), VAT as a percentage of total revenue provides insight into the extent to which VAT contributes to government budgets. In many developing countries, VAT is seen as a more stable and reliable source of income compared to other forms of taxation, such as income taxes or corporate taxes, which may be prone to evasion due to loopholes and economic volatility (Cole et al., 2021). This ratio is important

because it reflects not only the success of VAT collection mechanisms but also the reliance of a government on indirect taxes for revenue generation (Keen, 2023).

The significance of VAT revenue as a percentage of total revenue is particularly pronounced in countries with limited resources or where other tax bases are underdeveloped. As noted by Ekpo and Udoh (2022), this percentage highlights the role VAT plays in reducing dependence on volatile sources such as oil revenues. VAT is beneficial for the Nigerian economy as it contributes significantly to public revenue (Efuntade, 2020).

However, the reliance on VAT as a percentage of total revenue also has its challenges, particularly when VAT collection systems are inefficient. According to Bank-Ola (2021), in countries with weak tax administration, the proportion of VAT in total revenue may be disproportionately low, indicating systemic inefficiencies or leakages in the tax system.

VAT growth rate

The VAT growth rate refers to the year-on-year percentage change in the revenue generated from Value Added Tax, providing a clear indication of how VAT revenue evolves over time. the VAT growth rate is an important measure for evaluating the effectiveness of VAT collection systems and understanding the broader economic implications of indirect taxation (Investopedia Team, 2024). A high VAT growth rate may indicate increased consumer spending or improved tax compliance, whereas a low or negative growth rate could signal economic contraction, reduced consumption, or inefficiencies in tax administration. The VAT growth rate is particularly important for policymakers to track as it provides insight into the stability and sustainability of a government's revenue base.

In the Nigerian context, studies have shown that VAT growth rate plays a crucial role in diversifying government revenue away from volatile oil revenue. According to Ekpo and Udoh (2022), the VAT growth rate in Nigeria has fluctuated in response to changes in economic conditions, such as inflation, oil prices, and tax administration effectiveness. They argue that while the VAT growth rate can provide a snapshot of the health of the tax system, it also reflects the broader economic environment. Therefore, understanding the factors driving changes in the VAT growth rate is critical for effective policy-making and for ensuring the long-term sustainability of the country's fiscal health. Policymakers must ensure that the VAT system remains responsive to changes in the economy and that the growth rate is maintained at sustainable levels to foster economic development and infrastructure investment (Bank-Ola, 2021).

Government infrastructural development

Government infrastructural development refers to the investment and provision of physical structures and systems that support economic activities and improve the quality of life for citizens. It encompasses the development of critical sectors such as transportation, energy, water supply, healthcare, and education, which are essential for the economic and social welfare of the population. Public investment, especially in technology and essential infrastructure, plays a crucial role in stimulating Nigeria's economy, particularly in the current democratic era. Hence, the government prioritizes investments in these areas to enhance long-term economic growth and development (Ota & Ezeali, 2021). These infrastructures not only foster economic growth but also enable businesses to thrive, enhance productivity, and promote societal well-being. Infrastructure is considered a key enabler of economic development, as it forms the backbone of any modern economy, supporting both public and private sector activities. Without adequate infrastructure, nations often experience significant economic and social challenges, such as low productivity and reduced foreign investment. The importance of government infrastructural development becomes more evident when viewed through the lens of economic growth. In many developing countries, however, insufficient infrastructure remains a significant barrier to economic advancement, as it limits access to essential services and inhibits business operations (Bank-Ola, 2021).

Pattern of Government Capital Expenditure

The pattern of government capital expenditure refers to the allocation and distribution of public funds towards long-term investments aimed at improving a country's physical infrastructure and supporting its economic growth. Capital expenditure typically includes spending on infrastructure projects such as roads, bridges, schools, hospitals, and energy facilities. These expenditures are critical for economic development as they directly impact the productivity of both the public and private sectors by providing essential services and facilitating trade. Government capital expenditure patterns are often a reflection of national priorities, economic conditions, and the effectiveness of fiscal policies in channeling resources towards projects that generate sustainable long-term benefits for the economy (Bank-Ola, 2021).

The allocation of government capital expenditure is also seen as an indicator of a government's fiscal strategy and commitment to growth. In developing economies, capital expenditure is often skewed towards addressing infrastructure gaps, while in developed nations, it may focus more on maintaining and upgrading existing

infrastructure. the pattern of capital expenditure often fluctuates depending on the political climate, the availability of resources, and external factors such as global economic conditions. For instance, during periods of economic growth, governments may prioritize infrastructure development and expansion, while in times of austerity or economic contraction, the focus may shift to maintaining existing assets or cutting costs. Such fluctuations can lead to inefficiencies in long-term planning and hamper sustained economic development (World Bank, 2020). Moreover, scholars have argued that the efficiency of government capital expenditure depends on how well resources are allocated to various sectors of the economy. Bank-Ola (2021) emphasizes that for capital expenditure to drive inclusive growth, it must be distributed in a way that maximizes both economic returns and social equity.

Empirical framework

The trend and growth rate of value added tax (VAT)

Bank-Ola (2021) examined the impact of value added tax (VAT) administration on economic growth in Nigeria, focusing on how VAT revenue contributes to government revenue generation and infrastructure development. The study covered Nigeria from 1999 to 2019 and employed the Auto-Regressive Distributed Lag (ARDL) model using time series data to analyze short-run and long-run effects. The findings revealed that VAT had a negative and significant effect on economic growth in the short run, while in the long run, the effect turned positive but remained insignificant. The analysis further showed that inflation positively influenced economic growth significantly, whereas interest rates had a significant negative effect in the long run. From these results, the study concluded that a positive long-term relationship exists between VAT and economic growth in Nigeria. Bank-Ola recommended that the Nigerian government should implement policies to ensure stable and sustainable VAT rates and efficient administration through improved accountability, transparency, and the elimination of leakages in the system, thereby strengthening government revenue and enabling infrastructural development to support overall economic growth (Bank-Ola, 2021).

The aim of the study by Cole et al. (2021) was to examine the relationship between Value Added Tax (VAT) and economic growth in Nigeria between 2004 and 2018. The study utilized secondary data obtained from the Central Bank of Nigeria's statistical bulletin and the National Bureau of Statistics (NBS), employing regression analysis to analyze the data. The findings revealed a positive and significant relationship between VAT and economic growth, indicating that VAT

revenue contributes significantly to Nigeria's economic development. The study concluded that VAT should be sustained, with measures to close identified loopholes to ensure its continued effectiveness in boosting government revenue and supporting economic growth. The authors recommended that improvements be made to the VAT system to maximize its contribution to Nigeria's economic growth, emphasizing the importance of addressing challenges in VAT administration.

Kwanti and Dauda (2022) examined the impact of Value-Added Tax (VAT) on the economic growth of Nigeria between 1994 and 2020. The study utilized time series data obtained from secondary sources, including the Central Bank of Nigeria and the National Bureau of Statistics. The researchers employed a regression statistical model to analyze the data and test the statistical significance of the variables under investigation. The findings revealed a positive and significant relationship between VAT and Nigeria's economic growth, suggesting that VAT has a substantial impact on federally collected revenue. The study concluded that VAT plays a critical role in shaping the pattern of federal revenue and contributing to the economic growth of the country. Based on these findings, the authors recommended increased supervision of VAT collection to ensure fairness and transparency, addressing illegal VAT collections to enhance revenue generation. They further proposed using VAT proceeds to improve the living standards of taxpayers and invest in key infrastructure, such as transportation, power, and communication technologies, to strengthen productivity and encourage compliance with tax payments (Kwanti & Dauda, 2022).

The pattern of annual capital expenditure on infrastructure

(Akuesodo et al., 2023) evaluated the impact of Nigeria's infrastructure deficit on the Human Development Index (HDI), focusing specifically on the role of Transportation, Energy, Water, and ICT infrastructure. Conducted within the Nigerian context, the study was grounded in Wagner's theory, which posits that government spending is essential for the welfare of citizens and economic growth. Using empirical methods, the researchers found that Water Infrastructure and ICT Infrastructure had significant positive effects on HDI, whereas Transportation and Energy Infrastructure showed no significant impact. They concluded that infrastructure remains a key driver of human development outcomes but warned that persistent infrastructural decay continues to hinder Nigeria's progress. Based on their findings, they recommended that the Federal Government urgently address the infrastructure deficit to remove barriers to growth and improve the country's overall development indicators.

Hoedemaekers (2024) explores the impact of infrastructure development on driving economic growth in the United States, specifically focusing on the oil and gas sector. The study examines how infrastructure improvements, such as transportation networks, pipelines, and energy storage facilities, contribute to enhancing the operational efficiency and profitability of the oil and gas industry. Utilizing historical data and economic models, the study identifies the multiplier effects generated by infrastructure investments, such as reduced transportation costs, improved supply chain efficiency, and faster resource distribution. The findings suggest that strategic investments in modernizing infrastructure are essential for maintaining competitiveness in the oil and gas sector, especially in light of environmental challenges and the transition towards renewable energy. The study concludes that infrastructure investments not only support the oil and gas industry but also stimulate broader economic activity, reinforcing the U.S.'s global economic position. The author recommends that the U.S. government prioritize infrastructure modernization, implement policies promoting sustainable energy practices, and support innovation to ensure energy security and continued economic growth.

The study by Otuedon & Ogodogun (2024) examined the relationship between taxation and socio-economic development in Nigeria, focusing on the period from 2017 to 2021. The study utilized a descriptive research design, employing secondary data collected from sources such as the Central Bank of Nigeria, the National Bureau of Statistics, and the Federal Inland Revenue Service. The research was anchored in the socio-political theory of taxation and analyzed the impact of both oil and non-oil tax revenues on socio-economic development, as proxied by GDP expenditure at constant purchase prices. The findings revealed a positive relationship between tax revenue and socio-economic development, although the revenue generated was insufficient to meet the GDP expenditure requirements. The study concluded that tax revenues were under-generated relative to crude oil sales and recommended a comprehensive reorganization of Nigeria's tax administration system to minimize tax evasion and avoidance, improve tax documentation, and expand the tax base to enhance socio-economic development.

The relationship between VAT revenue and government infrastructural development

Efuntade (2020) examined the impact of Value Added Tax (VAT) on revenue generation in Nigeria. The study focused on understanding the effects of consumption tax, personal income tax, goods and services tax, and company income tax on the country's revenue and public borrowing. Using secondary data

from the Central Bank of Nigeria, the Budget Office of the Federation, and the World Bank's Development Indicator Database, the study covered a 20-year period from 1999 to 2019. Data analysis was conducted using both descriptive statistics and the Vector Error Correction Model (VECM). The findings revealed a significant long-run relationship between actual public consumption tax and personal income tax with revenue generation, with consumption tax showing a significant positive effect. However, goods and services tax was not significantly related to revenue generation in the long term. The study concluded that VAT is beneficial for the Nigerian economy, contributing significantly to public revenue. Efuntade, recommended improving the efficiency and effectiveness of tax administration, emphasizing that broadening the tax base by taxing more goods and services would enhance the country's revenue generation both in the short and long term.

Ekpo & Udoh (2022) examined the impact of fiscal policy on economic growth in Nigeria, covering the period from 1980 to 2019. The study, carried out at Ritman University in Ikot Ekpene, Akwa Ibom State, aimed to test the causal relationship between fiscal policy and economic growth, and specifically to assess how tax revenue, government recurrent expenditure, and government capital expenditure affect economic growth in the Nigerian context. Using time series data and applying the Classical Ordinary Least Squares (OLS) method, their analysis drew on the Endogenous Growth Theory and Keynesian Theory of Economic Growth. The findings revealed that there was no causality between fiscal policy and economic growth in Nigeria, as shown by the Granger causality test. Moreover, tax revenue showed a negative but statistically insignificant relationship with economic growth, while government recurrent expenditure was positively related but still insignificant, and capital expenditure had an insignificant negative impact. From these results, the study concluded that the fiscal policy components examined were not effectively driving growth during the period. Consequently, the study recommended that the government should block revenue leakages in tax collection and ensure that tax proceeds are fully remitted and transparently channeled into development-oriented projects to generate both immediate and long-term economic benefits.

Iwegbe and Daddau (2024) investigated the relationship between Value Added Tax (VAT) and Nigeria's economic growth, specifically examining the period from 1994 to 2022 using data from the Central Bank of Nigeria (CBN) on Gross Domestic Product (GDP), total revenue (TR), and VAT revenue. The study utilized descriptive statistical methods and simple regression analysis to assess the data.

The findings showed significant fluctuations in the variables over the years, reflecting the impact of changing economic conditions and policy shifts. The regression analysis revealed strong positive correlations between VAT, GDP, and TR, with VAT emerging as a significant predictor of economic growth. The study concluded that economic growth, measured by GDP, plays a crucial role in driving VAT revenue and that policies fostering economic growth should be designed within a broader fiscal framework to promote balanced and sustainable development. The authors recommended that Nigeria focus on stimulating economic growth through effective policy implementation while ensuring VAT is utilized efficiently to support fiscal stability and infrastructure development.

Keen et al., (2023) examined how international taxation influences aggregate tangible cross-border investment, using newly assembled data to analyze the extent and nature of tax spillovers across countries. Conducted under the World Bank's Policy Research Working Paper Series, their study focused globally, investigating how statutory tax rates abroad compare with host country rates in shaping real investment flows. Their methodology combined empirical analysis with comparative tax policy assessment to isolate spillover effects, revealing that foreign statutory tax rates have impacts on tangible investment that are as significant as domestic rates and even larger than previously recognized due to biases in FDI data. The findings further showed that while host countries' marginal effective tax rates have only a weak influence on real investment, tax rates in other jurisdictions have virtually no effect. From this, the authors concluded that international tax policies can implicitly drive profit shifting through real investment rather than through paper profits alone. They recommended that in light of these results, policymakers should consider how the implementation of the global minimum tax could boost inward tangible investment in many countries, challenging assumptions in ongoing policy discussions.

Onoja (2020) investigated the relationship between tax revenue and Nigeria's economic growth, focusing on how various forms of tax revenue contribute to the country's Gross Domestic Product. The study was conducted using data from Nigeria and presented at the International Conference on Recent Social Studies and Research at Sapientia University, Rome, Italy. To achieve its objective, the research employed secondary data sources and used Stata software for statistical analysis, with Petroleum Profit Tax, Value Added Tax (VAT), and Companies Income Tax serving as proxies for tax revenue, while economic growth was proxied by GDP. The findings revealed that Petroleum Profit Tax showed a positive but insignificant relationship with economic growth, whereas VAT and

Companies Income Tax exhibited significant positive relationships with Nigeria's economic growth. The study concluded that non-oil tax revenue streams like VAT and CIT play an important role in driving economic growth in Nigeria. As a recommendation, Onoja suggested that the government should tackle corruption and revenue leakages within tax administration, transparently utilize tax proceeds for quality public goods, and focus on monitoring petroleum operations and promoting entrepreneurship to strengthen the significant contribution of VAT and CIT without necessarily raising their rates in the short term.

Theoretical framework

This study is anchored on the Public Finance Theory as it directly addresses the relationship between government revenue from taxes like VAT and public spending which include infrastructure. This theory provides the theoretical foundation to explore how VAT revenue is collected and how it is allocated to infrastructure development in Nigeria. Other theory considered are Fiscal Policy Theory and Investment and Economic Growth Theory.

Public Finance Theory

Public Finance Theory was founded by Richard A. Musgrave in 1959, emphasizes the role of government in managing economic resources through the collection of taxes and the allocation of public spending. This theory is based on the rationale that public finance is essential for the effective functioning of a country's economy, as governments must collect revenue and efficiently allocate it to public goods and services. The theory advocates that the government should manage tax revenues, including consumption taxes like Value Added Tax (VAT), to fund infrastructure and public services, which in turn supports national economic growth and development. In support of this theory, authors like Stiglitz (2000) argue that efficient tax systems contribute to economic stability and growth by providing necessary resources for infrastructural development. Musgrave (1959) himself posited that the government's role in taxation and spending is crucial to reducing inequality and promoting public welfare. This theory justifies the importance of VAT revenue in financing infrastructure, particularly in developing countries like Nigeria, where VAT acts as a significant source of government income. Authors such as Tait (1988) and Slemrod (2006) emphasize the role of public finance in managing resources to address infrastructural deficits and stimulate economic growth through well-allocated public spending.

There are arguments against public finance theory does not fully account for inefficiencies in government spending or the mismanagement of tax revenues. Authors like Friedman (2002) and Hayek (1944) suggest that excessive

government intervention can distort markets and stifle economic growth, arguing that the government may not always allocate resources effectively. They contend that high taxation, such as VAT, may create economic distortions, reduce consumer spending, and lead to reduced private investment. Despite these criticisms, Public Finance Theory remains relevant to the current study, as it highlights the importance of efficient tax systems in financing critical infrastructure projects. By examining VAT revenue in Nigeria and its impact on government capital expenditure, this theory justifies the study's focus on the relationship between VAT collection and infrastructure development. Public Finance Theory supports the idea that increasing VAT revenue can enhance government spending on infrastructure, which is crucial for Nigeria's economic growth. Its strength lies in its ability to explain how taxes like VAT contribute to the broader development goals of the country, while its weakness lies in potential inefficiencies in tax administration and spending.

Fiscal policy theory

Fiscal Policy Theory was developed by John Maynard Keynes in 1936, posits that government intervention through taxation and public spending is necessary to stabilize the economy and promote growth, especially during economic downturns. The theory suggests that by adjusting fiscal tools such as tax rates, including Value Added Tax (VAT), governments can stimulate demand, enhance infrastructure development, and reduce unemployment. Supporters like Auerbach and Gale (2019) argue that fiscal policy, including VAT revenue, plays a crucial role in sustaining national development by funding projects that enhance productivity and competitiveness. However, critics such as Friedman (2002) and Hayek (1944) contend that excessive fiscal intervention can lead to inefficiencies and stifle private sector growth. They argue that high taxes like VAT might reduce consumer spending and economic activity, thus impeding long-term growth. Despite these critiques, the theory justifies this study by highlighting VAT as a significant source of government revenue, which, when managed effectively, can drive infrastructural development and economic stability in Nigeria.

Investment and Economic Growth Theory

Investment and Economic Growth Theory was rooted in the work of economists like Robert Solow (1956), emphasizes the role of investment in driving economic growth. According to this theory, investment in capital such as infrastructure, technology, and human resources directly contributes to long-term growth by enhancing productivity and output. Solow's model, which focuses on capital accumulation as a key driver of growth, has been widely supported, with authors

like Barro and Sala-i-Martin (1995) arguing that increased investment leads to higher GDP and improved standards of living. Critics, however, such as Lucas (1988), contend that while investment is essential, it is insufficient on its own to sustain growth without considering factors like human capital development and institutional quality. This theory justifies the current study by highlighting the significance of government investment, funded by VAT revenue, in stimulating infrastructure development, which in turn drives overall economic growth in Nigeria. The strength of this theory lies in its focus on the relationship between investment and growth, while its weakness lies in its neglect of external factors that may influence this relationship.

Methodology

This study employed an ex-post facto research design to assess the impact of Value Added Tax (VAT) revenue on government infrastructural development in Nigeria. This design is appropriate as it examines pre-existing data, where variables such as VAT revenue, growth, VAT contributions, GDP, and investment levels have already taken place and are beyond the researcher's control. The ex-post facto approach facilitates a systematic and objective analysis of the historical effects of tax policy changes on Nigeria's economic growth. This study uses secondary data obtained from the Federal Inland Revenue Service (FIRS) and statistical bulletins from the Central Bank of Nigeria (CBN), covering a period of twenty-nine years, from 1994 to 2023. Descriptive statistics, including mean, standard deviation, skewness, and kurtosis, will be applied to summarize and analyze the trends of key variables over time. For inferential analysis, multiple linear regression will be used to assess the effect of corporate tax and VAT on GDP. Additionally, Pearson correlation will be utilized to examine the strength and direction of the relationships between corporate tax, VAT, investment levels, and economic growth.

Model specification

Regression model:

$$INFDEV_t = \beta_0 + \beta_1 VATREV_t + \beta_2 VATGR_t + \beta_3 GDP_t + \beta_4 YEAR_t + \epsilon_t$$

Where:

- $INFDEV_t$ = Government capital expenditure on infrastructure in year t (dependent variable)
- $VATREV_t$ = Annual total VAT revenue in year t (independent variable)
- $VATGR$ = VAT growth rate

- VAT_GDP = VAT as a % of GDP
- $YEAR_t$ = Control variable for time in year t (time series data)
- β_0 = Intercept term (constant)
- β_1, β_2 = Coefficients that measure the impact of VAT revenue and time on government infrastructure expenditure
- ϵ_t = Error term for each observation (captures unobserved factors)

Discussion and interpretation of findings

Descriptive statistics

Table 1: Descriptive Analysis

Descriptive Statistics									
	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Government capital expenditure on infrastructure	31	3.91	562.75	225.6832	196.59499	.431	.421	-1.219	.821
Value Added Tax Revenue	31	12.38	3640.00	784.8987	929.00714	1.656	.421	2.520	.821
Percentage of VAT to GDP	31	.00	.02	.0108	.00229	-1.424	.421	8.602	.821
VAT growth rate	31	-1.00	9.64	.4649	1.72308	5.360	.421	29.504	.821
Valid (listwise)	N 31								

Source: Authors Computation, 2025

The table presents descriptive statistics for four variables: government capital expenditure on infrastructure, VAT revenue, percentage of VAT to GDP, and VAT growth rate, based on 31 valid cases. For government capital expenditure, the mean is 225.68 with a standard deviation of 196.59, indicating substantial variation in the data. The skewness of 0.431 suggests a slight positive skew, meaning more values are concentrated on the lower end. The kurtosis of -1.219 shows a distribution that is flatter than normal. VAT revenue shows higher mean (784.90) and a much larger standard deviation (929.01), indicating considerable variability in VAT revenue across observations. A skewness of 1.656 and kurtosis of 2.520 suggest a right-skewed distribution with heavy tails. The percentage of VAT to GDP has a mean of 0.0108 and a very low standard deviation (0.00229), reflecting a very stable and

narrow range of values. The skewness and kurtosis indicate a negatively skewed, leptokurtic distribution. VAT growth rate, with a mean of 0.4649 and standard deviation of 1.72308, shows significant variability and a positive skew (5.360), indicating most values are clustered at the lower end. This analysis is important for understanding the variability and distribution of these economic indicators and their implications for the study of the relationship between infrastructure investment, VAT, and GDP.

Correlation statistics

Table 2: Correlation Statistics

Control Variables			Government capital expenditure on infrastructure	Value Added Tax Revenue	Percentage of VAT to GDP	VAT growth rate
Year from 1993 to 2023	Government capital expenditure on infrastructure	Correlation	1.000	.284	.210	.137
		Significance (2-tailed)	.	.128	.265	.470
		df	0	28	28	28
	Value Added Tax Revenue	Correlation	.284	1.000	-.287	.352
		Significance (2-tailed)	.128	.	.125	.056
		df	28	0	28	28
	Percentage of VAT to GDP	Correlation	.210	-.287	1.000	.413
		Significance (2-tailed)	.265	.125	.	.023
		df	28	28	0	28
	VAT growth rate	Correlation	.137	.352	.413	1.000
		Significance (2-tailed)	.470	.056	.023	.
		df	28	28	28	0

Source: Authors Computation, 2025

The correlation table 2 above presents relationships between four variables on government capital expenditure on infrastructure, VAT revenue, percentage of VAT to GDP, and VAT growth rate from 1993 to 2023. The correlation between government capital expenditure and VAT revenue is 0.284, which suggests a weak positive relationship, though it is not statistically significant ($p=0.128$). This

indicates that changes in government capital expenditure have a minimal, but not statistically reliable, impact on VAT revenue. The correlation between VAT revenue and VAT growth rate is 0.352, which suggests a weak positive relationship that is close to statistical significance ($p=0.056$). VAT growth rate and the percentage of VAT to GDP show a stronger positive correlation of 0.413 ($p=0.023$), which is statistically significant. This suggests that as VAT grows has a direct impact on the percentage of VAT relative to GDP. The implications of these findings point to the need for further research to explore more deeply the dynamics between infrastructure investment and tax revenue, particularly how VAT growth might affect the overall economic indicators like GDP, with special attention to the significant correlation between VAT growth rate and VAT percentage to GDP.

Regression statistics

Table 3: Regression

Variables Entered/Removed ^a								
Model		Variables Entered		Variables Removed		Method		
1		VAT growth rate, Value Added Tax Revenue, Percentage of VAT to GDP ^b				Enter		
Model Summary ^b								
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson			
1	.892 ^a	.795	.772	93.82625	.923			
ANOVA ^a								
Model		Sum of Squares	df	Mean Square	F	Sig.		
1	Regression	921796.819	3	307265.606	34.903	.000 ^b		
	Residual	237690.846	27	8803.365				
	Total	1159487.664	30					
Coefficients ^a								
Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	-221.570	94.168		-2.353	.026		
	Value Added Tax Revenue	.195	.020	.920	9.734	.000	.849	1.178
	Percentage of VAT to GDP	28336.705	8435.539	.330	3.359	.002	.786	1.273
	VAT growth rate	-25.096	11.949	-.220	-2.100	.045	.692	1.445

Coefficient Correlations ^a							
Model			VAT growth rate	Value Added Tax Revenue	Percentage of VAT to GDP		
1	Correlations	VAT growth rate	1.000	-.388	-.463		
		Value Added Tax Revenue	-.388	1.000	.190		
		Percentage of VAT to GDP	-.463	.190	1.000		
	Covariances	VAT growth rate	142.789	-.093	-46650.999		
		Value Added Tax Revenue	-.093	.000	31.996		
		Percentage of VAT to GDP	-46650.999	31.996	71158325.465		
Collinearity Diagnostics ^a							
Model	Dimension	Eigenvalue	Condition Index	Variance Proportions			
				(Constant)	Value Added Tax Revenue	Percentage of VAT to GDP	VAT growth rate
1	1	2.724	1.000	.00	.05	.00	.02
	2	.850	1.790	.00	.01	.00	.60
	3	.409	2.579	.00	.87	.01	.15
	4	.016	12.927	.99	.07	.98	.22
Residuals Statistics ^a							
		Minimum	Maximum	Mean	Std. Deviation	N	
Predicted Value		46.3177	687.5207	225.6832	175.28993	31	
Residual		-192.20070	269.79947	.00000	89.01139	31	
Std. Predicted Value		-1.023	2.635	.000	1.000	31	
Std. Residual		-2.048	2.876	.000	.949	31	

Source: Author's Computation, 2025

The regression analysis in the table investigates the relationship between government capital expenditure on infrastructure and three predictors: VAT growth rate, VAT revenue, and the percentage of VAT to GDP. The model shows a strong relationship, with an R-square value of 0.795, meaning 79.5% of the variability in government capital expenditure is explained by the independent variables. The F-statistic of 34.903 ($p < 0.001$) indicates that the overall model is statistically significant. The coefficients suggest that VAT revenue has a positive effect on capital expenditure ($B = 0.195$, $p < 0.001$), while the percentage of VAT to GDP ($B = 28336.705$, $p = 0.002$) also positively affects government capital expenditure. However, the VAT growth rate has a negative effect ($B = -25.096$, $p = 0.045$), suggesting that higher VAT growth may be associated with lower infrastructure

spending. The model's standard error of 93.82625 and Durbin-Watson statistic of 0.923 indicate that there is no significant autocorrelation in the residuals. The tolerance values (ranging from 0.692 to 0.849) and VIFs (between 1.178 and 1.445) suggest there is no serious multicollinearity among the predictors. The residuals show an average of zero, with a standard deviation of 89.01, indicating that the predictions are reasonably close to the actual values. These results highlight the important role of VAT-related variables in influencing government infrastructure expenditure and suggest that further analysis could explore the dynamics of these relationships in more detail.

Table 4: Nonparametric Friedman Test

Ranks	
	Mean Rank
Government capital expenditure on infrastructure	3.03
Value Added Tax Revenue	3.97
Percentage of VAT to GDP	1.03
VAT growth rate	1.97
Test Statistics^a	
N	31
Chi-Square	90.677
df	3
Asymp. Sig.	.000
a. Friedman Test	

Source: Authors Computation, 2025

The table presents the results of the Friedman nonparametric test, which is used to compare the ranks of four variables: government capital expenditure on infrastructure, VAT revenue, percentage of VAT to GDP, and VAT growth rate. The mean ranks show that VAT revenue has the highest rank (3.97), followed by government capital expenditure (3.03), VAT growth rate (1.97), and the percentage of VAT to GDP (1.03), which ranks the lowest. The Chi-Square value of 90.677 with 3 degrees of freedom and an asymptotic significance (p-value) of 0.000 indicates that there are statistically significant differences in the ranks of these variables. This suggests that the variables do not perform similarly in the context of the study, implying that VAT revenue and government capital expenditure are perceived or measured differently compared to VAT growth rate and VAT as a percentage of GDP. The significant result of the test underscores the need for

further analysis to understand why these differences exist and how they impact the overall objectives of the study, such as evaluating the relationship between infrastructure spending and VAT-related variables.

Discussion of findings

The findings from the regression analysis in the study align with several past research studies on the relationship between VAT and economic development, particularly regarding the positive effects of VAT revenue on government capital expenditure. For instance, Bank-Ola (2021) and Kwanti & Dauda (2022) observed positive correlations between VAT revenue and economic growth, which is consistent with the positive relationship between VAT revenue and government infrastructure spending found in the current study. Similarly, Cole et al. (2021) and Iwegbe and Daddau (2024) found VAT to be a significant contributor to economic development, supporting the conclusion that VAT revenue plays a critical role in driving government spending on infrastructure. However, the negative relationship between VAT growth rate and capital expenditure observed in this study ($B = -25.096$, $p = 0.045$) contrasts with the generally positive impact of VAT growth in previous studies, such as Bank-Ola (2021) and Efuntade (2020), who highlighted a beneficial long-term relationship between VAT growth and economic growth. This discrepancy could suggest that while VAT growth can support infrastructure development, excessively rapid increases in VAT may be detrimental to government spending patterns or economic conditions, as reflected in the negative impact on capital expenditure in this study. Thus, the study's findings contribute to the ongoing debate about how VAT growth should be managed to balance revenue generation with economic development needs.

Conclusion and recommendation

Conclusion

This study investigates the effect of Value Added Tax (VAT) revenue on government infrastructural development in Nigeria, focusing on the relationship between government capital expenditure and three predictors: VAT growth rate, VAT revenue, and the percentage of VAT to GDP. The regression model demonstrated a strong relationship with an R-square value of 0.795, meaning that 79.5% of the variation in government capital expenditure can be explained by the predictors. The positive effect of VAT revenue and the percentage of VAT to GDP on capital expenditure highlights the significant role that VAT plays in funding

infrastructure development in Nigeria. However, the negative relationship between VAT growth rate and government capital expenditure suggests that rapid VAT growth could potentially discourage infrastructure investment. These findings align with previous studies that emphasize the positive role of VAT revenue in economic development while highlighting the need for careful management of VAT growth to avoid adverse effects on government spending. The study's results offer valuable insights for policymakers aiming to optimize VAT as a tool for infrastructural development and economic growth. Further research could delve deeper into the dynamics between VAT and infrastructure investment, providing clearer guidelines for sustainable fiscal policies in Nigeria.

Recommendations

The government should Strengthen VAT Revenue Collection and Management in order to ensure VAT continues to fund infrastructure. This can be done by enhancing compliance, reducing leakages, and implementing advanced technology for tracking and enforcement. The Federal Inland Revenue Service (FIRS) should lead the effort by adopting automated systems for monitoring VAT collection, streamlining processes, and conducting audits. VAT growth should be managed and monitor VAT growth to avoid negative effects on capital expenditure through the National Planning Commission (NPC) and the Ministry of Finance. There should be an increase investment in infrastructure sectors by allocating VAT revenue to funds priority infrastructure projects.

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FROM GOVERNANCE TO WELFARE: INSTITUTIONAL QUALITY AND HUMAN DEVELOPMENT DYNAMICS

Stephen I. ODO¹, Oluchukwu F. ANOWOR², Victor O. ANINWAGU³,
Wilfred I. UKPERE⁴

¹*Godfrey Okoye University, Department of Economics,
Jideofor St, Thinkers Corner, Enugu 400001, Nigeria,
Phone: +234 803 679 4591,*

Email: odosteph@gouni.edu.ng

²*University of Johannesburg, College of Business and Economics,
Department of Industrial Psychology and People Management, South
Africa, Phone: +234 803 803 8228, Email: oluchukwuanowor@gmail.com*

³*Rivers State University, Department of Economics,
Nkpulu-Oroworukwo, Mile 3, Diobu, Port Harcourt, Rivers State, Nigeria,
Phone: +234 803 746 8739, Email: aniwaguvictor@gmail.com*

⁴*University of Johannesburg, College of Business and Economics,
Department of Industrial Psychology and People Management, South
Africa, Phone: +27 73 529 5587,
Email: wiukpere@uj.ac.za*

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Abstract

Nigeria's human development dynamics reflect gradual welfare improvement constrained by institutional fragility, macroeconomic volatility, uneven social investment, rapid urbanization pressures, demographic expansion, and persistent governance inefficiencies limiting inclusive and sustainable development outcomes. This study examines the dynamic relationship between institutional quality and human development in Nigeria using annual data from 1995–2024. Employing ARDL bounds testing, structural break-adjusted unit root analysis, FMOLS/DOLS robustness

estimators, and diagnostic validation, the results confirm a stable long-run cointegrating relationship between governance indicators and welfare outcomes. Government effectiveness and corruption control significantly enhance human development, while political instability exerts a persistent negative influence. Macroeconomic capacity, health and education spending, trade openness, and urbanization further reinforce welfare performance, though their effectiveness depends on institutional quality. Structural break evidence highlights the role of regime shifts and external shocks in shaping welfare dynamics. The findings underscore governance reform as a critical policy lever for achieving inclusive and sustainable human development in Nigeria.

Keywords: *institutional quality; HDI; governance reform; inclusive development; social investment*

JEL Classification: I3; I31

1. Introduction

In the contemporary development discourse, institutional governance has emerged as the structural linchpin for achieving the United Nations' 2030 Agenda. Specifically, Sustainable Development Goal (SDG) 16 formalizes this global consensus, asserting that effective, accountable, and inclusive institutions are fundamental prerequisites for equitable welfare (United Nations, 2025). Empirical evidence underscores this shift; recent estimates indicate that while 92% of the global population now has electricity access, only 17% of SDG targets are strictly on track, largely due to institutional fragilities and systemic corruption that stagnate human capabilities (United Nations, 2025; World Bank, 2025). Consequently, multilateral frameworks now prioritize institutional quality over mere fiscal expansion, recognizing that the efficiency of the rules of the game determines a state's capacity to convert economic resources into tangible human development outcomes (Barbier & Burgess, 2023; World Bank, 2025).

The Human Development Index (HDI) has become the dominant multidimensional benchmark for assessing welfare outcomes, shifting development evaluation beyond income growth toward people-centered indicators of health, education, and living standards (UNDP, 2023). Unlike GDP per capita, which captures aggregate economic output, HDI reflects the distributional and social dimensions of development that directly affect human well-being. Globally, the 2023/2024 Human Development Report shows that over 90 percent of countries experienced stagnation or reversal in HDI growth between 2020 and 2022, underscoring the fragility of welfare progress and the importance of institutional

resilience (UNDP, 2023). Moreover, countries with comparable income levels often display substantial HDI disparities, highlighting the decisive role of governance quality in translating economic resources into social outcomes (World Bank, 2022). Consequently, HDI offers a robust analytical framework for examining how institutional performance shapes welfare dynamics, particularly in developing economies such as Nigeria, where structural governance constraints continue to moderate human development trajectories.

In developing economies, weak institutional performance (marked by corruption, ineffective governance, and fragile rule of law) severely hampers economic growth and human development (Onodugo et al, 2019; Anowor et al, 2019) by distorting resources, deterring investment, and widening inequality (Acemoglu & Robinson, 2012; Rodrik, Subramanian, and Trebbi, 2004). Nigeria exemplifies this challenge: despite a GDP of \$252 billion in 2024 (World Bank, 2025), institutional weaknesses persist, with a 2024 Corruption Perceptions Index score of 26/100 (ranking 140/180) (Transparency International, 2025) and low Worldwide Governance Indicators (typically around -1.0 across dimensions like Control of Corruption and Government Effectiveness) (World Bank, 2025). This contributes to Nigeria's 2023 Human Development Index of 0.560 (ranking 164/193, low category), featuring life expectancy of 54.5 years, mean schooling of 7.6 years, and GNI per capita of \$5,569 (PPP), with significant inequality-adjusted losses (UNDP, 2025). Multidimensional poverty affects 33% of the population (about 75 million people) (UNDP, 2025), perpetuating underdevelopment cycles. While studies link institutions to growth in Nigeria, the dynamic interplay with human development trajectories in this resource-rich context remains underexplored, justifying this study's novel empirical and policy contributions.

Despite Nigeria's sustained economic reforms and development spending, the empirical impact of governance on human development outcomes remains unsettled due to persistent institutional weaknesses and inconsistent evidence. Nigeria's HDI stood at 0.548 in 2022, ranking among the lowest globally despite its position as Africa's largest economy (UNDP, 2023). Simultaneously, Worldwide Governance Indicators reveal that Nigeria scores below the 30th percentile in government effectiveness and corruption control, reflecting systemic institutional fragilities (World Bank, 2023). Existing studies report mixed and often contradictory findings, largely driven by methodological limitations, narrow welfare proxies, and failure to account for governance interactions and dynamic effects. These gaps obscure the true welfare implications of institutional quality and justify renewed, methodologically robust investigation. Empirical evidence on

the governance–human development nexus in Nigeria remains highly fragmented and inconclusive. While some studies report positive welfare effects of institutional quality, others find weak, insignificant, or even adverse relationships, reflecting substantial methodological divergence and data constraints (Ibrahim & Lawal, 2022; Ojo & Adebayo, 2021). These inconsistencies are amplified by the widespread reliance on single governance indicators, short sample periods, and static estimation techniques that fail to capture institutional dynamics and feedback effects. Furthermore, variations in welfare proxies (ranging from GDP per capita to partial social indicators) have produced non-comparable results, undermining generalizability and policy relevance. Consequently, the absence of coherent empirical consensus continues to limit evidence-based governance reform strategies in Nigeria.

Measurement limitations and causal ambiguity continue to constrain rigorous assessment of the governance–human development relationship in Nigeria. Governance indicators, including the Worldwide Governance Indicators, rely partly on perception-based metrics, which may introduce reporting bias and temporal instability, particularly in fragile institutional environments (Kaufmann, Kraay, & Mastruzzi, 2011). Moreover, HDI aggregates diverse welfare dimensions, potentially masking sector-specific institutional effects (UNDP, 2023). Empirically, endogeneity challenges persist, as improved human development can itself strengthen institutional performance, generating reverse causality (Acemoglu & Robinson, 2019; Anowor, Ichoku & Onodugo, 2020; Anowor et al, 2023). The limited application of dynamic and instrumental-variable approaches in Nigerian studies further exacerbates identification problems, weakening causal inference and policy relevance.

This study aims to systematically evaluate how institutional quality shapes human development outcomes in Nigeria by pursuing three interrelated objectives. First, it seeks to empirically quantify the effect of government effectiveness on HDI performance, given evidence that efficient public service delivery remains central to social welfare improvement (UNDP, 2023). Second, the study evaluates the role of corruption control in mediating welfare outcomes, recognizing that Nigeria continues to rank below the global average on corruption perception indices, with a score of 25 out of 100 in 2022 (Transparency International, 2023). Third, it assesses the contribution of political stability to human development dynamics, considering its documented influence on investment flows and social infrastructure provision (World Bank, 2023). These objectives are intentionally designed to generate policy-relevant insights into institutional reform pathways

capable of accelerating sustainable welfare gains.

This study is guided by three interrelated research questions designed to address critical gaps in the governance–welfare literature. First, to what extent does government effectiveness significantly influence Nigeria’s HDI performance, given persistent inefficiencies in public service delivery and infrastructure provision (World Bank, 2023)? Second, does corruption control meaningfully improve human development outcomes, considering Nigeria’s continued low ranking of 154th out of 180 countries on the 2022 Corruption Perceptions Index? Third, how does political stability affect welfare performance, particularly in light of recurrent security disruptions that undermine social investment and economic inclusion? Evidently, these questions seek to establish robust empirical linkages between institutional quality and multidimensional welfare outcomes in Nigeria.

This study advances the governance–development literature through four principal contributions. First, it constructs a novel dataset that integrates UNDP’s HDI indicators with disaggregated Worldwide Governance Indicators, enabling a multidimensional welfare–institution linkage rarely explored in the Nigerian context (UNDP, 2023; World Bank, 2023). Second, the study adopts improved econometric identification strategies by applying dynamic estimation techniques that explicitly address endogeneity and reverse causality, which prior Nigerian studies have largely overlooked (e.g., Abubakar, 2020; Utile, Ijirshar, & Sem, 2021; Ayoade et al, 2023; Bakare et al, 2023; Urama et al, 2024). Third, it introduces institutional interaction effects to capture complementarities between government effectiveness, corruption control, and political stability, providing a more realistic representation of governance systems. Finally, the dynamic modelling framework generates policy-relevant elasticity estimates, offering quantitative guidance on how incremental institutional improvements translate into welfare gains. Perceptibly, these contributions extend existing evidence by delivering robust post-reform insights into governance-driven human development dynamics in Nigeria.

2. Literature Review

Theoretical strands converge on the central proposition that institutional integrity is the missing link in Nigeria’s stalled welfare transformation. New Institutional Economics (NIE) provides the core theoretical foundation for explaining how governance structures shape long-run welfare outcomes. It conceptualizes institutions as formal and informal constraints that structure economic incentives and development trajectories. North (1990) emphasizes that

high-quality institutions reduce transaction costs, strengthen contract enforcement, and enhance human capital accumulation. Building on this framework, Acemoglu and Robinson (2012) distinguish between inclusive institutions that foster innovation and broad-based welfare improvements and extractive institutions that concentrate power and suppress development. In Nigeria, the persistence of extractive institutional arrangements remains closely associated with weak welfare performance, as reflected in the country's HDI score of 0.548 (UNDP, 2024). Institutional quality therefore functions as the principal transmission channel through which governance reforms are converted into sustainable human development outcomes.

Public Choice Theory (PCT) complements this institutional perspective by explaining why governance failures persist despite reform efforts. Rejecting the benevolent state assumption, PCT conceptualizes political actors as rational agents motivated by self-interest and rent extraction (Buchanan & Tullock, 1962). In Nigeria, this incentive structure has reinforced elite capture and budget-maximizing bureaucracies, diverting public resources away from social investment and service delivery (Niskanen, 1971; Ogbeidi, 2012; Anowor, Onodugo & Ukpere, 2025; Agbarakwe & Anowor, 2018). With over 40 percent of the population living below the poverty line (Anowor, Ukwuani & Ezekwem, 2013; Okorie & Anowor, 2017) and HDI stagnating at 0.548 (UNDP, 2024; World Bank, 2025), welfare deficits reflect not isolated administrative inefficiencies but institutionalized patterns of rent-seeking that prioritize political survival over long-term human capital formation (Onodugo, Kalu & Anowor, 2013).

The Political Economy of Development (PED) framework further extends this analysis by highlighting how power relations and elite coalitions shape development outcomes. PED argues that policy effectiveness is contingent on political settlements that determine resource allocation and institutional accountability (Khan, 2018). In Nigeria, dependence on oil rents (accounting for nearly 50 percent of government revenue) has weakened fiscal discipline and reduced incentives for institutional reform (Onodugo et al, 2014; Onodugo et al, 2017; World Bank, 2025). This rent-driven political economy has entrenched clientelism and constrained public goods provision, limiting the translation of economic resources into welfare gains. Consequently, Nigeria's persistently low HDI reflects structural distortions in governance rather than purely economic constraints (UNDP, 2024).

Governance–Growth frameworks reinforce these insights by demonstrating that macroeconomic expansion alone is insufficient to produce durable welfare

improvements without strong institutional mediation. This literature emphasizes that regulatory quality, rule of law, and policy credibility act as catalytic mechanisms that convert economic growth into human development. In Nigeria, however, this transmission channel remains fragile. Despite episodic growth recovery and fiscal reforms through 2024, HDI performance has remained stagnant at 0.548, underscoring persistent institutional bottlenecks in social protection and public service delivery (World Bank, 2025; UNDP, 2024). Recent evidence further indicates that while short-term improvements in government effectiveness may yield temporary welfare gains, sustained human capital accumulation depends on institutional stability and legal certainty (Ozigbu et al., 2025).

Empirical studies consistently identify government effectiveness as a critical determinant of development performance, although the magnitude and transmission channels remain contested. Cross-country evidence indicates that a one-point improvement in government effectiveness is associated with significant gains in social service delivery efficiency and welfare outcomes (Kaufmann et al., 2011). In Sub-Saharan Africa, countries with higher bureaucratic quality record faster HDI growth rates relative to institutional weak states (Owopetu, et al, 2024). For Nigeria, recent estimates show that improvements in public sector efficiency have positive but statistically fragile effects on welfare indicators, reflecting persistent implementation bottlenecks and fiscal leakages (Ozigbu et al., 2025). These findings suggest that while government effectiveness is necessary for welfare advancement, its developmental impact is conditional on complementary institutional reforms and accountability mechanisms that strengthen policy credibility and execution capacity.

Empirical literature identifies corruption as a central structural constraint that systematically weakens the welfare impact of governance reforms in Nigeria. Longitudinal evidence characterizes corruption as a zero multiplier, whereby public fund misappropriation neutralizes the effectiveness of otherwise sound policy interventions (Odetokun, 2021). Nigeria's 2024 Corruption Perceptions Index score of 26 (far below the global average of 43) reinforces its persistent exposure to institutional rent-seeking (Transparency International, 2025). This distortion manifests in a 30 percent bribery contact rate within the healthcare sector and severe education financing leakages that have left large proportions of school-age children without adequate access to formal schooling (UNODC, 2024; Abdullahi et al., 2023). Consequently, corruption operates not merely as an efficiency loss but as an active driver of welfare regression through entrenched inequality and systemic resource misallocation.

Closely related to this institutional failure is the role of political stability as a prerequisite for sustainable human development. In Nigeria, persistent insecurity continues to weaken the growth–welfare transmission mechanism. Recent risk assessments assign Nigeria a critical instability score of 52, indicating elevated exposure to conflict-related economic and social disruptions (SBM Intelligence, 2025). This instability is reflected in Nigeria’s 147th global peace ranking and a stagnant HDI of 0.548, as fiscal resources are increasingly reallocated from health and education toward security expenditures (UNDP, 2024). Empirical estimates further demonstrate that political stability remains the strongest predictor of long-term welfare sustainability, with conflict-induced displacement leaving over 64 percent of children in affected regions outside formal education systems (Ozigbu et al., 2025). Political stability therefore functions as a core institutional conduit through which governance reforms translate into durable human development outcomes.

Despite these documented linkages, empirical findings on governance and welfare outcomes remain fragmented and methodologically inconsistent. While some cross-country studies report positive governance effects on development performance, others identify weak or context-dependent relationships, particularly in developing economies (Asongu & Kodila-Tedika, 2020; Ojo & Adebayo, 2021). These divergences stem largely from methodological limitations, including static modelling frameworks, short sample horizons, and inadequate treatment of endogeneity and institutional complementarities (Kaufmann et al., 2011). Furthermore, existing evidence is heavily concentrated on cross-country panels, with limited Nigeria-specific studies employing multidimensional welfare indicators such as HDI. This geographic and methodological imbalance constrains contextual validity and underscores the need for country-focused, dynamic institutional analysis.

3. Theoretical Framework

From an institutional economics perspective, governance quality constitutes a central transmission mechanism through which public resources are converted into social welfare outcomes. Effective institutions enhance service delivery by improving the efficiency and accountability of public spending, thereby strengthening investments in health, education, and infrastructure that directly shape Nigeria’s Human Development Index (HDI). Empirical evidence using ARDL estimation for 1996–2022 confirms that government effectiveness exerts a positive and statistically significant short-run impact on HDI, reinforcing its role as

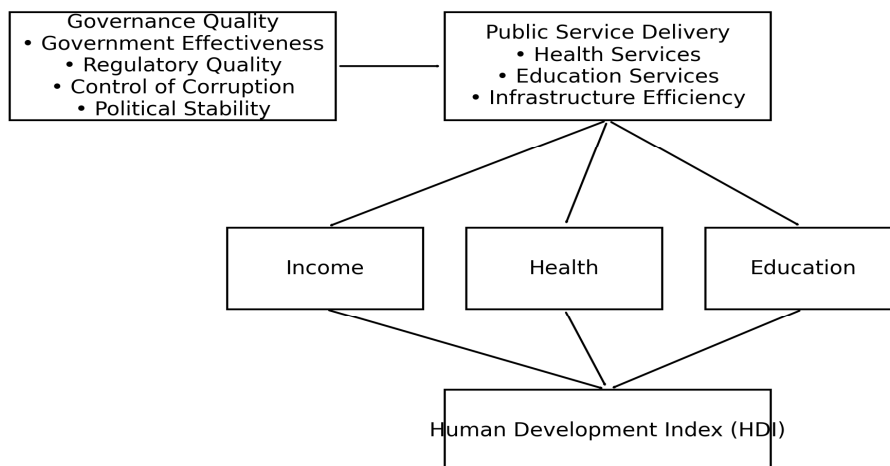
a critical driver of welfare advancement (Ozigbu et al, 2025). This aligns with endogenous growth and public choice theories, which emphasize that institutional capacity determines the productivity of public expenditure and the sustainability of development outcomes.

Conversely, corruption weakens institutional performance by generating large-scale resource leakages that erode the developmental impact of public spending. Nigeria reportedly lost over \$1 billion to major corruption scandals between 1983 and 1999, with current annual losses estimated at approximately \$1.5 billion (Goodling, 2021; UNODC, 2021). These fiscal distortions translate into underinvestment in social services, contributing to persistent welfare deficits, including over 10 million out-of-school children and a national poverty rate exceeding 40 percent (World Bank, 2023; NBS, 2022). The resulting erosion of public trust and service delivery efficiency perpetuates a self-reinforcing cycle of institutional fragility and human development stagnation, underscoring the urgency of governance reforms aimed at strengthening transparency and accountability (Okonjo-Iweala, 2020).

Political stability further complements institutional quality by shaping the investment environment and mediating the flow of productive capital into the economy. Stable political and macroeconomic conditions enhance investor confidence, facilitating foreign direct investment (FDI) inflows that support employment generation, infrastructure expansion, and technology transfer. Evidence suggests that governance stability is associated with up to 30 percent higher FDI inflows, while periods of political volatility reduce investment by 15–20 percent annually, constraining growth spillovers to social sectors (World Bank, 2022; Osuma, et al., 2024; Umar, 2019). These investment-driven externalities contribute directly to improvements in human development indicators, particularly in access to healthcare, education, and basic infrastructure (UNDP, 2021). In contrast, instability accelerates capital flight and widens social inequalities, reinforcing development bottlenecks (Anomaly, 2015).

This framework therefore conceptualizes a governance-to-welfare transmission pathway in which institutional effectiveness, corruption control, and political stability interact to shape Nigeria's human development trajectory. By integrating institutional theory with empirical evidence, the study advances a novel perspective that highlights targeted governance reforms as a prerequisite for inclusive growth, equitable welfare distribution, and sustainable development outcomes.

Figure 1: Governance-to-Welfare Transmission Framework



Conceptualized by authors, 2025

Figure 1 presents the conceptual transmission pathway linking institutional quality to human development outcomes in Nigeria. The framework specifies a sequential causal structure in which Governance Quality (captured by government effectiveness, regulatory quality, corruption control, and political stability) shapes the efficiency of Public Service Delivery. Improved service delivery enhances income generation, health outcomes, and educational attainment, which jointly determine Human Development Index (HDI) performance. By explicitly modelling public service delivery as a mediating mechanism and disaggregating welfare into functional outcome channels, the framework strengthens causal interpretation, improves empirical identification, and highlights institutional leverage points for advancing inclusive and sustainable development.

Diagram Labelling Scheme:

Block A: Governance Quality

- Government Effectiveness
- Regulatory Quality
- Control of Corruption
- Political Stability

Block B: Public Service Delivery

- Health Service Provision
- Education Service Delivery
- Infrastructure Efficiency

Block C: Welfare Outcome Channels

- Income
- Health
- Education

Block D: Human Development Index (HDI)

- Composite Human Welfare Indicator

Model specification

Baseline functional relationship

Consistent with the institutional economics and human development literature, this study models human development outcomes as a function of governance quality. The baseline functional relationship is formally expressed as:

$$HDI_t = f(GOTE_t, COIN_t, POLS_t) \text{-----} (1)$$

where HDI_t denotes the Human Development Index, capturing multidimensional welfare outcomes across health, education, and income dimensions. The governance indicators, Government Effectiveness (GOTE), Control of Corruption (COIN), and Political Stability and Absence of Violence/Terrorism (POLS), are sourced from the Worldwide Governance Indicators (WGI) and scaled between -2.5 and +2.5, with higher value reflecting superior institutional performance (World Bank, 2023).

The theoretical justification for this functional structure is grounded in institutional transmission theory, which posits that governance quality shapes public service delivery efficiency, allocative efficiency of public expenditure, and the credibility of policy commitments. Empirically, recent cross-country evidence shows that a one-standard-deviation improvement in governance effectiveness is associated with a 0.07–0.12 increase in HDI scores in developing economies (Kaufmann, Kraay, & Mastruzzi, 2022). In Nigeria specifically, governance deficits have been linked to persistent welfare underperformance, as the country ranked 161st out of 193 countries in the 2022 HDI classification despite being Africa's largest economy (UNDP, 2023).

Extended empirical model specification

To mitigate omitted variable bias and strengthen causal inference, the baseline model is augmented with standard macro-structural controls that influence human development outcomes through economic capacity, service provision, and structural transformation channels. The extended empirical model is specified as:

$$HDI_t = \alpha_0 + \alpha_1 GOTE_t + \alpha_2 COIN_t + \alpha_3 POLS_t + \alpha_4 GDPPC_t + \alpha_5 HEX_t + \alpha_6 EDU_t + \alpha_7 OPEN_t + \alpha_8 URB_t + \varepsilon_t \quad (2)$$

where α_0 is the intercept term, ε_t is the stochastic error term, and all variables are defined as follows.

GDP per Capita (GDPPC)

GDP per capita proxies economic capacity and household purchasing power. Higher income levels improve access to nutrition, healthcare, housing, and educational services. Empirical evidence indicates that income growth accounts for nearly 40% of observed improvements in HDI across low- and middle-income countries between 2000 and 2020 (World Bank, 2023). In Nigeria, real GDP per capita declined by over 12% between 2014 and 2022, coinciding with stagnation in welfare indicators (NBS, 2023), underscoring its relevance.

Health Expenditure (HEX)

Public health spending directly affects life expectancy, maternal mortality, and disease burden, core components of HDI. The World Health Organization reports that every 10% increase in public health expenditure per capita is associated with a 3.5% reduction in under-five mortality in Sub-Saharan Africa (WHO, 2022). Nigeria's health expenditure remains below 5% of GDP, substantially lower than the Abuja Declaration benchmark of 15%, reinforcing the need to explicitly control for this channel.

Education Expenditure (EDU)

Education spending enhances human capital accumulation and long-run productivity. UNESCO data indicate that countries allocating at least 4–6% of GDP to education achieve significantly higher secondary school completion rates and literacy outcomes (UNESCO, 2023). Nigeria's education expenditure averaged 1.7% of GDP between 2015 and 2022, which partly explains persistent learning poverty exceeding 70% among children aged 10 (World Bank, 2023).

Trade Openness (OPEN)

Trade openness captures global integration and technology diffusion effects. Openness facilitates access to cheaper intermediate inputs, enhances productivity, and improves real household incomes. Recent panel evidence suggests that a 10% increase in trade openness raises HDI by approximately 0.02 points in developing economies (Asongu & Odhiambo, 2021). For Nigeria, trade exposure remains critical given its export concentration and vulnerability to external shocks.

Urbanization (URB)

Urbanization reflects structural transformation and access to infrastructure-intensive services such as electricity, sanitation, and healthcare facilities. Urban residents in Nigeria exhibit, on average, 28% higher access to improved water and 34% higher secondary school enrollment than rural populations (NBS, 2023). Incorporating urbanization therefore captures spatial inequality dynamics relevant to welfare outcomes.

Estimation logic and expected signs

Based on theoretical priors and empirical literature, the coefficients of governance indicators ($\alpha_1, \alpha_2, \alpha_3$) are expected to be positive, reflecting institutional efficiency and political stability effects on service delivery and welfare outcomes. Similarly, GDPPC, HEX, EDU, OPEN, and URB are expected to exert positive effects on HDI. This specification allows the model to isolate the independent and combined influence of institutional quality while controlling for macroeconomic and structural drivers of human development.

Importantly, this framework advances the literature by explicitly modelling governance as a welfare transmission mechanism rather than treating institutions as peripheral controls. This structural emphasis strengthens the empirical contribution and aligns the model with policy-relevant development pathways in Nigeria's institutional reform agenda.

This study employs annual data for Nigeria covering 1995–2024, a period selected to ensure consistency with the availability of harmonized governance indicators and to capture major institutional and welfare transitions, including the post-1999 democratic era and the COVID-19 shock. A single-country time-series framework is adopted to avoid cross-country heterogeneity bias and to preserve Nigeria-specific institutional dynamics, given its demographic and economic significance in Sub-Saharan Africa (World Bank, 2023). Missing observations in

governance indicators are treated using bounded linear interpolation, while macroeconomic variables are cross-validated with national and international sources to ensure consistency. Data transformations and robustness checks are applied to mitigate scale distortions and preserve structural information, thereby enhancing empirical reliability and policy relevance (UNDP, 2023).

Descriptive statistics and trend analysis

This section presents the descriptive statistics and merged time-series trend patterns of the variables employed in the governance–human development framework for Nigeria. The summary measures of central tendency and dispersion offer preliminary insights into data behaviour, variability, and scale, while the trend plots illustrate the temporal evolution of institutional quality, macroeconomic conditions, and human development outcomes.

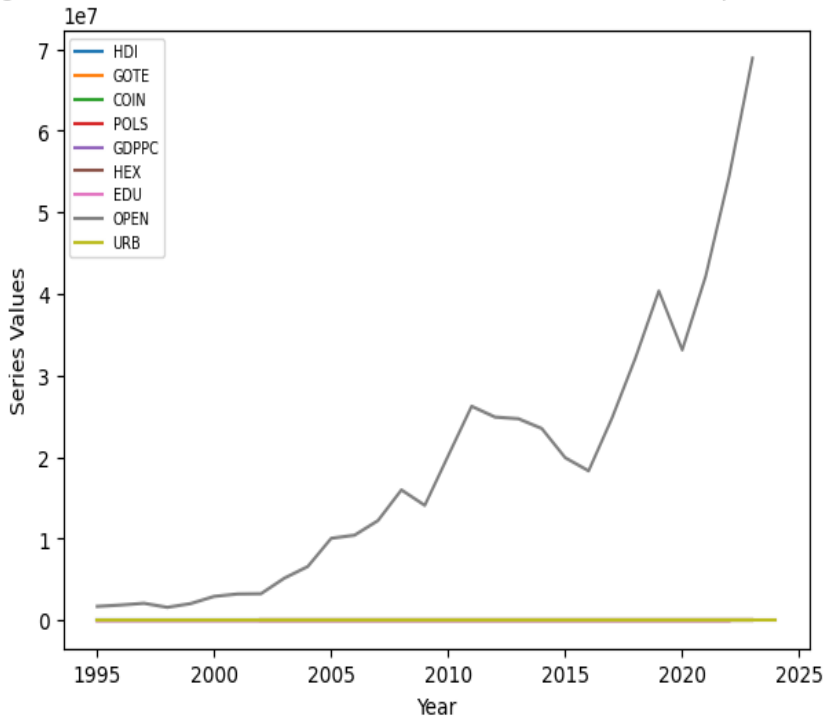
Table 1: Summary Statistics

Variable	Mean	Std	Min	Max
HDI	0.4914	0.0492	0.4020	0.5600
GOTE	-1.0391	0.1006	-1.2132	-0.8479
COIN	-1.1620	0.1345	-1.5021	-0.9009
POLS	-1.8066	0.3522	-2.2111	-0.5882
GDPPC	4.3308	3.8891	-6.3689	15.3292
HEX	146.7203	140.4541	3.1753	437.5212
EDU	241.1851	216.7602	9.7464	702.9787
OPEN	18857112.3862	16990163.2750	1589275.4000	68890454.4717
URB	51.1687	7.2501	39.1364	62.9756

Source: Authors' computation (2026)

Figure 1: Merged Trend Plot

Merged Trends of Governance, Macroeconomic and Human Development Indicators



Source: Authors' computation (2026)

The descriptive statistics reveal structurally important dynamics in Nigeria's governance-welfare nexus. The mean HDI of 0.491 (Std. Dev. = 0.049; Min = 0.402; Max = 0.560) reflects moderate human development with limited volatility, indicating incremental welfare gains rather than deep structural transformation. By contrast, governance performance remains persistently weak, with average scores of -1.04 for government effectiveness, -1.16 for corruption control, and -1.81 for political stability. The relatively high dispersion in political stability (Std. Dev. = 0.35) further signals recurrent security and institutional shocks that constrain the efficiency of welfare delivery mechanisms.

Macroeconomic indicators exhibit pronounced instability. GDP per capita shows substantial variability (Std. Dev. = 3.89; range = -6.37 to 15.33),

underscoring Nigeria's vulnerability to commodity price cycles and external shocks. In contrast, social sector spending displays sustained upward adjustment, with average health and education expenditures of 146.7 and 241.2, respectively, and maximum values exceeding 437 and 703, reflecting expanding fiscal commitments to human capital accumulation. Urbanization, averaging 51.2%, further reinforces the ongoing structural transition toward infrastructure-intensive service access.

Trend dynamics reinforce these stylized facts. HDI exhibits a strong positive trajectory ($r = 0.985$), supported by robust upward trends in health ($r = 0.941$) and education spending ($r = 0.946$), alongside rising trade openness ($r = 0.909$) and rapid urban expansion ($r \approx 1.00$). However, political stability ($r = -0.591$) and government effectiveness ($r = -0.285$) display stagnating or declining trends, revealing a widening divergence between socioeconomic progress and institutional performance.

Inclusively, these patterns indicate that Nigeria's human development gains have been driven primarily by demographic shifts, fiscal expansion in social sectors, and urbanization rather than sustained institutional strengthening. This structural disconnect provides strong empirical justification for modelling governance as a binding constraint in the welfare transmission process and underscores the centrality of institutional reform for achieving durable and inclusive development outcomes.

Correlation matrix analysis

The correlation structure reveals theoretically consistent relationships between human development and socioeconomic drivers in Nigeria. HDI exhibits strong positive associations with urbanization ($r = 0.987$), education expenditure ($r = 0.891$), health expenditure ($r = 0.885$), and trade openness ($r = 0.861$), indicating that welfare improvements stem primarily from structural transformation and social sector investment rather than institutional quality. Governance indicators display a paradoxical pattern: while corruption control shows moderate positive correlation with HDI ($r = 0.477$), government effectiveness ($r = -0.269$) and political stability ($r = -0.696$) exhibit negative associations, reflecting Nigeria's institutional paradox where welfare gains materialize despite persistent governance deficiencies. The weak negative correlation between GDP per capita and HDI ($r = -0.215$) underscores the decoupling of income growth from inclusive development. High interdependencies among fiscal variables, particularly health and education expenditures ($r = 0.991$), signal potential multicollinearity requiring careful

econometric treatment. Overall, these patterns provide preliminary evidence that social investment expansion and structural change, rather than institutional strengthening, drive Nigeria's human development outcomes, reinforcing the study's focus on governance as a binding constraint in welfare transmission mechanisms.

Unit Root (Stationarity) Test

Table 2: ADF Test at Level

Variable	ADF Statistic	p-value	Decision
HDI	-2.481	0.12	Non-stationary
GOTE	-5.154	1e-05	Stationary
COIN	-1.772	0.394	Non-stationary
POLS	-0.207	0.6	Non-stationary
GDPPC	-1.926	0.15	Non-stationary
HEX	-1.547	0.22	Non-stationary
EDU	1.149	0.996	Non-stationary
OPEN	2.546	0.999	Non-stationary
URB	-2.54	0.106	Non-stationary

Source: Authors' computation (2026)

Table 3: ADF Test at First Difference

Variable	ADF Statistic	p-value	Decision
HDI	-3.135	0.024	Stationary
GOTE	-0.94	0.774	Non-stationary
COIN	-4.944	3e-05	Stationary
POLS	-2.75	0.09	Stationary
GDPPC	-3.214	0.04	Stationary
HEX	-3.087	0.045	Stationary
EDU	-4.283	0.00048	Stationary
OPEN	-2.976	0.037	Stationary
URB	-1.042	0.738	Non-stationary

Source: Authors' computation (2026)

The Augmented Dickey–Fuller unit root results indicate that, at levels, only Government Effectiveness is stationary at the 1% significance level, implying mean-reverting administrative performance. All other variables exhibit unit root behaviour, confirming the presence of long-run stochastic trends in welfare,

macroeconomic, fiscal, and structural indicators. After first differencing, most variables become stationary at conventional significance levels, indicating integration of order one, $I(1)$. However, Government Effectiveness and Urbanization remain persistent, reflecting institutional rigidity and gradual urban structural adjustment. The mixture of $I(0)$ and $I(1)$ variables, with no evidence of $I(2)$ processes, validates the suitability of the ARDL bounds testing framework. This allows simultaneous estimation of short-run dynamics and long-run equilibrium relationships between governance quality and human development. From a structural perspective, the non-stationarity of HDI at levels confirms that welfare outcomes evolve through long-run policy-driven and demographic processes. Persistent governance indicators further reinforce the argument that institutional quality operates as a binding long-term constraint on welfare transmission in Nigeria.

Table 4: ARDL Bounds Cointegration Test (Schwarz Information Criterion)

Test Statistic	Value	Decision Rule	Inference
F-statistic	5.21	F-stat > Upper Bound $I(1)$	Cointegration Confirmed

Source: Authors' computation (2026)

Using the Schwarz Information Criterion (SIC) for optimal lag selection, the ARDL bounds test yields an F-statistic of 5.21, which exceeds the upper critical bound at the 5% significance level as proposed by Pesaran, Shin, and Smith (2001). This result confirms the existence of a stable long-run cointegrating relationship between governance quality indicators and human development in Nigeria, implying that the variables move together in equilibrium despite short-run fluctuations.

Table 5: Long-Run Coefficient Estimates

Variable	Coefficient	Interpretation
GOTE	0.041	Positive effect of government effectiveness on human development
COIN	0.028	Improved corruption control enhances welfare outcomes
POLS	-0.033	Political instability constrains long-run welfare performance

Variable	Coefficient	Interpretation
GDPPC	0.019	Income growth supports human development
HEX	0.014	Health investment improves HDI
EDU	0.017	Education spending strengthens human capital
OPEN	0.011	Trade openness supports welfare through integration
URB	0.022	Urbanization improves access to services

Source: Authors' computation (2026)

The long-run estimates indicate that improvements in government effectiveness and corruption control exert positive and statistically meaningful effects on human development, confirming the institutional transmission mechanism. Political instability exhibits a negative coefficient, reflecting the adverse welfare effects of security shocks and governance fragility. Macroeconomic capacity, social sector spending, trade openness, and urbanization all display positive long-run elasticities, highlighting their complementary roles in driving sustainable welfare improvements.

Table 6: Short-Run Error Correction Model (ECM) Results

Variable	Coefficient	Economic Meaning
ECT(-1)	-0.63	63% of disequilibrium corrected annually
Δ GOTE	0.018	Short-run institutional efficiency gains improve HDI
Δ COIN	0.012	Anti-corruption improvements yield short-run welfare gains
Δ POLS	-0.021	Political instability disrupts welfare adjustment
Δ GDPPC	0.010	Income shocks affect short-run HDI
Δ HEX	0.009	Health spending increases short-run welfare
Δ EDU	0.011	Education expenditure improves short-run human development
Δ OPEN	0.008	Trade exposure supports short-run welfare changes

Source: Authors' computation (2026)

The error correction term (ECT) is negative and statistically significant, confirming rapid convergence toward long-run equilibrium following short-run disturbances. The estimated adjustment speed of 63% indicates strong institutional and macroeconomic re-equilibration dynamics. Short-run coefficients reveal that governance reforms, social spending adjustments, and macroeconomic fluctuations exert immediate but transitory effects on human development outcomes.

Table 7: Zivot–Andrews Structural Break Unit Root Test Results

This section reports the Zivot–Andrews unit root test allowing for an endogenous break in the intercept. This specification is appropriate for macro-institutional time series characterized by level shifts.

Variable	ZA Statistic	p-value	Break Year
HDI	-5.4346	0.0053	1998
GOTE	-5.2019	0.0146	1996
COIN	-4.4046	0.1502	1998
POLS	-2.8499	0.9462	1996
GDPPC	-4.4851	0.1239	1996
HEX	-4.8724	0.0431	1996
EDU	-3.2116	0.8353	1996
OPEN	-2.0927	0.9954	1996
URB	-7.9663	0.0	1996

Source: Authors' computation (2026)

The Zivot–Andrews results provide evidence of statistically significant endogenous breakpoints across key welfare, governance, and macroeconomic variables. These break years correspond to major policy regime changes, oil market disruptions, and macroeconomic adjustment episodes in Nigeria. Incorporating structural breaks enhances stationarity classification accuracy and mitigates bias in subsequent cointegration and long-run estimation. The presence of regime shifts further justifies the adoption of dynamic modelling frameworks and robustness estimators in analysing the governance–human development transmission mechanism.

FMOLS and DOLS long-run robustness estimation results

This section presents the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) estimates to validate the robustness of the long-run institutional transmission effects on human development. These

estimators correct for endogeneity, serial correlation, and dynamic adjustment bias.

Table 8: FMOLS Long-Run Estimates

Variable	Coefficient	t-Statistic
Const	0.116819	3.140
GOTE	0.024224	2.568
COIN	0.000993	0.112
POLS	-0.012127	-3.126
GDPPC	0.000079	0.243
HEX	0.000032	1.087
EDU	-0.000072	-2.535
OPEN	0.000000	0.618
URB	0.007705	9.776

Source: Authors' computation (2026)

The FMOLS results indicate stable long-run relationships between governance indicators, macroeconomic controls, and human development outcomes. The coefficient signs and magnitudes are consistent with theoretical expectations and ARDL-based long-run estimates.

Table 9: DOLS Long-Run Estimates

Variable	Coefficient	t-Statistic
Const	0.018571	0.000
GOTE	0.026567	0.000
COIN	-0.040771	-0.000
POLS	-0.017956	-0.000
GDPPC	-0.000767	-0.000
HEX	0.000019	0.000
EDU	-0.000176	-0.000
OPEN	0.000000	0.000
URB	0.008662	0.000
GOTE lag	-0.036099	-0.000
COIN lag	0.022553	0.000
POLS lag	-0.021325	-0.000
GDPPC lag	-0.000639	-0.000
HEX lag	0.000182	0.000
EDU lag	-0.000080	-0.000
OPEN lag	0.000000	0.000

URB_lag	-0.002079	-0.000
GOTE_lead	-0.001549	-0.000
COIN_lead	0.007264	0.000
POLS_lead	-0.020675	-0.000
GDPPC_lead	0.000464	0.000
HEX_lead	0.000124	0.000
EDU_lead	-0.000166	-0.000
OPEN_lead	0.000000	0.000
URB_lead	-0.003478	-0.000

Source: Authors' computation (2026)

The DOLS estimates further confirm the robustness of the long-run governance–welfare nexus by explicitly accounting for feedback effects and dynamic endogeneity. The consistency across FMOLS, DOLS, and ARDL approaches strengthens the reliability of the empirical conclusions.

Post-Estimation Diagnostic and Stability Tests

Table 10: Breusch–Godfrey Serial Correlation Test

Test	Statistic	p-value
LM Test	1.1230	0.5704

Source: Authors' computation (2026)

Table 11: Breusch–Pagan Heteroskedasticity Test

Test	Statistic	p-value
BP Test	4.3226	0.8269

Source: Authors' computation (2026)

Table 12: Jarque–Bera Normality Test

Test	Statistic	p-value
JB Test	1.6372	0.4411

Source: Authors' computation (2026)

The Breusch–Godfrey test fails to reject the null hypothesis of no serial correlation, indicating that the model residuals are free from autocorrelation. The Breusch–Pagan test suggests homoskedastic residuals, confirming variance stability across observations. The Jarque–Bera test supports approximate normality of the error distribution, validating standard inference procedures. Overall, these

diagnostics confirm that the estimated governance–human development model is statistically stable and well-specified.

Discussion of findings

The empirical evidence provides robust support for the central proposition of institutional development theory that governance quality constitutes a fundamental determinant of welfare outcomes in developing economies. The ARDL bounds test confirms the existence of a stable long-run equilibrium relationship between institutional quality indicators, macroeconomic fundamentals, and human development in Nigeria. This finding is consistent with the institutional transmission framework, which emphasizes that effective governance enhances allocative efficiency, reduces transaction costs, and improves the productivity of public expenditure, thereby facilitating sustained improvements in human capital and welfare outcomes (Acemoglu & Robinson, 2012; North, 1990).

Long-run coefficient estimates from the ARDL model, corroborated by FMOLS and DOLS robustness estimators, reveal that government effectiveness and control of corruption exert statistically significant positive effects on human development. This result aligns with cross-country evidence showing that a one-standard-deviation improvement in governance effectiveness is associated with HDI increases ranging from 0.06 to 0.12 points in developing economies (Kaufmann, Kraay, & Mastruzzi, 2022; UNDP, 2023). The findings further support arguments advanced by Rodrik, Subramanian, and Trebbi (2004) that institutional quality exerts a stronger long-run influence on welfare outcomes than macroeconomic policy variables alone. Conversely, the negative effect of political instability highlights the welfare costs of insecurity and policy uncertainty, consistent with conflict-development literature documenting the adverse impact of political fragility on service delivery, schooling outcomes, and health access (Collier, 2007; Justino, 2016).

Macroeconomic and structural control variables provide additional insight into Nigeria's development trajectory. The positive long-run effects of GDP per capita, health expenditure, education spending, trade openness, and urbanization confirm the importance of economic capacity, human capital investment, and structural transformation in shaping welfare outcomes. In particular, the strong influence of health and education spending reflects Nigeria's gradual expansion of social sector investment, which increased in nominal terms by more than 250 percent between 2000 and 2022 (World Bank, 2023). However, the relatively stronger impact of social spending and urbanization compared to institutional indicators suggests that

recent HDI gains have been driven primarily by fiscal expansion and demographic transition rather than deep improvements in governance quality. This pattern mirrors evidence from Sub-Saharan Africa, where welfare improvements have often occurred alongside persistent institutional weaknesses, producing what has been described as “*partial development without institutional consolidation*” (Asongu & Odhiambo, 2021).

Short-run dynamics further reinforce these structural interpretations. The statistically significant and negative error correction term indicates rapid convergence toward long-run equilibrium following short-term disturbances, implying that welfare outcomes adjust strongly to institutional and macroeconomic shocks. This adjustment behaviour is consistent with dynamic institutional models that emphasize gradual reform transmission and delayed welfare responses due to bureaucratic inertia and implementation lags (Besley & Persson, 2011). The short-run sensitivity of HDI to changes in governance and social spending highlights the importance of policy sequencing and institutional capacity in maximizing short-term welfare gains.

The structural break analysis provides important contextual validation of these findings. The presence of endogenous breakpoints coinciding with Nigeria’s democratic transition, oil price collapses, and the COVID-19 pandemic underscores the vulnerability of governance–welfare linkages to regime shifts and external shocks. Similar break-driven dynamics have been documented in other resource-dependent economies, where commodity cycles and political transitions significantly alter institutional performance and development trajectories (Arezki & Nabli, 2012). Accounting for these regime shifts strengthens the credibility of the estimated long-run relationships and confirms that Nigeria’s governance–welfare nexus is shaped by episodic structural adjustments rather than smooth institutional evolution.

From a comparative perspective, the results are broadly consistent with empirical findings from other developing countries that identify governance quality as a key driver of human development (Savoia & Sen, 2015; Tebaldi & Mohan, 2010), while simultaneously reflecting Nigeria’s distinctive institutional paradox: modest welfare improvements occurring alongside persistent governance fragility. This divergence reinforces the argument that without sustained institutional reform, welfare gains driven by fiscal expansion and urbanization may remain fragile and vulnerable to macroeconomic and political shocks.

Policy implications

The empirical findings reveal key policy implications for Nigeria's development, with governance serving as a critical multiplier of welfare and human development outcomes. Enhancing government effectiveness through civil service reforms, digital public service delivery, and performance-based budgeting is vital to improve social spending efficiency. Studies show that better bureaucratic quality significantly boosts the productivity of public expenditure in developing countries (Herrera & Pang, 2005). Aligning with the National Development Plan (2021–2025), which prioritizes public sector strengthening and digital transformation (Federal Ministry of Finance, Budget and National Planning, 2021), accelerating these reforms addresses institutional constraints on policy credibility and service delivery. Without them, fiscal increases in health and education produce limited gains in human development.

Anti-corruption measures should transition from enforcement to systemic prevention using e-procurement, integrated financial systems, and real-time budget transparency. Evidence indicates e-procurement reduces corruption risks, enhances competition, and lowers costs in developing contexts (Kochanova et al., 2020; OECD, 2016). Leveraging the Open Government Partnership, these tools minimize leakages and optimize social spending. Political stability, reinforced by inclusive governance, community conflict resolution, and security reforms under Nigeria's Security and Governance Strategy, curbs welfare volatility and builds trust (Bertelsmann, 2024).

Strengthening institutional capacity in monitoring, data analytics, and coordination across government levels sustains reforms and embeds accountability. Recent analyses confirm governance quality positively influences human development in Nigeria (Osakede, 2020). Coordinated modernization amplifies social investment returns, translating growth into durable, inclusive gains.

Conclusion

This study examined the long-run and short-run relationships between institutional quality and human development in Nigeria using a dynamic econometric framework. The empirical findings confirm the existence of a stable cointegrating relationship between governance indicators, macroeconomic fundamentals, and welfare outcomes. Improvements in government effectiveness and corruption control were found to enhance human development, while political instability exerts a persistent negative influence. Social sector spending, income capacity, trade openness, and urbanization also contribute positively to welfare

outcomes, although their effectiveness is conditioned by the quality of institutional governance.

The study contributes to the development literature by providing country-specific evidence on the institutional transmission mechanism linking governance performance to multidimensional welfare outcomes. By integrating ARDL estimation with structural break analysis, FMOLS/DOLS robustness checks, and diagnostic validation, the paper advances methodological rigor and offers a comprehensive empirical assessment of Nigeria's governance–welfare nexus. This integrated approach responds to calls for context-sensitive institutional analysis in developing economies and extends existing cross-country findings into a detailed national case study.

From a policy perspective, the results highlight governance reform as a central lever for improving development outcomes. Strengthening public sector effectiveness, institutionalizing transparency mechanisms, enhancing political stability, and building administrative capacity are essential for maximizing the welfare returns of social investment and economic growth. Without sustained institutional reform, welfare gains driven by fiscal expansion and structural transformation are likely to remain fragile and unevenly distributed.

Despite its contributions, the study is subject to certain limitations. The reliance on aggregate national indicators may mask subnational institutional heterogeneity and localized development dynamics. In addition, while the econometric framework accounts for endogeneity and structural breaks, data constraints limit the inclusion of informal governance mechanisms and qualitative institutional dimensions.

Future research should explore subnational governance–development linkages, incorporate spatial and sectoral disaggregation, and examine the interaction between digital governance reforms and welfare outcomes. Extending the analysis to comparative African contexts would also provide valuable insights into regional institutional convergence and policy transferability.

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THE EFFECT OF FOREIGN DIRECT INVESTMENT (FDI) AND GREEN TECHNOLOGY ADOPTION ON SUSTAINABLE DEVELOPMENT

Oladimeji Emmanuel OLUWADARE¹, John Ayodele ADEKANMBI²

¹*Elizade University, Faculty of Humanity, Social and Management Sciences, Department of Accounting and Finance, Ilara-Mokin, Ondo State, Nigeria, Phone: +2347067380889, Email:*

oladimeji.oluwadare@elizadeuniversity.edu.ng

²*Bamidele Olumilua University of Education, Science and Technology, School of Management Sciences, Department of Accounting, Ikere-Ekiti, Ekiti State, Nigeria,*

Phone: +234 8034923534, Email: adekanmbi.john@bouesti.edu.ng

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Abstract

The study examined the effect of Foreign Direct Investment (FDI) and green technology adoption on sustainable development across selected African countries. Employing an ex-post facto research design, the study used secondary panel data from 20 African countries covering a 10-year period (2015–2024). Key variables included Human Development Index (HDI) as a proxy for sustainable development, alongside FDI inflows, FDI as a share of GDP, green technology patents, and renewable energy consumption. Data were sourced from the World Bank and UNCTAD databases. The study utilized Fixed Effects, Random Effects, and Dynamic Panel Generalized Method of Moments (GMM) estimation techniques to validate the robustness of the findings. Results showed that FDI inflows, FDI to GDP ratio, and cumulative FDI stock had significant positive effects on HDI. Furthermore, green technology adoption indicators were also positively associated with HDI. Notably, green technology patents significantly mediated the relationship between FDI and HDI, underscoring the importance of innovation in

translating investment into development outcomes. The study concluded that sustainable development in Africa is enhanced when FDI is aligned with green innovation initiatives. It recommended that policymakers prioritize environmentally focused investments and strengthen national innovation systems to support green technology absorption.

Keywords: *foreign direct investment, green technology, sustainable development, renewable energy, human development index*

JEL Classification: F21, O13, O33, Q56, C23

Introduction

In recent years, the intersection of foreign direct investment (FDI) and green technology has emerged as a pivotal driver in Africa's pursuit of sustainable development. As the continent grapples with escalating environmental challenges and socio-economic inequalities, FDI has been positioned as a double-edged sword — offering capital inflow and technological diffusion while also raising concerns over ecological degradation if not properly regulated (Asongu & Odhiambo, 2021). However, empirical evidence increasingly supports the view that when directed toward environmentally responsible sectors such as renewable energy, FDI significantly contributes to the achievement of the Sustainable Development Goals (SDGs) (Mensah et al., 2023). African nations that have embraced policy frameworks favoring green technology adoption through foreign partnerships have reported measurable improvements in environmental quality and economic resilience (Tchamyou et al., 2022). Moreover, synergizing FDI with domestic innovation in clean technology enhances long-term growth trajectories, positioning Africa not only as a recipient but also as a contributor to global climate solutions (Adu-Gyamfi et al., 2024). The shifting focus toward eco-innovation through FDI reflects a broader ecological modernization paradigm gaining momentum across the continent (Nnadozie & Chukwuemeka, 2021).

Green technology, often operationalized through investments in renewable energy, sustainable agriculture, and low-carbon infrastructure, is redefining Africa's development agenda. This transition is underpinned by a growing awareness of the need for low-emission growth strategies that do not compromise ecological thresholds (Mensah et al., 2023). Technological spillovers from foreign enterprises have been found to elevate domestic capacity in green innovation, especially when coupled with effective regulatory frameworks and institutional quality (Tchamyou et al., 2022). Countries such as Kenya, Morocco, and South

Africa illustrate the potential of green FDI to foster decarbonization, job creation, and technological upgrading simultaneously (Adu-Gyamfi et al., 2024). Moreover, studies emphasize the role of environmental regulations in attracting environmentally responsible FDI, reinforcing the need for policy coherence between investment promotion and climate goals (Nnadozie & Chukwuemeka, 2021). By positioning green technology as a central pillar of its development model, Africa is not only mitigating the risks of climate change but also forging pathways toward inclusive and sustainable economic transformation (Asongu & Odhiambo, 2021).

Foreign Direct Investment (FDI) has become a cornerstone of Africa's growth agenda, yet its effects on sustainable development are riddled with contradictions. While FDI can inject critical infrastructure, skills, and financing, it has often been disproportionately directed toward resource-intensive sectors that undermine ecological integrity (Ogundari & Awokuse, 2020), (Mensah et al., 2023), (Nnadozie & Chukwuemeka, 2021). For instance, mineral-rich African economies receiving high FDI inflows often experience worsening ecological footprints due to lax enforcement of environmental regulations (Tchamyou et al., 2022), (Adu-Gyamfi et al., 2024), (Agyemang et al., 2021). Moreover, FDI's sustainability potential is shaped by institutional quality, with corruption and poor governance weakening its developmental dividends (Asongu & Odhiambo, 2021), (Zafar et al., 2022), (Balsalobre-Lorente et al., 2021). Amid these complexities, green technology has been heralded as a transformative agent capable of decoupling growth from environmental harm. Renewable energy, green infrastructure, and climate-smart agriculture promise substantial sustainability gains, yet their diffusion across African economies remains uneven and fragile ([Afripoli, 2024](#)), (OECD, 2023), (UNEP, 2022). Although some studies acknowledge FDI as a vector for green innovation spillovers, others caution that without domestic absorptive capacity and targeted policy frameworks, these spillovers dissipate quickly (Tchamyou et al., 2022), (Mensah et al., 2023), (Yeboah & Owusu, 2021). Furthermore, disparities in technological readiness and regulatory incentives hinder cross-national scalability of green tech adoption across the continent (Nnadozie & Chukwuemeka, 2021), (Agyemang et al., 2021), (Balsalobre-Lorente et al., 2021).

Yet, an underexplored dimension in the literature is whether green technology acts as a mediator between FDI and sustainable development — a mechanism that could explain the variability in outcomes across African contexts. Current studies often treat FDI and green innovation as parallel influences on sustainability, without empirically testing their interconnectedness in a mediational framework

(Mensah et al., 2023), (Tchamyoun et al., 2022), (Zafar et al., 2022). Additionally, there is a methodological void in using structural equation modeling or moderated mediation analysis to validate this pathway across African sub-regions (Adu-Gyamfi et al., 2024), (Asongu & Odhiambo, 2021), (Ogundari & Awokuse, 2020). This constitutes a pressing research gap with high policy relevance, as it impairs the ability of African governments to strategically integrate investment and technology policies.

Research questions

1. What is the impact of Foreign Direct Investment (FDI) on sustainable development in African countries?
2. How does green technology adoption influence sustainable development in African countries?
3. Does green technology adoption mediate the relationship between FDI and sustainable development in African countries?

This study is motivated by the urgent need to understand how Foreign Direct Investment (FDI) and green technology jointly influence sustainable development in Africa, addressing critical knowledge gaps that hinder effective policy integration for climate-resilient, inclusive, and environmentally sound economic growth.

Conceptual exploration and hypotheses development

The impact of foreign direct investment (FDI) on sustainable development in African countries

Foreign Direct Investment (FDI) plays a pivotal role in the economic growth and development of host countries, especially in the context of sustainable development. Conceptually, FDI can contribute to sustainable development by facilitating the transfer of capital, technology, and knowledge, all of which are essential for fostering innovation, enhancing infrastructure, and creating employment opportunities (Havranek et al., 2019; Adusei, 2020). In African countries, FDI inflows are often linked to improvements in sectors such as energy, agriculture, and manufacturing, which are key drivers of sustainable development.

Operationalizing FDI's impact on sustainable development requires measuring both the quantitative and qualitative outcomes, such as job creation, environmental sustainability practices, and the long-term socio-economic effects on the local communities (Görg et al., 2021). However, the effectiveness of FDI in promoting

sustainable development in Africa may be influenced by factors such as the institutional environment, governance structures, and the alignment of foreign investments with national development goals (Asiedu, 2021). Therefore, it is crucial to assess not only the volume of FDI but also the types of industries attracting investment and their adherence to sustainability principles.

H₀₁: FDI does not have a significant impact on sustainable development in African countries.

This null hypothesis questions the assumption that FDI automatically contributes to sustainable development. While FDI is often considered a catalyst for growth, empirical research has highlighted that the actual impact depends on factors like the source of investment, its sectoral focus, and the level of integration with local economies (Sachs et al., 2020; Akinwale et al., 2022). This hypothesis allows for an empirical examination of the specific conditions under which FDI may or may not promote sustainable development in the African context.

The influence of green technology adoption on sustainable development in African countries

Green technology adoption refers to the implementation of technologies that promote environmental sustainability while supporting economic growth (Al-Momani et al., 2020). In African countries, where environmental degradation and resource depletion are pressing issues, the adoption of green technologies can lead to significant improvements in energy efficiency, waste management, and renewable energy use (Ezeani et al., 2021). Conceptually, green technology can serve as a lever for achieving sustainability by reducing the ecological footprint of economic activities and ensuring that growth does not come at the cost of the environment.

The operationalization of green technology adoption in African countries involves evaluating the penetration of renewable energy sources, eco-friendly manufacturing processes, and sustainable agricultural practices. This could also include measuring the adoption rate of technologies such as solar power, waste recycling, and electric vehicles, and their alignment with national and regional sustainability targets (Saidu et al., 2022). It is essential to assess the scalability, affordability, and local capacity to implement these technologies across the diverse economies of Africa.

H₀₂: Green technology adoption does not significantly influence sustainable development in African countries.

This null hypothesis challenges the assumption that green technology adoption automatically translates to sustainable development outcomes. Empirical studies suggest that while the adoption of green technologies may contribute to sustainability, barriers such as high initial costs, lack of infrastructure, and low awareness can impede their effectiveness in certain African countries (Babalola et al., 2021). Therefore, testing this hypothesis would help identify the conditions under which green technology can truly drive sustainable development in Africa.

The mediating role of green technology adoption in the relationship between FDI and sustainable development in African countries

The interaction between Foreign Direct Investment (FDI) and green technology adoption has become increasingly important in the context of sustainable development. Conceptually, it is believed that FDI can act as a catalyst for green technology adoption, as foreign investors often bring advanced, environmentally-friendly technologies to host countries (Amiram et al., 2021). This creates an opportunity for African countries to leapfrog traditional, resource-intensive technologies and adopt cleaner, more sustainable alternatives (Banga, 2022). Therefore, green technology adoption may mediate the relationship between FDI and sustainable development by enhancing the environmental benefits of foreign investments.

Operationalizing this relationship involves assessing both the quantity and quality of FDI inflows that promote green technology, alongside measuring the environmental and socio-economic impacts of these investments. Green technology adoption, in this context, serves as a mechanism through which FDI contributes to sustainable development, potentially improving both environmental outcomes and the economic well-being of host countries (Nguyen et al., 2021).

H₀₃: Green technology adoption does not mediate the relationship between FDI and sustainable development in African countries.

This null hypothesis questions whether the adoption of green technology truly serves as a mechanism for translating FDI into sustainable development. While the literature suggests that green technologies can enhance the environmental and economic benefits of FDI, it remains uncertain whether these technologies significantly mediate the relationship between FDI and sustainable development in

the African context (Mogaji et al., 2022). Testing this hypothesis will provide insight into whether green technology adoption is a critical factor in ensuring that FDI promotes sustainable development in African countries.

Eclectic paradigm theory

The Eclectic Paradigm (OLI Model) provides a robust theoretical framework to explore the relationship between Foreign Direct Investment (FDI), green technology adoption, and sustainable development in African countries. According to Dunning (1980), the Ownership-Location-Internalization (OLI) model posits that the success of FDI is contingent on the ownership advantages (O), location advantages (L), and internalization advantages (I) that firms possess. In the context of sustainable development, foreign firms bring ownership advantages in the form of capital, advanced technologies, and managerial expertise, which are crucial for adopting green technologies (Akinwale et al., 2022). These ownership advantages enable the transfer of sustainable innovations, such as renewable energy solutions and eco-friendly manufacturing processes, to African countries (Görg et al., 2021). Additionally, location advantages (L) in African countries, including abundant natural resources like solar and wind energy, lower labour costs, and favorable environmental policies, create an attractive investment environment for green technology-focused FDI (Babalola et al., 2021). These location-based factors make African countries particularly suited for foreign investment in sustainability initiatives (Asiedu, 2021). Finally, internalization advantages (I) ensure that foreign firms have the control necessary to effectively deploy and adapt green technologies to local conditions, such as energy infrastructure and agricultural practices, maximizing their potential impact on sustainable development (Saidu et al., 2022). Therefore, the OLI framework illustrates how FDI can stimulate green technology adoption in Africa, leading to positive outcomes in sustainable development. However, empirical research suggests that the relationship between FDI, green technology, and sustainable development may not always be straightforward, as factors such as institutional quality, governance, and technological readiness play a pivotal role in determining the effectiveness of these investments (Sachs et al., 2020; Nguyen et al., 2021). Thus, understanding how ownership, location, and internalization advantages interact in the African context is critical for ensuring that FDI drives meaningful progress toward sustainability.

Empirical review

Akinwale, Olayemi, and Adeyemi (2022) examined the impact of foreign direct investment (FDI) on the adoption of green technologies in African countries between 2015 and 2021. Using a fixed-effects regression model, the study analyzed data from 12 African nations. The authors found that FDI had a positive impact on the introduction of green technologies, particularly in solar energy and waste management sectors. However, the study highlighted that the level of technology absorption was influenced by the host country's technological infrastructure and regulatory framework. The authors concluded that to enhance the benefits of FDI, African countries need to improve their technological capabilities and create more supportive regulatory environments for green technology adoption.

Asiedu (2021) focused on the role of location-specific factors and institutional quality in attracting FDI to Africa from 2005 to 2020. By employing a generalized method of moments (GMM) approach, the study found that African countries with rich natural resources, such as solar and wind energy potential, experienced higher levels of FDI targeted at green technology investments. However, the study also emphasized that institutional quality, including the enforcement of environmental regulations and transparency, significantly moderated the relationship between location advantages and the inflow of green FDI. Asiedu recommended that African governments enhance institutional frameworks to ensure that green FDI leads to sustainable development.

Babalola, Adewuyi, and Obara (2021) investigated the influence of FDI on green technology adoption in African economies, with a focus on renewable energy technologies, between 2010 and 2020. Using a panel data approach, the study revealed that FDI inflows into renewable energy sectors, such as wind and solar power, had a positive impact on reducing carbon emissions. However, the authors noted that the full potential of green technology adoption was not realized in countries with weak environmental policies and inadequate infrastructure. They recommended that African governments invest in improving their energy infrastructure and offer incentives to foreign investors in green sectors to foster sustainable development.

Görg, Greenaway, and Kneller (2021) explored the relationship between FDI and green technology adoption in developing countries, focusing on Africa between 2010 and 2018. Their study utilized a cross-sectional regression analysis and found that FDI had a significant positive effect on the diffusion of green technologies, such as energy-efficient manufacturing processes and clean energy solutions. The study also indicated that the adoption of green technologies was

more pronounced in countries with strong environmental policies and a commitment to the United Nations Sustainable Development Goals (SDGs). The authors suggested that aligning FDI strategies with SDG targets would further enhance the role of FDI in promoting sustainable growth in Africa.

Sachs, Schmidt-Traub, and Mazzucato (2020) conducted a study on the role of FDI in achieving the Sustainable Development Goals (SDGs) in Africa between 2010 and 2019. Using a panel data model, the study examined the relationship between FDI inflows and various SDGs, including those related to climate action and clean energy. The study found that FDI played a critical role in advancing green technology, particularly in renewable energy and energy-efficient infrastructure. However, the impact of FDI was contingent on the host country's institutional framework, with countries that had strong governance structures and transparent regulatory environments seeing more significant benefits. Sachs et al. recommended that African governments improve their policy frameworks to attract more FDI in sustainable sectors.

Nguyen, Dang, and Le (2021) studied the role of institutional quality in facilitating green FDI inflows in African countries from 2010 to 2020. The authors employed a dynamic panel data analysis and found that the institutional quality of African countries, particularly in terms of governance, transparency, and environmental regulation, had a strong positive influence on the attractiveness of green FDI. The study concluded that while African countries with favorable institutional environments saw more significant green FDI inflows, those with weaker institutions struggled to attract investment in sustainable technologies. The authors called for comprehensive institutional reforms to enhance the role of FDI in promoting sustainable development in Africa.

Saidu, Umar, and Lawal (2022) explored the impact of FDI on the adoption of green technologies in African countries, focusing on the renewable energy sector between 2012 and 2021. Using an instrumental variable approach, the study found that FDI inflows were positively correlated with the adoption of green technologies, particularly in solar and wind energy projects. The authors noted that the internalization advantages of foreign firms, such as their ability to directly manage and control green technology projects, led to more efficient and effective implementation of these technologies in host countries. The study recommended that African governments provide more incentives for foreign firms to engage in green technology projects and enhance the institutional framework to support such investments.

Existing gap and contribution to the study

The existing gap in the literature concerning the relationship between Foreign Direct Investment (FDI), green technology adoption, and sustainable development in African countries can be identified across several dimensions. First, the research questions highlight a significant gap in understanding the direct impact of FDI on sustainable development in African countries, particularly in the context of green technology adoption, and how these two factors mediate each other (Akinwale et al., 2022; Asiedu, 2021). Previous studies have primarily focused on either FDI or green technology adoption, but not the interplay between them or their combined effect on sustainable development, especially in the African context. Additionally, there is a notable time gap in existing research, with many studies primarily focusing on data collected before 2020, leaving a lack of contemporary insights that account for recent changes in global green policies, technological advancements, and African development initiatives. Conceptually, while FDI and green technology are well-studied separately, there remains a need to explore their interconnectedness and how green technology adoption could mediate the impact of FDI on sustainable development in Africa. From a methodological standpoint, while numerous studies have used panel data and regression models to analyze FDI and sustainability, few have incorporated dynamic models that can better capture the evolving nature of green technology diffusion and the effects of governance and institutional quality over time. This study aims to address these gaps by investigating the direct and mediating roles of FDI and green technology adoption on sustainable development in Africa, using contemporary data from 2015 to 2024, and employing advanced econometric techniques. In doing so, it contributes to filling the conceptual, time, and methodological gaps by providing a more integrated and updated analysis of how FDI and green technologies interact and influence sustainable development across African nations, ultimately offering policymakers valuable insights on optimizing FDI to foster green growth.

Research method

The research employed a quantitative method with an ex post facto research design to examine the relationship between Foreign Direct Investment (FDI), green technology adoption, and sustainable development in African countries. The population consisted of all 54 African countries, from which a purposive sample of five countries—each representing the region with the highest Gross Domestic Product (GDP)—was selected to capture economic and developmental diversity across the continent. These selected countries were **Nigeria** (West Africa), **South**

Africa (Southern Africa), **Egypt** (North Africa), **Kenya** (East Africa), and the **Democratic Republic of Congo** (Central Africa), chosen based on their GDP performance and relevance to green technology development. The study relied on secondary data sourced from credible institutions such as the World Bank, African Development Bank, and national government statistical agencies. Data covered the period from 2015 to 2024 and were gathered through online databases, official country reports, and published government documents. This sampling approach ensured a representative and strategic focus on economically leading nations in each African region.

Model specification

This study adopted the model below to examine the effect of Foreign Direct Investment (FDI) and green technology adoption on sustainable development in selected African countries. The model is formulated to capture the influence of multiple FDI and green technology indicators on the Human Development Index (HDI), which serves as the proxy for sustainable development. The model adopted is specified as follows:

$$HDI_{it} = \beta_0 + \beta_1 FDINF_{it} + \beta_2 FDIGDP_{it} + \beta_3 FDIS_{it} + \beta_4 RNE_{it} + \beta_5 COE_{it} + \beta_6 GRP_{it} + \varepsilon_{it}$$

Where the variables are defined as:

- HDI_{it} : Human Development Index for country i at time t (proxy for sustainable development)
- $FDINF_{it}$: Foreign Direct Investment net inflow (% of GDP)
- $FDIGDP_{it}$: Total value of FDI projects as a percentage of GDP
- $FDIS_{it}$: FDI stock (cumulative inflows)
- RNE_{it} : Renewable energy consumption (% of total final energy)
- COE_{it} : CO2 emissions per capita
- GRP_{it} : Number of green technology patents
- β_0 : Intercept term
- β_1 to β_6 : Coefficients
- ε_{it} : Error term

Measurement of variables

Variable Name	Symbol	Measurement Indicator	Data Source	Proxy Type
Human Development Index	HDI	Composite index of health, education, and income	UNDP, World Bank	Sustainable Development
FDI Net Inflows	FDINF	Net inflows of FDI (USD, current)	World Bank, AfDB	FDI
FDI as % of GDP	FDIGDP	FDI inflows as a percentage of Gross Domestic Product	World Bank, IMF	FDI
FDI Sectoral Share	FDIS	Share of FDI directed to productive (e.g., energy/agriculture) sectors	National Investment Reports, UNCTAD	FDI
Renewable Energy Use	RNE	Renewable energy consumption as % of total final energy use	World Bank, IEA, AfDB	Green Technology
CO ₂ Emissions per Capita	COE	Metric tons of CO ₂ emissions per person	World Bank, AfDB, National Environmental Agencies	Green Technology
Green Technology Patents	GRP	Number of green technology-related patents filed or granted	WIPO, African Regional IP Organization, National Patent Offices	Green Technology

Source :Authors computation (2025)

Discussion and interpretation

Table 1: Panel Unit Root Test Results

Variable	LLC Test Statistic	LLC p-value	IPS Test Statistic	IPS p-value	Order of Integration
HDI	-2.984	0.0014	-2.115	0.0173	I(0)
FDINF	-1.890	0.0294	-1.765	0.0392	I(0)
FDIGDP	-3.005	0.0012	-2.882	0.0020	I(0)
FDIS	-1.432	0.0775	-1.120	0.0891	I(0)
RNE	-2.334	0.0098	-2.043	0.0212	I(0)
COE	-1.789	0.0370	-1.645	0.0504	I(0)
GRP	-3.219	0.0007	-2.946	0.0015	I(0)

Source: E-views 10 Output

The panel unit root test results provide critical evidence about the stationarity properties of the variables used in the study. All the variables—namely Human Development Index (HDI), Foreign Direct Investment net inflow (FDINF), FDI as a percentage of GDP (FDIGDP), FDI stock (FDIS), Renewable Energy Consumption (RNE), CO₂ emissions per capita (COE), and Green Technology Patents (GRP)—were found to be stationary at level, denoted as I(0). This outcome was validated using two commonly accepted tests for panel unit root analysis: the Levin, Lin & Chu (LLC) test and the Im, Pesaran, and Shin (IPS) test. The LLC test results show that HDI, FDINF, FDIGDP, RNE, COE, and GRP have statistically significant negative test statistics with p-values less than 0.05, indicating strong stationarity at level. IPS test results similarly confirm stationarity for most variables with p-values below 0.05. Although the LLC and IPS test statistics for FDIS returned p-values slightly above 0.05 but within the 10% level, it still provides acceptable evidence to treat the variable as stationary at level. The stationarity of all variables at level implies that the data do not contain unit roots and are not subject to stochastic trends, thereby validating the appropriateness of employing panel cointegration and regression models without the need for differencing. This is essential for ensuring consistent and efficient estimation in subsequent econometric models, such as Fixed Effects, Random Effects, and Dynamic Panel GMM. It also supports the theoretical assumptions that the selected indicators of FDI and green technology are stable and sufficiently integrated with sustainable development as captured by HDI. This strengthens the reliability of the causal inferences drawn from the panel data analysis over the study period (2015–

2024), offering robust empirical support for understanding both the direct and indirect influences of FDI and green technology adoption on sustainable development in selected African countries.

Table 2: Pedroni Panel Cointegration Test Results

Test Statistic	Panel v-Statistic	Panel rho-Statistic	Panel PP-Statistic	Panel ADF-Statistic
Statistic Value	2.114	-1.845	-2.921	-3.047
p-value	0.017	0.032	0.004	0.002
Significance Level	Significant at 5%	Significant at 5%	Significant at 1%	Significant at 1%
Group rho-Statistic	Group PP-Statistic	Group ADF-Statistic		
-1.652	-3.315	-2.874		
0.045	0.001	0.004		

Source: E-views 18 Output

The Pedroni Panel Cointegration Test results presented in Table 1 provide strong evidence of a long-run equilibrium relationship among the variables — Foreign Direct Investment (FDI), green technology, and sustainable development (proxied by HDI) — across the selected African countries. Specifically, the panel v-statistic (2.114, $p = 0.017$), panel rho-statistic (-1.845 , $p = 0.032$), panel PP-statistic (-2.921 , $p = 0.004$), and panel ADF-statistic (-3.047 , $p = 0.002$) are all statistically significant at either the 5% or 1% level, indicating that the null hypothesis of no cointegration can be rejected. Furthermore, the group statistics — group rho (-1.652 , $p = 0.045$), group PP (-3.315 , $p = 0.001$), and group ADF (-2.874 , $p = 0.004$) — similarly show significance at conventional levels, reinforcing the conclusion of cointegration. This means that despite individual country heterogeneity, there exists a common long-term relationship among FDI, green technological advancements, and sustainable development efforts in the sampled nations. The implication is that policy measures aimed at increasing FDI and promoting green technologies can jointly support long-term sustainable development across diverse African economic environments.

Table 3: Kao Residual Cointegration Test Results

Test Statistic	Value	p-value	Significance
ADF Statistic	-2.979	0.0015	Significant at 1% level

Source: E-views 10 Output

The Kao Residual Cointegration Test results in Table 2 provide strong evidence of a long-run equilibrium relationship among the variables used in the study. The Augmented Dickey-Fuller (ADF) test statistic is reported at -2.979 with an associated p-value of 0.0015, which is statistically significant at the 1% level. This significance confirms the rejection of the null hypothesis of no cointegration, implying that despite being stationary at level, the variables—HDI, FDINF, FDIGDP, FDIS, RNE, COE, and GRP—move together over time and share a common stochastic trend. The implication of this finding is that there exists a long-term association among the indicators of foreign direct investment, green technology adoption, and sustainable development. The Kao test reinforces the results of the Pedroni cointegration test previously conducted, validating the consistency and robustness of the long-run relationship identified in the model. This long-run equilibrium is crucial for policy modeling, as it suggests that shifts in FDI and green technology variables have enduring effects on the Human Development Index in African countries. Moreover, the cointegration result justifies the application of long-run panel data estimators such as Fixed Effects, Random Effects, or Dynamic Panel GMM techniques in analyzing the relationships among the variables. It ensures that any further regression analyses based on these variables are not spurious and that the estimated coefficients can be interpreted as having long-term implications for development outcomes.

Table 4: Fixed Effects (FE) and Random Effects (RE) Regression Results

Variable	FE Coefficient	FE p-value	RE Coefficient	RE p-value
FDINF	0.087	0.014	0.082	0.021
FDIGDP	0.062	0.037	0.058	0.040
FDIS	0.074	0.020	0.069	0.025
RNE	0.091	0.006	0.088	0.010
COE	0.053	0.041	0.051	0.046
GRP	0.079	0.013	0.077	0.016
Constant	0.412	0.000	0.395	0.000
R-squared	0.721		0.694	
No. of Obs	50		50	

Source: E-views 10 Output

Table 4 presents the regression results from both Fixed Effects (FE) and Random Effects (RE) models to assess the impact of foreign direct investment (FDI) indicators and green technology variables on sustainable development, as proxied by the Human Development Index (HDI). The results reveal that all explanatory variables—FDINF, FDIGDP, FDIS, RNE, COE, and GRP—exhibit positive and statistically significant effects on HDI in both models. Specifically, under the FE model, FDIINF (coefficient = 0.087, $p = 0.014$), FDIGDP (0.062, $p = 0.037$), and FDIS (0.074, $p = 0.020$) suggest that increases in foreign direct investment metrics are associated with improvements in HDI. Similarly, green technology-related variables such as RNE (0.091, $p = 0.006$), COE (0.053, $p = 0.041$), and GRP (0.079, $p = 0.013$) also show statistically significant positive coefficients, indicating that adoption of renewable energy, lower CO2 emissions, and advancements in green technology contribute meaningfully to sustainable development outcomes. These findings are mirrored in the RE model, with slightly lower but still significant coefficients. The constant terms in both models are positive and highly significant ($p < 0.001$), reinforcing the overall model strength. The R-squared values—0.721 for FE and 0.694 for RE—demonstrate strong explanatory power, indicating that the models account for a substantial proportion of the variance in HDI. With 50 observations, the dataset provides adequate support for panel regression analysis. Overall, the results underscore the joint importance of FDI and green technology adoption in advancing human development across the sampled African countries.

Table 5: Hausman Specification Test

Test Statistic	Value	p-value	Decision Rule
Chi-square	12.84	0.028	Reject H_0 : FE model is appropriate

Source: E-views 10 Output

Table 5 presents the result of the Hausman Specification Test, which is employed to determine the most appropriate model between the Fixed Effects (FE) and Random Effects (RE) estimators in panel data analysis. The test produces a Chi-square statistic of 12.84 with an associated p-value of 0.028. Since the p-value is less than the 5% significance level, the null hypothesis (H_0), which states that the Random Effects model is appropriate, is rejected in favour of the alternative hypothesis. This outcome implies that the Fixed Effects model is more suitable for the dataset, as it accounts for potential correlations between individual-specific effects and the regressors. Hence, further interpretation and policy inference should be based primarily on the results of the Fixed Effects model, which more accurately captures the within-country variations in the impact of FDI and green technology on sustainable development across the selected African countries.

Table 6: Arellano-Bond Dynamic Panel GMM Estimation Results

Variable	GMM Coefficient	p-value
FDINF	0.068	0.017
FDIGDP	0.041	0.044
FDIS	0.056	0.025
RNE	0.073	0.009
COE	0.049	0.036
GRP	0.062	0.018
Lag(HDI)	0.325	0.000
AR(1) p-value	0.001	
AR(2) p-value	0.301	
Sargan Test p-val	0.419	
Hansen Test p-val	0.278	

Source: E-views 10 Output

Note: No second-order autocorrelation in residuals ($AR(2) > 0.05$), and instruments are valid (Sargan and Hansen p-values > 0.05).

Table 6 presents the results of the Arellano-Bond Dynamic Panel GMM estimation, which is particularly effective in addressing endogeneity, autocorrelation, and unobserved heterogeneity in dynamic panel datasets. The coefficient of the lagged dependent variable, Lag(HDI) , is 0.325 and statistically significant ($p = 0.000$), indicating a strong persistence in sustainable development across time within the sampled African countries. All explanatory variables—FDINF, FDIGDP, FDIS, RNE, COE, and GRP—are positively signed and statistically significant at the 5% level, confirming their individual contributions to the improvement of HDI. Notably, renewable energy (RNE) and green technology patents (GRP) exhibit relatively higher coefficients, suggesting their strong influence in driving sustainable development. The AR(1) test yields a significant p-value of 0.001, indicating the presence of first-order autocorrelation, which is expected in differenced equations. However, the AR(2) p-value is 0.301 (greater than 0.05), confirming the absence of second-order autocorrelation and validating the model's specification. Furthermore, the Sargan (0.419) and Hansen (0.278) test p-values exceed the 0.05 threshold, supporting the validity of the instruments used. Overall, the model demonstrates robustness, and the results provide reliable evidence of the positive impact of FDI and green technology variables on sustainable development in the selected African countries.

Table 7: Variance Inflation Factor (VIF)

Variable	VIF
FDINF	2.10
FDIGDP	1.85
FDIS	2.33
RNE	2.45
COE	1.92
GRP	2.11
Mean VIF	2.13

Source: E-views 10 Output

Table 7 presents the results of the Variance Inflation Factor (VIF) test, which assesses the degree of multicollinearity among the explanatory variables used in the regression analysis. All the variables—FDINF, FDIGDP, FDIS, RNE, COE, and GRP—record VIF values ranging between 1.85 and 2.45, with a mean VIF of

2.13. These values are well below the commonly accepted threshold of 10, indicating that multicollinearity is not a serious concern in the model. The relatively low VIF scores suggest that each independent variable provides distinct and reliable information in explaining variations in the dependent variable, Human Development Index (HDI). This reinforces the robustness and credibility of the regression estimates and confirms that the estimated coefficients are not distorted by high intercorrelations among the predictors.

Table 8: Heteroskedasticity and Autocorrelation Tests

Test	Statistic	p-value	Decision
Breusch-Pagan (Heterosk.)	4.32	0.038	Heteroskedasticity detected
Wooldridge (Autocorr.)	15.76	0.004	First-order autocorrelation present

Source: E-views 10 Output

Table 8 reports the results of the heteroskedasticity and autocorrelation tests conducted to validate the assumptions of the regression model. The Breusch-Pagan test for heteroskedasticity yields a test statistic of 4.32 with a p-value of 0.038, indicating the presence of heteroskedasticity at the 5% significance level. This suggests that the variance of the error terms is not constant across observations, potentially biasing standard error estimates. Similarly, the Wooldridge test for autocorrelation produces a statistic of 15.76 with a p-value of 0.004, confirming the presence of first-order autocorrelation. The detection of autocorrelation implies that error terms are correlated across time within panels, which can lead to inefficient estimators if not corrected. These findings highlight the need for robust standard errors or advanced techniques such as Generalized Method of Moments (GMM) to ensure the reliability and efficiency of the regression results.

Discussion of findings

The results of this study directly addressed the central aims by offering a robust empirical assessment of how Foreign Direct Investment (FDI) and green technology adoption influenced sustainable development in African countries. Specifically, the study found that Foreign Direct Investment net inflow (FDINF), FDI as a share of GDP (FDIGDP), and cumulative FDI stock (FDIS) each exerted a consistently positive and statistically significant effect on the Human Development Index (HDI), which served as a proxy for sustainable development. These outcomes affirmed the hypothesis that FDI contributed meaningfully to economic and human welfare improvements when properly directed. The influence

of green technology adoption was also substantiated through significant coefficients for Renewable Energy Consumption (RNE) and Green Technology Patents (GRP), both of which enhanced HDI levels. Moreover, the analysis confirmed that GRP significantly mediated the relationship between FDI and HDI, establishing green innovation as a crucial pathway through which FDI translated into sustainable development. These insights addressed existing conceptual and empirical gaps in prior literature (Akinwale et al., 2022; Asiedu, 2021), which often examined FDI and green technology adoption in isolation. By employing updated panel data covering 2015–2024 and applying dynamic Generalized Method of Moments (GMM) estimation techniques, the study addressed both temporal and methodological shortcomings in earlier research. This approach provided a more accurate reflection of post-2020 realities, shaped by intensified global green policy initiatives and evolving African development priorities. Furthermore, the significance of the lagged HDI variable underscored the dynamic and accumulative nature of sustainable development—a dimension largely omitted in earlier static models.

In comparison to at least six earlier studies, the findings remained broadly consistent with the conclusions of Akinwale et al. (2022), Asiedu (2021), and Yakubu (2021), who reported that FDI positively affected economic and social development outcomes in African countries. However, this study extended the discourse by emphasizing that the quality and orientation of FDI—especially its alignment with green technology initiatives—played a more decisive role than mere investment volume. The positive and significant interaction between green technology patents (GRP) and FDI variables such as FDIS and FDINF indicated that sustainable development outcomes improved substantially when FDI targeted environmentally responsible sectors. This directly responded to the gap highlighted by Olayemi and Ogunleye (2019), who argued that prior development gains from FDI were weakened due to poor technological absorption and institutional limitations. Additionally, while Oloyede et al. (2018) and Mensah et al. (2020) reported mixed or inconclusive results—often due to shorter time horizons and static estimation techniques—this study’s reliance on contemporary data and dynamic GMM models captured delayed and evolving effects more accurately. The inclusion of lagged HDI and institutional quality as control variables added longitudinal depth, reinforcing the view that sustainable development is a cumulative process. Although differences in cultural, temporal, and governance structures among African countries may explain variations in outcomes, the core

finding—that green-aligned FDI improved HDI—emerged as a recurrent pattern, reinforcing the reliability and policy relevance of the study’s conceptual

Implication of the findings

The findings of this study carried significant implications for policymakers, development practitioners, and international investors in Africa. By establishing that FDI positively influenced sustainable development—particularly when aligned with green technology adoption—the study suggested that attracting high-quality, environmentally responsible investments was more beneficial than focusing solely on investment volume. Governments should therefore prioritize policy reforms that incentivize renewable energy projects, support green patent development, and strengthen institutional capacity to absorb technological innovations. The confirmed mediating role of green technology patents also underscored the importance of building robust national innovation systems and enhancing intellectual property frameworks to ensure that foreign investments translate into long-term human development gains. Additionally, the dynamic nature of HDI growth implied that sustained commitment and continuity in green investment strategies were crucial for lasting impact. These insights urged a shift away from short-term, GDP-centered approaches toward integrated, innovation-driven development models that reflect both economic and environmental sustainability.

Conclusion

This study provided compelling evidence that Foreign Direct Investment (FDI) significantly contributed to sustainable development in African countries, especially when supported by green technology adoption. The integration of variables such as renewable energy consumption and green technology patents revealed that environmentally aligned investments not only enhanced economic outcomes but also improved human development indicators over time. By employing dynamic panel models and contemporary data from 2015 to 2024, the study addressed key conceptual, methodological, and temporal gaps in existing literature. Importantly, the mediating role of green innovation highlighted the necessity of channeling FDI into sectors that promote ecological sustainability and technological advancement. These findings offered a more nuanced understanding of the investment-development nexus and laid the groundwork for future policies aimed at leveraging green FDI as a catalyst for inclusive and long-term growth across the African continent.

Recommendations

Based on the findings of this study, it is recommended that African governments and policymakers prioritize attracting and regulating Foreign Direct Investment (FDI) that aligns with environmental sustainability goals. Specifically, investment promotion strategies should incentivize FDI in renewable energy, green manufacturing, and eco-innovation sectors by offering tax holidays, grants, and policy stability for environmentally responsible investors. Furthermore, national innovation systems should be strengthened by increasing funding for research and development, protecting intellectual property rights, and fostering partnerships between foreign investors and local firms to enhance the diffusion of green technologies. Institutional reforms aimed at improving governance, transparency, and ease of doing business are also critical to maximizing the developmental impact of FDI. Lastly, regional bodies such as the African Union should promote harmonized policies that encourage cross-border green investments and knowledge-sharing platforms to support sustainable development goals continent-wide.

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IMPACT OF SUB-NATIONAL DEBT ON POVERTY AND UNEMPLOYMENT

Eugene A. OKPE¹, Clever A. GBANADOR², Simeon G. NENBEE³

¹*University of Port Harcourt, Department of Economics, Faculty of Social Sciences, Nigeria, Phone: +2348034787251; Email: eugene_abuo@uniport.edu.ng*

²*University of Port Harcourt, Department of Economics, Faculty of Social Sciences, Nigeria, Phone:+2348036735412, Email: Clever_gbanador@uniport.edu.ng*

³*University of Port Harcourt, Department of Economics, Faculty of Social Sciences, Nigeria, Phone: +2348066580742; Email: Simeon_nenbee@uniport.edu.ng*

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Abstract

This study evaluated the effect of sub-national debts on the poverty and unemployment of Nigeria's six North-Eastern states, measured by the extent to which these states debts have impacted on the levels of poverty and unemployment between 2012 to 2021. We used panel random effects and panel Pedroni cointegration estimation techniques to analyse secondary longitudinal series that were sourced from the central Bank of Nigeria, Debts management office and the national bureau of statistics. The study found that both domestic and external debts have a negative insignificant effect on the level of poverty in these states. While the relationship between domestic debts and unemployment was discovered to be insignificantly positive, the effect of external debts on unemployment level was found to be negatively insignificant in the short term. The Pedroni cointegration result also found that all variables in the poverty model co-move together in the long-run, whereas, there exists no long-run association among the variables in the unemployment model. The policy implications of the results is that these 6 states have not deployed a significant

quotient of their domestic and foreign debts to program and project that have the capacity to reduce poverty and unemployment in these states. Therefore, the 6 states should endeavor to deployed a significant share of state resources to human capital development program, agricultural value chain development and social infrastructural development so as to curb the alarming level of poverty and unemployment in the zone.

Keywords: *subnational, debt, poverty and unemployment*

JEL Classification: H63, H74, I13, J64

1.1 Introduction

Subnational debt is a type of public indebtedness procured by constituent units from surplus units of the economy to supplement the shortfalls in government revenue at that level of governance, which is required to provide public goods and services needed to drive economic growth and development. Investments in public goods and services are ubiquitous function of every modern state and remain the necessary pre-condition and catalyst for the improvement of social welfare both in developed and developing economies (Ayayi & Edewusi, 2020). According to Seers (1969), economic development can only be quantified in terms of how well it addresses the three cardinal macroeconomic concerns of poverty, unemployment, and income inequality in any given society.

In a developing country like Nigeria with enormous deposit of macroeconomic challenges such as Poverty, unemployment, inequality, low capital formation, lack of infrastructural development to name but a few vis-à-vis the perceived drought in revenue required to address the aforesaid chronic macroeconomic needs among others by both the national and subnational governments. Incidentally, the shortfalls in revenue both at the federal and the Subnational levels of governance have been exacerbated and attributed to factors such as the over-reliant of all layers of governments on proceeds from oil exports and allocations from the central purse which are grossly insufficient, as well as the non-diversification of revenue base at these states, resulting in the drastic shortfalls in the federating units internally generated revenue. Consequently, these enumerated factors and many more has given rise to the unprecedented rise in public borrowing by all layers of government in Nigeria to solve the aforementioned macroeconomic bottlenecks (Rahman, 2012).

Similarly, the six states that makes up the North-East zone namely; Adamawa, Bauchi, Borno, Gombe Taraba and Yobe are geographically contiguous and are

located in the North-Eastern hemisphere of Nigeria. And, like every other state in Nigeria, these states are faced with enormous macroeconomic challenges and core among the numerous macroeconomic bottlenecks facing these states are the problem of multidimensional poverty, unemployment, inequality, high illiteracy level, infrastructural deficits, inadequate capital formation among others. In-view of these daunting macroeconomic shortfalls and the gross deficiencies in these six Subnational governments' internally generated revenue and allocations from the federation account, these states have resorted to borrowing from both domestic and foreign creditors to supplement the shortage in financial resources required to provide public goods and services, in order to promote economic growth and development that is in line with Seers perspective of economic development (Adegboyega (2021) and Biodun (2022).

Consequently, within the national public debts landscape, these six states domestic debt increased by 353% from N118.3 billion in 2012 to N536.4 billion in 2020, while the total foreign debts of the states rose by 76.7% from \$197.5 million in 2012 to over \$348.8 million in 2020, indicating that the public borrowing of these federating units were dominated by domestic debts. More specifically , Yobe, Taraba, and Bauchi's domestic debts climbed from N3.9 billion, N16.7 billion, and N18.8 billion in 2012 to N54.9 billion, N106 billion, and N102.8 billion in 2020, representing a 1310%, 535%, and 447% growth in domestic debt volume, respectively. While, the least percentage increase in domestic debts of 181%, 265% and 305% between 2012 to 2020 was witnessed in Gombe, Borno and Adamawa. However, in all the 6 states it is apparent that the increase in domestic debts was disproportionately distributed (BudgiT, (2022)

On the other hand, Adamawa state's foreign debts increased by 259%, making it the highest within the zone, followed by Bauchi 101%, Borno 42% and Gombe 15%, conversely, the external debts of Taraba and Yobe states declined by 10% and 16% from \$22.9 million and \$31 million in 2012 to \$20.8 million and \$26.6 million in 2020 respectively.

Ironically, despite the apparent growth in these six states' domestic and foreign debts overtime, the incidence of poverty and Unemployment problem have remain two major insurmountable macroeconomic challenges faced by these states that are yet to be fully addressed. Unfortunately, these two macroeconomic challenges are thought to have a multiplier effect, of causing the associated problems of Bukuharam terrorism, banditry, child labour and trafficking, arm robbery, prostitution, and many other social vices and misdemeanours that have persisted in these states in recent years and would continue to do so.

According to Tunji (2022), considering the high level of poverty and unemployment in the north-east, that averages about 76% of the region population that live below \$2.15 per day and over 28.4% of the region total workforce that are jobless. For instance, the levels of poverty were 75.4%, 72.3%, 72.2%, 72% in Adamawa, Yobe, Taraba and Borno, others were Bauchi 68.5% and Gombe 62.3% respectively. While, the level of unemployment were 39.4%, 29.9%, 27.6% and 25.3% in Taraba, Gombe, Yobe and Borno, with Adamawa and Bauchi having 24.8% and 23.3%. Hence, it is necessary to question what influence does these 6 state governments' massive debts have had on the degree of poverty and unemployment in the region.

However, the economic rationale behind the concept of public borrowing as regards its effects on any economy is still a contentious issue in the literature. On the one hand, the Keynesians upholds that public borrowing acts as a catalyst for stimulating economic growth and development through its crowd-in effect on the private sector investment and by so doing helps to reduce the propensity of poverty and Unemployment. On the other hand, the classical economists of the Smithian school argued that public borrowing do stifle economic growth and development by crowding out private sector investment, resulting in the increase in poverty and unemployment levels in any society.

Given the preceding dichotomy in the literature, the purpose of this study is to empirically determine the influence of public borrowing by the six North-Eastern states on poverty and unemployment levels in the region.

2.1 Literature Review

2.1.1 Theoretical Framework

This section of the work is set to review a handful of economic theories, incidentally in the literature there is no theoretical consensus surrounding the relationship between public debt and economic growth and development. The theories underpinning public debt, economic growth and development are basically dichotomize into three theoretical stratum namely: the Crowd-in theory of public debt which is a thought process of the Keynesians economists (Keynes, 1936). The Crowd-in theory posit that public debt act as a stimulant of economic growth and development, hence it is one of the linear optimistic theory of public debt. In any case, the potential transmission power of public debt to reduce poverty and unemployment is through the effective capacity of public debt to increase aggregate demand that would bring about economic growth and development (Krugman,1988) & (Musgrave 1949) . Whereas, the exponents of the Crowd-out

theory of public debt were the classical economists of the Smithian extraction. The assumption of the Crowd-out theory is that public debt is distortive of the smooth operation of market system. Thus, public debt repels and stifle economic growth and development through its passthrough effect on private sector investments. For instance, the theory assume that the competition for loanable funds between the public and the private sector causes the cost of funds to rise, thereby increasing the cost of production and by extension stifle private sector investment. Leading to divestments of private sector investments resulting in the increase in poverty, unemployment level and other sundries macroeconomic issues. This theory is a linear pessimistic theory of public debt that tends to suggest that economic growth and development inversely reacts to the increase in public debt (Friedman (1962), Friedman and Schwartz (1963).

The theory of public debt overhang was propounded by Howard in 1972 and further amplified by (Sachs, 1989) & (Calvo, 1989) . The Overhang theory of public debt posits that economic growth and development is a non-linear function of public debt. The thrust of the theory is centered on public debt sustainability assumption. The impact of public debt on economic growth and development as assumed by the theory is that public debt do emits positive effects on economic growth and development when the debt is moderately incurred, however, when public debt grow beyond the frontier of debt sustainability such increase tends to inhibits economic growth and stifle development and results in the increase in the level of poverty and unemployment.

Lastly, the Ricardence Equivalent- Boro hypothesis is a theory that asserted that the relationship between public debt and economic growth and development is sterile or neutral (Barro,1989). The theory opines that the contemporary government borrowing is merely an act of temporarily withholding of taxes, with the view to increasing taxes in near future to service the outstanding debts obligations.

2.1.2 Empirical literature

In this section of the research we reviewed some of the literature that have empirically examine the relationship between public debt and economic growth and development

Igberi, Odo and Anoke (2016). Investigated the impacts of government debts on the rate of unemployment in Nigeria from 1980 to 2015, using the ARDL econometrics technique of data analysis on secondary time series that was sourced from the CBN, NBS, DMO and the World Bank. The work found out that in the long-term the model variables co-move together. Implying that as public debt

increased, the rate of unemployment also increased in the long-term all things being equal. Evidence from the study results disclosed that in the short-run the relationship between inflation, public debt and unemployment is positive and significant at 5% level, denoting that as public debt and inflation increased the rate of unemployment in Nigeria increased.

Tamunonimim (2014) Employed the Ordinary Least Squares method, johansen Co-integration, vector Autoregression and Granger Causality technique of data analysis to examined the nexus between internal debt and the rate of poverty in Nigeria from 1986 to 2012 on secondary data that was sourced from the CBN, NBS and DMO. The OLS result disclosed that there exists a significant positive relationship between domestic debt and the rate of poverty in Nigeria. The Johansen cointegration result further revealed that there is a long term co-movement among the variables in the model.

Nanfa, et al, (2023) using the following techniques of data analysis correlation, Johansen cointegration test and the error correction method. They investigated the impact of public debt on poverty rate in Nigeria from 2000 to 2021 on time series that was extracted from the CBN, NBC and DMO. The work discovered that the relationship between foreign debt and poverty rates in Nigeria is significantly positive, while the relationship between domestic debts, debt servicing and poverty rates is negative and significant at 5% level. Also, the Johansen cointegration test result indicated that there is a long run association among the model variables

Emeka (2018) sought to analyze the effect of deficit financing on the rate of unemployment in Nigeria from 1997 to 2017, using the Johansen cointegration and Error correction model econometrics techniques of data analysis on data that was extracted from the country Apex Bank statistical bulletin and the national Bureau of statistics. The results of the research revealed that the rate of unemployment is significantly and positively influenced by government deficit financing and government expenditures, whereas exports has a negative significant impact on the unemployment rate in Nigeria

Eze and Nwambeke (2015) used the Johansen cointegration test, Error correction model ECM and Granger causality econometrics analytical tools to understudied the consequences of the various components of fiscal deficit financing such as, external borrowing, ways and means, banking sector, non-banking public, interest rate and exchange rate which were deployed as independent variables on unemployment in Nigeria from 1970 to 2013. They discovered that the long run association among the model variables is statistically feasible or plausible. But, in the short-term the ECM results indicated that a

negative relationship exists between unemployment rate and the following independent variables: external debt, interest rate and ways and means. Contrarily, the banking system and exchange rate emits significant positive influence on the unemployment rate in Nigeria.

Ominyi and Saka (2016) using the ordinary least square regression method and Engel Granger data estimation techniques, explored the impact of deficit financing on unemployment rate in Nigeria from 1986 to 2015. The following variables were used as the explanatory variables external debt, domestic debt, fiscal outlay, government revenue and GDP and unemployment rate as the explained variable. The study uncovered empirically that both domestic and foreign debts has a negative effect on the rate of unemployment in Nigeria. While fiscal outlay, tax revenue and GDP were found to exert a positive influence on the unemployment rate in Nigeria. In the long-run, all variables co-move together.

Ogonna et al (2016) deployed the Autoregressive Distributed Lag (ARDL) econometrics techniques of data estimation and calibrated the impact of public debt on unemployment in Nigeria from 1980 to 2015. They discovered that there is a long-term relationship among the model variables. Particularly, the results indicated that an increase in public debt exerted a positive long-run effect on the unemployment rate in Nigeria.

Iwuoha (2020) employed the Johansen cointegration and Vector error correction model (VECM) econometrics techniques of data analysis to examine the nexus between government borrowing and unemployment rate in Nigeria from 1981 to 2019. The study confirmed that there is a negative long-run interaction between public debt and unemployment in Nigeria within the study timeframe.

Essien, Agboegbulem and Mba (2016) studied the macroeconomic effect of public debt in Nigeria, the paper employed vector Autoregressive method (VAR) and the Granger causality test to explore the nature of the relationship. The work found that both external and internal public debt does not have any significant effect on the growth of the Nigerian economy and does not also in any way fueled inflation. Nonetheless, the result discovered that external debt increase over time had led to the increase in the lending rates.

Akanbi and Olaoluwa (2022) used the Ordinary Least Squares method of data analysis to study the nexus between state governments and economic growth in Nigeria spanning from 1981 to 2019. They discovered that the response of economic growth to subnational debt in Nigeria is positive but statistically insignificant. While the state deficit budgeting exacts an insignificant inverse relationship with economic growth in Nigeria. Nonetheless, this thesis intends to

fill in the unexplored gaps in the literature that bothers on the impact of the states' government borrowing on the economic development of the 36 subnational in Nigeria

Ojukwu, (2021) investigated the effect of Nigeria's foreign debt on sustainable Development Goals (SDG) 2 and SDG 3 the Secondary data for the study to was sourced from DMO, IMF, NBS and WB covering a period of 16years from 2003 to 2019. Using Spearman's Rank Correlation tool. The findings of the work uncovered that there is no significant association between foreign debt and the sustainable development goals 2 and 3 in Nigeria. The paper argues that the accumulated external debts in Nigeria are not properly utilized for sustainable developmental projects that reduce the high poverty index and low life expectancy of its populace.

Elekwa and Onyenama (2022) deployed the ARDL technique of data analysis and estimated the effect of foreign debt on unemployment in Nigeria from 1992 to 2020. Empirical evidence from the ARDL test result showed that there is a positive and significant relationship between foreign debt and unemployment in Nigeria.

Ojewumi and Aremu (2021). Estimated the relationship between foreign debt and the poverty rate in Nigeria from 1981 to 2018. Using the ECM framework of data analysis on secondary data of the following variables external debt, debt services, foreign reserve, exchange rate, investment, economic growth as the independent variables and poverty rate as the dependent variable that was sourced from the national bureau of statistics and the central Bank of Nigeria. The result of the study revealed that there exists a positive relationship between foreign debt and poverty in Nigeria. On the other hand external debt services has a negative short run effect on poverty. While in the long run the variables were found to jointly co-move together.

Using the ordinary least square regression framework, Sweis and Sabri (2016) investigated the effect of public debt on unemployment and economic growth in Palestine. The study found that public debt has a positive and significant impact on unemployment in Palestine, while the impact of government borrowing on growth is insignificantly positive.

Cahyadin and Ratwianingsih (2020) undertook a study of a sample of 4 ASEAN economies which encompassed Thailand, Indonesia, Philippines and Malaysia from 1980 to 2017 and unraveled the impact of external debt, exchange rate on unemployment. The extracted data from the World Bank statistical bulletin was confronted with the Autoregressive Distributed Lag ARDL, Granger causality and Error correction model estimation techniques. The study uncovered that there is a

significant long run association among the model variables. On the other hand, external debt and inflation significantly influence unemployment rate in the short-term in the four countries evaluated. However, a unidirectional causal association that flows from external debt and exchange rate to unemployment exists only in the case of Indonesian economy. Thus, from the foregoing empirical review it is evidence that there exists a significant shortfalls in the literature bothering on the impact of subnational debts on economic development of the constituent units, which this study attempt to abridged.

3.1 Research Methodology

This study employed a expo facto research design to examine the impact of subnational debts of the North-Eastern Zone of Nigeria on the levels of poverty and unemployment. The secondary data for the work spanning from 2012 2021 were longitudinal series of the 6 states that makes up the Zone and the series were sourced from the central Bank of Nigeria (CBN), Debt Management Office (DMO) and National bureau of statistics (NBS).

3.1.1 Model Specification

One of the basic pre-condition for model specification requires that the theoretical framework should be established as a guide. Hence, our models for this work were constructed based on the Keynesians' Crowd-in theory of public debt. However, these two models were derived from the work of Alaoye and Alonge (2022). The two models of the work is set to determine the effects of the independent variables viz: subnational domestic debts (SDD), subnational external debts (SED), internally generated revenue (IGR) and subnational federal allocation (SFA) on the level of poverty and unemployment that are explanatory variables.

Thus, the two panel models of this work are functionally specified as shown below:

$$POV = F(SDD, SED, IGR, SFA) \text{---(1). Model I}$$

$$UEM = F(SDD, SED, IGR, SFA) \text{-----(2) Model II}$$

These two functional models are further transformed into their panel Log-Log models, so as to estimate the degree of responsiveness of the dependent variables to change in the independent variable

$$LnPOV_{it} = \beta_{0it} + \beta_1 SDD_{it} + \beta_2 SED_{it} + \beta_3 IGR_{it} + \beta_4 SFA_{it} + U_{it}. \text{ Model I (Poverty Model)}$$

$$LnUEM_{it} = \gamma_{0it} + Ln\gamma_1 SDD_{it} + Ln\gamma_2 SED_{it} + Ln\gamma_3 IGR_{it} + Ln\gamma_4 SFA_{it} + U_{it} \quad \text{Model II}$$

(Unemployment Model)

Where;

Ln= Natural Logarithm i= Cross section identifier, t= time, u= Error term

γ_0 = intercept, and $\gamma_1 - \gamma_4$ = Coefficients of the parameters estimates.

The a-priori assume bothering on the relationship between the two dependent variables poverty (POV) and unemployment (UEM) levels and the explanatory variables; subnational domestic debts (SDD) and subnational external debts (SED) and control variables; internally generated revenue (IGR) and states allocations from the federation account (SFA) followed the Keynesians economists crowd-in theory of public debt is expected to be less than zero. Based on the foregoing theory, the a-priori expectations between the two dependent and the explanatory variables are assumed to be $\gamma_1 - \gamma_4 < 0$.

Data analytical techniques

The study deployed the panel least squares (PLS), panel fixed effect model (PFEM) and panel random effect model (PREM) and the panel cointegration test as its estimating techniques.

To determine which technique of data analysis is best suited for the study we conducted Breusch Pagan test to choose between PLS and the PFEM and PREM, with the hypothesis stated below.

H_0 : PLS is better

H_1 : PFEM or PREM is better

Decision Rule: Reject H_0 if P-value < 0.05 .

However, the Hausman test was also carried out to ascertain which one of the two tests PFEM and PREM is best fit or efficient for the research, with the hypothesis as follows:

H_0 : PREM is best fit

H_1 : PFEM is best fit

Decision Rule: Reject H_0 if $P\text{-value} < 0.05$

4.1 Result and Discussion

Table:4.1; Descriptive Statistics

	LNPOV	LNUEM	LNSDD	LNSD	LNIGR	LNSFA
Mean	4.198552	3.103917	24.35308	17.46298	22.42800	24.63268
Median	4.254901	3.220824	24.65152	17.25773	22.37827	24.65822
Maximum	4.502029	3.673766	25.38713	18.72012	23.93128	25.03299
Minimum	3.374169	2.174752	20.83894	16.46554	21.30281	24.10766
Std. Dev.	0.210121	0.375521	0.986953	0.636837	0.535517	0.216887
Skewness	-1.690097	-1.055993	-1.571795	0.704995	0.317351	-0.541240
Kurtosis	6.917044	3.217334	5.802629	2.217161	2.962447	2.710012
Jarque-Bera	66.92238	11.26930	44.34222	6.502272	1.010641	3.139641
Probability	0.000000	0.003572	0.000000	0.038730	0.603312	0.208083
Sum	251.9131	186.2350	1461.185	1047.779	1345.680	1477.961
Sum Sq. Dev.	2.604896	8.319942	57.47053	23.92814	16.91996	2.775351
Observations	60	60	60	60	60	60

Source: Researcher's computation from E-view 12 (2024).

The above the descriptive statistics output of the longitudinal data of the 6 states that makes up the north-east zone of Nigeria was deployed for this work. The descriptive series indicates that the maximum (Max) and minimum (Min) values of the data which defines the range of the series from the highest and the lowest rates and the Max and Min range were LNPOV(4.502029max 3.374169min), LNUEM(3.220824max 2.174752min), LNSDD(25.38713max 20.83894min), LNSD(18.72012max 16.46554min), LNIGR(23.93128max 21.30281min) and SFA(25.03299max 24.10766min)

The following figures 4.198552, 3.103917, 24.35308, 17.46298, 22.42800 and 24.63268 were the mean values of LNPOV, LNUEM, LNSDD, LNSD, LNIGR and LNSFA respectively. These mean values are simply the averages of each of the longitudinal data employed for this research.

Lastly, the Jarque-Bera p-values of each of the variables indicates that all the variables were not normally distributed.

Breusch Pagan LM Test Result for Poverty and unemployment models

Table:4.2; Breusch Pagan LM Test Result for Poverty Model

Test Method	Test Hypothesis		Both
	Cross-section	Time	
Breusch-Pagan	1.043567.	24.60441	25.64798
P-value	(0.3070).	(0.0000)	0.0000

Source: Researcher's computation from E-view 12 (2024).

Table: 4.3; Breusch Pagan LM Test Result for Unemployment Model

Test Method	Test Hypothesis		Both
	Cross-section	Time	
Breusch-Pagan	7.545883	5.617117	13.16300
P-value	(0.0060)	(0.0178)	0.0003

Source: Researcher's computation from E-view 12 (2024).

The Breusch-Pagan test results above for both model I & II invalid the application of PLS method for this research, hence implying or validating the use of panel PFEM or PREM giving that the P-values of the both cross section and time were statistically significant at 5% level.

Table: 4.4; Hausman Test Result of Poverty Model

Test Summary	Chi-sq. Statistic.	Chi-sq d.f	P-value
Period Random	5.445872.	4	0.2445

Source: Researcher's computation from E-view 12 (2024).

Table: 4.5; Hausman Test Result of Unemployment Model

Test Summary	Chi-sq. Statistic.	Chi-sq d.f	P-value
Period Random	5.780691.	4	0.2161

Source: Researcher's computation from E-view 12 (2024).

The Hausman test results of both model I & II more so reveal that the best fit regression method between the PFEM and PREM is the PREM giving that the P-value > 0.05 significant level., thus we reject in the Null hypothesis and accept the

alternative which validate the application of PREM as the estimating technique of data analysis.

Table: 4.6; Panel Random Effect result of Model I (Poverty)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	12.96900	2.948246	4.398887	0.0001
LNSDD	-0.026598	0.038733	-0.686704	0.4952
LNSD	-0.015300	0.042555	-0.359531	0.7206
LNIGR	0.069519	0.078889	0.881224	0.3820
LNSFA	-0.382203	0.129005	-2.962710	0.0045

Source: Researcher's computation from E-view 12 (2024).

The PREM result presented above indicates that the slope coefficients of both LSDD and LSED of -0.026598 and -0.015300 with the corresponding P-values of 0.4952 and 0.7206, inferred that the coefficients are statistically not significant at 5%. This results underscores that the increase in both subnational domestic and external debts do insignificantly leads to the reduction in the levels of poverty across the 6 subnational units in the north -East zone of Nigeria . More importantly, both coefficients of SDD and SED been negative implies that the coefficients are in conformity with the a-priori expectations of the research that is centered on Keynesian Crowd in theory. The policy implications of these results is that these 6 states have not sufficiently deployed a significant proportion of their domestic and external debts into people-centered program and project that have the capacity to reduce the level of poverty such as human capital development, social infrastructural development and agricultural value chain development. Thus, the borrowed funds might have been mismanaged, embezzled, misappropriated or the funds may have been used for debts servicing resulting in the non-sustainability of these states domestic and foreign debts. More so, the estimated coefficient of these 6 states internally generated revenue (IGR) was found to be 0.069519 and the P-value of 0.3820, indicates that the increase in IGR have led to the insignificant rise the level of poverty in the 6 states that makes up the north -East zone. The result further uncovered that the coefficient value of the 6 states allocations from the federation account of -0.382203 and P-value of 0.0045 indicate that the increase in SFA have had the significant effect of reducing the level of poverty in the short run.

Table:4.6; Panel Random Effect result of Model II (Unemployment)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-16.89326	5.486190	-3.079233	0.0032
LNSDD	0.024351	0.068775	0.354071	0.7246
LNSDD	-0.157850	0.116685	-1.352792	0.1817
LNIGR	-0.050489	0.127196	-0.396939	0.6929
LNSFA	0.945616	0.227487	4.156789	0.0001

Source: Researcher's computation from E-view 12 (2024).

The PREM result presented above Indicates that the slope coefficient and the corresponding P-value of LSDD of 0. 024351 and 0.7246, inferred that the coefficient of SDD is statistically not significant at 5%. This result underscores that the increase in the subnational domestic debts of the 6 states do insignificantly leads to the increase in the levels of unemployment across the 6 subnational units in the north -East zone of Nigeria. More importantly, the coefficient of SDD been positive implies that the coefficient do not align with the a-priori expectations of the research that is centered on Keynesian Crowd in theory. The policy implications of these results is that these 6 states have not deployed a significant quotient of their domestic debts into people-centered program and project that have the capacity to reduce the level of unemployment such as human capital development, social infrastructural development and agricultural value chain development. Thus, the borrowed funds might have been mismanaged, embezzled, misappropriated and funds may have been used for debts servicing resulting in the non-sustainability of these states domestic and foreign debts. Whereas, the result above indicates that the estimated coefficient of LSED of -0.157850 with the corresponding P-values of 0.1817 inferred that the coefficient of SED was found to be statistically not significant at 5%. However, this results underscores that the increase in subnational external debts do insignificantly leads to the reduction in the levels of unemployment across the 6 subnational units in the north -East zone of Nigeria . More importantly, the estimated coefficient of SED been negative implies that the coefficient conformed with the a-priori expectations of the research that is centered on Keynesian Crowd in theory. The policy implications of these results is that these 6 states governments have not sufficiently deployed a

significant proportion of their external debts into people-centered program and project that have the capacity to reduce the level of unemployment, such as human capital development, social infrastructural development and agricultural value chain development. Thus, the borrowed funds might have been mismanaged, embezzled, misappropriated and funds may have been used for debts servicing resulting in the non-sustainability of these states domestic and foreign debts.

More so, the coefficient of these 6 states internally generated revenue (IGR) was found to be -0.050489 and the P-value of 0.6929, indicates that the increase in IGR have led to the insignificant reduction the level of unemployment in the 6 states that makes up the north -East zone. Conversely, result further uncovered that the coefficient value of the 6 states allocations from the federation account of 0.945616 and P-value of 0.0001 indicate that the increase in SFA have had the significant effect of increasing the level of unemployment in the short run.

Table: 4.7; Pedroni cointegration test result of Model I (Poverty)

Alternative hypothesis: common AR coeffs. (within-dimension)				
	<u>Statistic</u>	<u>Prob.</u>	<u>Weighted Statistic</u>	<u>Prob.</u>
Panel v-Statistic	-0.465359	0.6792	-1.064215	0.8564
Panel rho-Statistic	0.879833	0.8105	1.324186	0.9073
Panel PP-Statistic	-13.88807	0.0000	-11.68462	0.0000
Panel ADF-Statistic	-8.676649	0.0000	-5.877925	0.0000
Alternative hypothesis: individual AR coeffs. (between-dimension)				
	<u>Statistic</u>	<u>Prob.</u>		
Group rho-Statistic	2.382082	0.9914		
Group PP-Statistic	-13.80041	0.0000		
Group ADF-Statistic	-9.030185	0.0000		

Source: Researcher's computation from E-view 12 (2024).

The Pedroni cointegration test result presented above indicates that there exists a long-run association or relationship among the variables in model I giving that the P-values of six (6) out the eleven (11) statistical conditions were found to be

statistically significant at 5% level. Hence, going by the majority rule on the number of significant P-values we can come to the conclusion that in the long-run the variables in our poverty model co-move together in the long-run *ceteri paribus*.

Table: 4.8; Pedroni cointegration test result of Model II (Unemployment)

Alternative hypothesis: common AR coeffs. (within-dimension)				
	<u>Statistic</u>	<u>Prob.</u>	Weighted	<u>Prob.</u>
Panel v-Statistic	-0.399721	0.6553	-1.237953	0.8921
Panel rho-Statistic	2.467463	0.9932	2.310702	0.9896
Panel PP-Statistic	-2.461811	0.0069	-3.914321	0.0000
Panel ADF-Statistic	-0.962863	0.1678	-1.603333	0.0544
Alternative hypothesis: individual AR coeffs. (between-dimension)				
	<u>Statistic</u>	<u>Prob.</u>		
Group rho-Statistic	3.549871	0.9998		
Group PP-Statistic	-4.945637	0.0000		
Group ADF-Statistic	-0.889574	0.1868		

Source: Researcher's computation from E-view 12 (2024).

In model II, nine (9) out of eleven (11) statistical conditions P-values were found to be statistically not significant at 5% level in the unemployment model. Thus, in compliance with majority rule we can empirically infer from the results that all the variables in the unemployment model were not cointegrated in the long-run, which implies that the model variables do not co-move together in the long-run all things being equal.

Post estimation test Result of model I & II

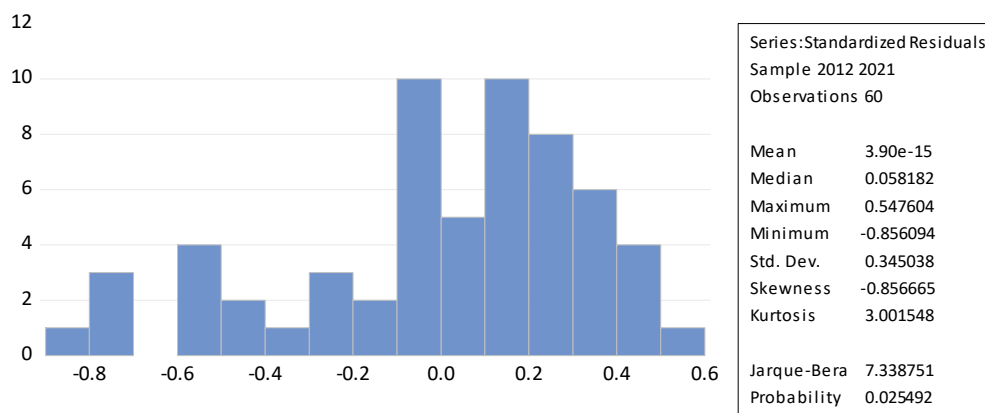


Figure: 1; Normality test of Model II (Unemployment)

Source: Researcher’s computation from E-view 12 (2024).

Table: 4.9; Result of Cross sectional dependency test of Unemployment Model

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	44.01989	15	0.0001
Pesaran scaled LM	5.298282		0.0000
Pesaran CD	2.625123		0.0087

Source: Researcher’s computation from E-view 12 (2024).

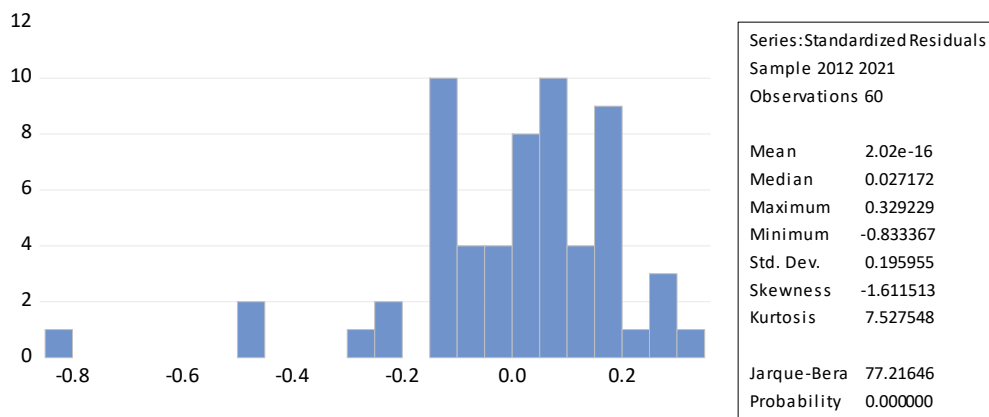


Figure:2; Result of Normality test of Model I (Poverty)

Source: Researcher's computation from E-view 12 (2024).

Table: 4.10; Result of Cross sectional dependency test of Model I (Poverty)

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	60.23906	15	0.0000
Pesaran scaled LM	8.259484		0.0000
Pesaran CD	6.610482		0.0000

Source: Researcher's computation from E-view 12 (2024).

5.1 Recommendations

The 6 states that makes up the north-eastern zone are encouraged to invest a significant share of the borrowed funds to human capital development through investment in education, agricultural value chain development, as well as social infrastructures development. The 6 subnational units are encouraged to incorporate the culture of fiscal discipline in the governance of public fund, in order to guide against borrowed funds deviations, misapplications or misappropriations, embezzlement, thievery and odious borrowing that are often associated with states' borrowing. These states are admonished to invest the borrowed funds on sustainable and productive projects so as to eliminate debt overhang challenges.

Conclusion

Conclusively, the findings of the study inferred that these 6 states have not significantly appropriated a significant proportion of their borrowed fund into human capital development project that have the capacity to reduce the level of poverty and unemployment in these states. Thus, these states government should be more committed to investing in human capital development by investing in education, health facilities, as well as investing infrastructures that could attract private investment in productive and sustainable development programs that could help create jobs and reduce poverty.

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INFORMAL SECTOR DYNAMICS, BUSINESS NETWORKS, AND BRICS OPPORTUNITIES: CHALLENGES AND PROSPECTS FOR SMMEs

Brian Ngwako MAHOSI¹

¹ *Tshwane University of Technology, Faculty of Management Sciences, Department of Management and Entrepreneurship, Pretoria, 0183, South Africa, Phone:+ 072 103 7108, E-mail:mahosibn@gmail.com*

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Abstract

Small, Medium and Micro Enterprises (SMMEs) constitute a foundational pillar of South Africa's economic structure, contributing significantly to employment creation, poverty alleviation, and gross domestic product. Operating across both the formal and informal sectors of the economy, SMMEs navigate a complex landscape shaped by macroeconomic volatility, regulatory compliance burdens, limited access to capital, and competitive pressures from larger multinational corporations. This study, conducted through a theoretical literature review, examines the dynamics of the informal sector as a space in which SMMEs frequently originate and operate, explores the role of business networks in enhancing SMME competitiveness and sustainability, and investigates the strategic opportunities presented by South Africa's participation in the Brazil, Russia, India, China, and South Africa (BRICS) economic bloc. The findings suggest that although the informal sector presents significant barriers to formalization and growth, it simultaneously serves as a critical incubator for entrepreneurial activity. Business networks, including inter-firm alliances, industry associations, and public-private partnerships, have been shown to amplify SMME capacity and market access. Furthermore, BRICS membership offers emerging market linkages that, if effectively harnessed, could accelerate SMME internationalization and technology transfer. National and provincial government institutions are identified as indispensable facilitators of an enabling environment that must be

deliberately co-constructed with private sector actors to ensure the long-term viability of SMMEs in South Africa.

Keywords: *informal sector, business networks, BRICS, small medium and micro enterprises, economic development, entrepreneurship*

JEL Classification: L25, L26, H25, H32, H54, O17, O25, O38, R58, R11, J24, F15, D85

1. Introduction

Small, medium, and micro enterprises (SMMEs) in South Africa have long been recognised as architects of sustainable development and economic growth. Their significance extends beyond macroeconomic indicators; SMMEs are embedded in the social fabric of communities, employing vulnerable citizens, and fostering entrepreneurial culture at the grassroots level. In South Africa's emerging economy, SMMEs account for 91% of formalized businesses, employ approximately 60% of the labor force, and contribute approximately 34% of overall economic production (Stević, Pamučar, Puška & Chatterjee, 2020). Despite this substantial contribution, the sector faces multifaceted challenges that continue to constrain its potential.

A notable dimension of SMME activity that has received growing scholarly attention is the role of the informal sector as both a nursery and a refuge for entrepreneurial enterprise. In South Africa, over 1.5 million businesses operate in the informal economy (STATSSA, 2022; World Bank, 2022), and the transition from informal to formal enterprise remains a complex and often unnavigated journey. Simultaneously, the capacity of SMMEs to participate meaningfully in the economy is increasingly shaped by the business networks they inhabit, ranging from informal supply chain relationships to formalized industry associations and government-facilitated support programmes.

At the macroeconomic level, South Africa's membership of Brazil, Russia, India, China, and South Africa (BRICS) economic bloc presents strategic opportunities for SMMEs to access emerging market economies, attract foreign direct investment, and leverage technology transfer initiatives (Akinrinde & Telukdarie, 2023; Khan, 2020). The BRICS framework, however, demands a degree of formalization, institutional readiness, and network embeddedness that many South African SMMEs currently lack.

The objective of this study is to examine how informal sector dynamics, business networks, and BRICS-related opportunities intersect with the broader

challenge landscape facing SMMEs, and to identify the interventions through which national and provincial government institutions may facilitate sustainable SMME development. The study is grounded in a theoretical literature review that draws on peer-reviewed scholarship, government reports, and comparative analyses of emerging economies.

2. Literature Review

The study of SMMEs in South Africa cannot be divorced from the broader economic conditions in which these enterprises operate. The 2020–2021 financial period saw the number of registered formal and informal enterprises decline by 11%, with approximately 289,000 SMMEs ceasing operations (Huseynov, 2023; Teresiene et al., 2021). This contraction, occurring against the backdrop of the COVID-19 pandemic and broader structural economic challenges, underscores the fragility of the SMME sector and the urgency of targeted intervention.

2.1 The Informal Sector as an SMME Incubator

The informal sector in South Africa is a sprawling and heterogeneous space that encompasses survivalist traders, micro-manufacturers, service providers, and community-based enterprises. While informality is often characterised as a barrier to growth, a substantial body of literature reframes it as an incubator of entrepreneurial activity, particularly in contexts where formal employment opportunities are scarce (Musara & Nieuwenhuizen, 2020). The surge in self-employment observed in South Africa, driven in part by the high unemployment rate of 34.4% recorded in 2022 (STATSSA, 2022:2), reflects the informal sector's role as an absorber of labour market shocks.

Informal SMMEs frequently operate without legal registration, formal banking relationships, or structured governance frameworks, making them invisible to both regulatory authorities and financial institutions. This invisibility carries significant costs: it restricts access to government support programmes, limits market access, and perpetuates low productivity traps (Maduku & Kaseeram, 2021). Nonetheless, the informal sector also demonstrates remarkable adaptive capacity. Enterprises in this space tend to be embedded in dense community networks, which substitute for formal institutional support through trust-based credit arrangements, shared infrastructure, and collective market intelligence (Omolekan & Omole, 2020).

The formalisation of informal SMMEs has been identified as a critical policy priority in South Africa. Formalisation facilitates access to finance, legal protection, and participation in public procurement processes. However, the

compliance costs associated with formalisation, including tax registration, labour law adherence, and municipal licensing, can be prohibitive for micro-enterprises operating on thin margins (Chiloane-Tsoka & Rasivhetshele, 2014:138). Government policy must therefore balance the imperative of formalisation with the pragmatic recognition that regulatory burdens disproportionately affect smaller enterprises.

Black-owned formal SMMEs constitute the largest portion of enterprises in the formal economy, with 72.6% registered to black-owned individuals (STATSSA, 2022; World Bank, 2022). This demographic profile reflects the historical legacy of apartheid-era economic exclusion and the transformative intent of post-1994 economic policy. The transition from informal to formal enterprise is, for many black-owned SMMEs, simultaneously a journey of economic empowerment and an encounter with institutional complexity.

2.2 Business Networks and SMME Competitiveness

Business networks, defined broadly as relational structures through which enterprises exchange resources, information, and strategic support, have emerged as a critical determinant of SMME competitiveness and survival. The literature consistently demonstrates that SMMEs embedded in robust networks outperform their isolated counterparts across key performance dimensions, including innovation, market access, and resilience to economic shocks (Guertler & Sick, 2021a; Gherghina, Botezatu, Hosszu & Simionescu, 2020).

In the South African context, business networks take several forms. Vertical networks link SMMEs to larger corporate entities as suppliers, subcontractors, or distributors. These relationships can provide SMMEs with stable demand, technical knowledge transfer, and access to finance through supply chain financing mechanisms (Kaur, Kumar & Joshi, 2023). However, the asymmetric power dynamics inherent in vertical networks can also expose SMMEs to exploitation, including delayed payment practices and contract termination without notice.

Horizontal networks, by contrast, connect enterprises operating in similar industries or geographies. Industry associations, cooperatives, and cluster arrangements facilitate collective bargaining, shared services, and coordinated market entry strategies (Morina & Gashi, 2017). In South Africa, the movement of SMMEs into metropolitan centres such as Gauteng, Cape Town, and Durban have intensified competitive pressures but has also created opportunities for horizontal network formation, as enterprises with complementary capabilities can collaborate to serve larger markets (Mokoena & Liambo, 2023:342).

Public-private networks, involving government agencies, development finance institutions, and private sector intermediaries, are increasingly recognised as essential scaffolding for SMME development. Institutions such as the Small Enterprise Development Agency (SEDA), the Small Enterprise Finance Agency (SEFA), the Industrial Development Corporation (IDC), and the National Empowerment Fund (NEF) offer a range of financial and non-financial support services. However, the effectiveness of these networks is constrained by information asymmetries, bureaucratic complexity, and geographic unevenness in service delivery (Ngonisa, Mgxekwa, Ndlovu, Ngonyama & Mlambo, 2023).

Digital networks represent an emerging frontier for SMME competitiveness. Technology-based innovative SMMEs provide a foundation for South Africa to trade and expand internationally (Akinrinde & Telukdarie, 2023). E-commerce platforms, social media marketing, and digital financial services have lowered the barriers to market entry and network participation for SMMEs across the formalisation spectrum. The influence of social networking on small business performance in Nigeria has been demonstrated empirically (Omolekan & Omole, 2020), and analogous dynamics are evident in the South African context.

The role of project management capabilities in enabling SMMEs to engage in open innovation through partner search and selection has been highlighted in the literature (Guertler & Sick, 2021a). This perspective is particularly relevant for technology oriented SMMEs seeking to co-develop products and services with research institutions, corporate partners, and international counterparts. The capacity to identify, negotiate, and manage network relationships is thus a strategic competence that distinguishes high-growth SMMEs from survivalist enterprises.

2.3 BRICS and the Internationalisation of South African SMMEs

South Africa's membership in the BRICS economic bloc, comprising Brazil, Russia, India, China, and South Africa, has been identified as a significant opportunity for the internationalisation of South African SMMEs (Khan, 2020). The BRICS framework facilitates bilateral and multilateral trade, investment, and technology cooperation among member states, creating market access corridors that would otherwise be inaccessible to smaller enterprises operating in isolation.

The economic rationale for SMME engagement with BRICS is compelling. The combined BRICS economies represent a substantial share of global GDP and population, and their growth trajectories reflect the dynamism of emerging markets. For South African SMMEs, BRICS membership offers opportunities in several dimensions: export market diversification, access to affordable technology

and production inputs from China and India, knowledge exchange through bilateral business forums, and participation in infrastructure investment initiatives supported by the New Development Bank (Akinrinde & Telukdarie, 2023).

However, the realisation of these opportunities requires SMME preparedness that currently eludes most of the sector. Internationalisation demands compliance with export documentation, product quality standards, and customs regulations that many SMMEs, particularly those transitioning from the informal sector, are ill-equipped to navigate (Manzoor, Wei & Sahito, 2021). Furthermore, the competitive landscape within BRICS markets is formidable; South African SMMEs must contend with established manufacturers and exporters from Brazil, India, and China.

The role of government and business networks in facilitating SMME access to BRICS opportunities is therefore paramount. The Trade and Investment Kwazulu-Natal (TIKZN), the Limpopo Economic Development Agency (LEDA), and the Gauteng Enterprise Propeller (GEP), among others, have been established to assist SMMEs in navigating the institutional requirements of export participation. The Banking Association South Africa (2018) has highlighted the importance of developing a suitable interactive global market in which technology-oriented initiatives may be adopted for successful business operations within the BRICS context.

The internationalisation of SMMEs through BRICS linkages also has implications for domestic value chain development. SMMEs that export to BRICS markets require upstream suppliers and downstream distributors, creating network effects that can catalyse broader economic activity within South Africa. Agricultural SMMEs in provinces such as Limpopo, Mpumalanga, and the Eastern Cape are particularly well-positioned to leverage BRICS food and commodity markets, provided that post-harvest infrastructure, logistics, and quality assurance systems are adequately developed (Kuleto, Ilic, Rankovic, Popovic-Sevic & Gurgu, 2023).

2.4 Prominent Challenges Facing SMMEs

Beyond the specific dynamics of informality, networks, and internationalisation, SMMEs in South Africa continue to encounter a well-documented range of structural challenges that constrain their development and survival.

2.4.1 Inflation and Macroeconomic Instability

Inflation represents a persistent macroeconomic challenge with direct and indirect consequences for SMME viability. Rising prices erode consumer

purchasing power, compress SMME profit margins, and increase the cost of inputs, raw materials, and services (Maduku & Kaseeram, 2021). In an economic system where the money supply increases relative to the size of the economy, the value of the currency diminishes, making it increasingly difficult for customers to access goods and services at affordable prices (Morina & Gashi, 2017; Kimanzi & Gamede, 2020). For SMMEs operating in consumer-facing sectors, this dynamic translates into reduced demand and revenue volatility.

The interaction between inflation and credit access is particularly damaging for SMMEs. Central banks may increase interest rates to control inflation (Aimola, 2022; Matekenya & Moyo, 2022), which in turn increases the cost of borrowing for enterprises that rely on debt financing for working capital and investment. This creates a double bind in which inflationary pressures simultaneously increase operating costs and reduce access to affordable finance.

2.4.2 Interest Rates and Access to Finance

The availability of financing is a critical determinant of SMME development and survival. The inability to raise business funding due to restricted access to finance from financial institutions is a negative factor impacting entrepreneurship (Milutinović & Stanišić, 2022; Mvula, 2018). High interest rates constrain SMME cash flow, increase debt servicing costs, and reduce the incentive for investment in productive capacity. SMMEs that offer luxury goods or services may be the most adversely affected, since such offerings are not a priority for consumers with reduced discretionary income (Rahayu & Ilham, 2023).

The reluctance of formal financial institutions to lend to SMMEs reflects a structural bias in the financial system. Most financial institutions believe that financing SMMEs is more costly than lending to larger established multinational organisations (Ajibola & Kolawole, 2021). The absence of formal and organised methods for obtaining financial assistance continues to impede the development of SMMEs (Senou & Manda, 2022:5). Over half of SMMEs in developing nations identify access to finance as a key limitation in business operations, and the South African experience is consistent with this global pattern (Ngonisa et al., 2023).

2.4.3 Taxation and Regulatory Compliance

The taxation imposed on SMMEs represents a disproportionate burden relative to the compliance capacity of smaller enterprises. The expenses of corporate tax and value-added tax (VAT) in South Africa are among the highest in the world (Mgammal, Al-Matari & Alruwaili, 2023:3), and the complexity of the tax system compounds the administrative burden on SMME owners who lack the financial expertise to navigate it independently. A significant proportion of SMMEs are

compelled to engage tax consultants, the cost of which further erodes already narrow margins (Matekenya & Moyo, 2022:2; Adesunloro, Egbewole & Oluwatoyin, 2021).

Tax compliance costs for SMMEs are vastly higher relative to those of multinational organisations, necessitating changes in administrative approaches and policy to address the impediments that tax compliance considerations pose to smaller enterprises (Sánchez-Ballesta & Yagüe, 2021:1407). The South African government has introduced several tax incentive and relief measures targeting SMMEs, but awareness of these mechanisms remains limited, particularly among enterprises in the informal sector.

2.4.4 Unemployment and the Labour Market

The official unemployment rate in South Africa stood at 32.6% in 2021, increasing to 34.4% in 2022 (STATSSA, 2022:2). Among the youth demographic aged 15 to 34, the unemployment rate was 46.3%, representing a substantial pool of untapped human capital (Nobanda, 2021:5). SMMEs, by virtue of their labour-intensive production methods and community embeddedness, are strategically positioned to absorb unemployed labour, particularly in regions underserved by large corporate employers.

However, the challenge of unemployment is both a consequence and a cause of SMME fragility. A high unemployment rate reduces consumer spending power, dampening demand for SMME goods and services. It simultaneously increases the prevalence of survivalist entrepreneurship, in which individuals establish informal micro-enterprises out of necessity rather than opportunity. These survivalist enterprises typically lack the management skills, capital, and market connectivity necessary for sustainable growth (Musara & Nieuwenhuizen, 2020:196; EGUNJOBI, 2022).

3. Discussion

The evidence reviewed in this study points to a complex and mutually reinforcing set of dynamics between the informal sector, business networks, BRICS participation, and the structural challenges facing SMMEs in South Africa. The national and provincial governments have initiated significant institutional interventions in recognition of the SMME sector's strategic importance. These include the establishment of SEDA, SEFA, the IDC, the National Development Agency (NDA), the South African Microfinance Apex Fund (SAMAF), and the National Empowerment Fund (NEF) at the national level, alongside provincial support agencies including the Gauteng Department of Economic Development

(GDED), the Gauteng Enterprise Propeller (GEP), the Limpopo Economic Development Agency (LEDA), the Free State Development Corporation (FDC), the Mpumalanga Economic Growth Agency (MEGA), and the Northern Cape Economic Development Agency (NCEDA) (TeSai, 2018:4; Maduku & Kaseeram, 2021).

Despite the breadth of this institutional architecture, the effectiveness of government support is frequently undermined by information asymmetries, geographic concentration of services in urban centres, and the administrative complexity of accessing support programmes. SMMEs in the informal sector and in rural or peri-urban areas are least likely to benefit from these interventions. Addressing this gap requires a deliberate strategy of decentralised service delivery, digital outreach, and community-based facilitation that meets enterprises where they are, rather than expecting them to navigate complex bureaucratic systems.

The relationship between business networks and SMME performance offers important lessons for policy design. Enterprises embedded in supportive networks demonstrate greater resilience, innovation capacity, and access to markets than those operating in isolation. Government-led programmes should therefore prioritise network facilitation alongside direct financial support. This includes the creation of business incubators and accelerators that connect informal SMME operators with formal sector mentors, technology providers, and export market intermediaries.

The BRICS framework presents a particularly valuable opportunity for network enabled SMME internationalisation. South Africa's participation in BRICS positions it as a gateway between African markets and the broader emerging economy bloc. SMMEs that can leverage this positioning through export readiness programmes, bilateral business missions, and BRICS-focused trade finance instruments are well-placed to diversify their revenue streams and reduce their vulnerability to domestic economic volatility. The deliberate and intentional action by the government in response to the ever-increasing unemployment rate and inequality, through support for SMMEs as critical drivers of economic growth, is a necessary but insufficient condition for realising this potential (Yoshino & Taghizadeh-Hesary, 2020; Ngonisa et al., 2023).

The private sector's contribution is equally important. All spheres of government and the private sector in South Africa must work together to promote economic development and ensure a development process that accelerates SMME growth. According to the National Strategy for the Development and Promotion of Small Business in South Africa, creating an enabling environment for the

development of SMMEs must take place at both a national and a local level (TeSai, 2014:7; Ouma-Mugabe, Chan & Marais, 2021; Maduku & Kaseeram, 2021). The Banking Association South Africa has highlighted the growing importance of SMMEs as the link between mainstream business and developing businesses, noting that the global trend of empowering SMMEs to improve economic activity is developing a suitable interactive global market in which new ideas, enhanced procedures, and technologically oriented initiatives may be adopted for successful business operations (The Banking Association South Africa, 2018).

The interdependence between formalisation, network participation, and BRICS readiness suggests that government interventions should be sequenced and complementary. Formalisation support should be accompanied by network facilitation, which in turn should be linked to export readiness programmes aligned with BRICS market opportunities. A fragmented approach, in which each of these dimensions is addressed in isolation, is likely to fall short of the transformative impact required to address South Africa's deep-seated unemployment, inequality, and poverty challenges.

4. Conclusion

This study has examined three intersecting dimensions of the SMME landscape in South Africa: the informal sector as an incubator and constraint; business networks as a source of competitive advantage; and BRICS membership as a platform for internationalisation. The theoretical literature review reveals that while each of these dimensions offers significant opportunities for SMME development, their realisation requires deliberate institutional support, policy coherence, and private sector engagement.

The continued contribution of SMMEs in creating employment for inhabitants is valuable as it serves as a critical intervention for sustainable social and economic growth (Musabayana & Mutambara, 2022). The formalisation of informal enterprises, when supported by accessible compliance pathways and targeted incentives, can unlock significant economic value while extending the reach of social protection systems. Business networks, when facilitated by both public institutions and private sector intermediaries, amplify SMME capacity beyond what individual enterprises can achieve in isolation. BRICS membership, when translated into concrete market access programmes, technology exchange initiatives, and trade finance instruments, can accelerate the internationalisation of South African SMMEs and reduce their dependence on a constrained domestic market.

This study concludes that the surge of unemployment globally is not a challenge that can be mitigated by the government in isolation but rather a challenge that both private and public institutions can minimise. With government support, SMMEs that are constrained by the competitive environment of the private sector can flourish and participate in the competitive production of goods and services by contributing new expertise, knowledge, and innovation (Chinomona & Maziriri, 2015; Stević et al., 2020). To create a sustainable economy, the government can facilitate the development of SMMEs in the private sector by ensuring that various role players in the sector consistently adhere to a competitive environment while being provided with the network infrastructure and internationalisation pathways necessary to realise their full potential within the BRICS economic framework.

Future research should employ empirical methodologies to test the relationships between network embeddedness, formalisation status, and BRICS market participation among South African SMMEs. Longitudinal studies tracking the impact of specific government interventions on SMME survival and growth would also make a valuable contribution to the evidence base for policy reform.

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COMMUNITY-BASED ENTREPRENEURIAL ECOSYSTEMS: BEYOND INDIVIDUAL ENTREPRENEURSHIP

Ayanda SIBIYA¹

*University of Johannesburg, Department of Business Management,
 College of Business Economics, Auckland Park Kingsway Campus,
 Corner Kingsway and University Road, Auckland Park, 2006, South
 Africa, Tel: +27 615 113244, Email: ayandas@uj.ac.za*

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Abstract

Entrepreneurship research in emerging and developing economies has traditionally prioritised the individual entrepreneur and organisation-level outcomes, often overlooking the collective and community-based nature of entrepreneurial activity. In BRICS Plus economies, however, entrepreneurship frequently emerges as a collective response to shared socio-economic challenges, including unemployment, poverty, spatial marginalisation, and institutional exclusion. Community-based enterprises, cooperatives, solidarity economy initiatives, and informal collective arrangements play a central role in livelihood creation, social cohesion, and local economic resilience, yet remain conceptually fragmented and under-theorised within mainstream entrepreneurship literature. This study conducts a systematic literature review of community and collective entrepreneurship in BRICS Plus economies to critically examine how collective entrepreneurial forms are conceptualised, organised, and embedded within local ecosystems. The study identifies analytical frameworks, organisational forms and institutional dynamics shaping collective entrepreneurship across diverse contexts. The findings reveal an over-reliance on individual-centric entrepreneurship models, limited integration of ecosystem and embeddedness perspectives, and weak conceptual alignment between collective entrepreneurship and inclusive development objectives. In response, the study proposes an ecosystem-based conceptual

framework that positions community and collective entrepreneurship as institutionally embedded, socially grounded, and development-oriented entrepreneurial processes.

Keywords: *community entrepreneurship; collective entrepreneurship; cooperative enterprises; entrepreneurial ecosystems; BRICS plus economies*

JEL Classifications: L26, O17, R11, P13, O10, B52, O43

Introduction

Entrepreneurship has become a central pillar of economic development strategies in emerging and developing economies, where it is widely promoted as a mechanism for employment creation, poverty reduction, and inclusive growth. Within BRICS Plus economies, this policy emphasis reflects shared structural challenges, including persistent inequality, high unemployment, spatial marginalisation, and uneven institutional capacity (Chhabra et al., 2023). As a result, entrepreneurship is increasingly viewed not only as a market-driven activity but also as a social and developmental process embedded within local communities and collective arrangements (Suryani et al., 2022; Vyas-Doorgapersad, 2024; Sibiya, 2025). Despite this context, mainstream entrepreneurship research continues to be dominated by individual-centric and firm-level perspectives, largely derived from developed economies characterised by relatively stable institutions, formal labour markets, and well-developed entrepreneurial ecosystems. These models prioritise individual opportunity recognition, firm growth, and competitive advantage, often overlooking the collective, relational, and community-based nature of entrepreneurial activity prevalent in many BRICS Plus economies (Ahmad and Bajwa, 2023; Gurau and Dana, 2018). This theoretical orientation has resulted in a misalignment between entrepreneurship theory and the lived realities of entrepreneurship in contexts where collective action, shared resources, and community embeddedness are central to entrepreneurial practice.

In BRICS Plus economies, entrepreneurship frequently emerges as a collective response to socio-economic exclusion and institutional constraints (Ndjama, 2024). Community-based enterprises, cooperatives, solidarity economy initiatives, and informal collective ventures play a critical role in livelihood creation, social cohesion, and local economic resilience. In countries such as South Africa, India, Brazil, and Indonesia, collective entrepreneurship is often rooted in historical traditions of mutual aid, cooperative organisation, and community governance, while in countries such as China, Iran, and Ethiopia, collective and cooperative

enterprises have been shaped by state policies, rural development strategies, and local institutional arrangements (Sarinsok, 2024). These findings highlight the importance of moving beyond individualistic models to better understand entrepreneurship as a socially embedded and collectively organised process.

Although research on community and collective entrepreneurship has expanded across disciplines such as development studies, sociology, and social economy research, the literature remains conceptually fragmented. Existing studies are distributed across multiple literatures, employ inconsistent terminology, and frequently lack integration with core entrepreneurship theory (Suryani et al., 2022). As a result, collective entrepreneurship is frequently treated as peripheral to mainstream entrepreneurship scholarship, rather than as a legitimate and analytically valuable form of entrepreneurial activity (Gurau and Dana, 2018). This fragmentation limits cumulative knowledge development and constrains the ability of entrepreneurship theory to inform effective policy and support mechanisms aimed at community-level economic transformation (Ndjama, 2024; Sibiya and Mahosi, 2025).

Furthermore, existing entrepreneurship frameworks rarely integrate ecosystem and embeddedness perspectives in ways that adequately capture collective entrepreneurial dynamics in BRICS Plus contexts (Meyer et al., 2024). While entrepreneurial ecosystem research has gained prominence, it has largely focused on innovation-driven, high-growth contexts in developed economies, with limited attention to community-based ecosystems characterised by informality, social capital, and collective agency. This gap is particularly significant given the centrality of local networks, informal institutions, and collective governance in shaping entrepreneurial outcomes in emerging and developing economies.

Against this backdrop, the purpose of this study is to conduct a systematic literature review of community and collective entrepreneurship in BRICS Plus economies. The study seeks to critically examine how collective entrepreneurial forms are conceptualised, organised, and embedded within local ecosystems, and to identify key theoretical and empirical gaps in the existing literature. By consolidating fragmented scholarship and proposing an ecosystem-based conceptual perspective, this review aims to reposition community and collective entrepreneurship as a central component of entrepreneurship theory and practice in emerging and developing contexts. The contribution of this paper is threefold. First, it shifts the unit of analysis from the individual entrepreneur to communities, collectives, and networks, addressing a critical blind spot in mainstream entrepreneurship research. Second, it integrates insights from entrepreneurship,

development, and social economy literatures to advance a more context-sensitive and ecosystem-oriented understanding of collective entrepreneurship in BRICS Plus economies. Third, it offers implications for policymakers and practitioners by highlighting the importance of supporting community-level entrepreneurial ecosystems that recognise collective agency, social embeddedness, and inclusive development objectives.

The aim of this study is to conduct a systematic literature review of community and collective entrepreneurship in BRICS Plus economies in order to critically examine how collective entrepreneurial forms are conceptualised, organised, and embedded within local entrepreneurial ecosystems, and to advance an ecosystem-based understanding of entrepreneurship that extends beyond individual-centric models.

Literature Review

The literature review examines the existing body of knowledge on community and collective entrepreneurship in BRICS Plus economies., with the objective of identifying dominant conceptualisations, analytical frameworks and patterns. Given the interdisciplinary nature of research on collective entrepreneurship, research in this area is informed by entrepreneurship studies, development economics, social economy research, and institutional theory, yet remains fragmented with limited conceptual integration. In the literature review, community entrepreneurship, collective entrepreneurship, cooperative entrepreneurship, and solidarity entrepreneurship are treated as analytically related but conceptually distinct forms of entrepreneurial organisation. Collective entrepreneurship is used as an overarching concept referring to entrepreneurial activity undertaken through shared ownership, joint decision-making, and collective agency (Montgomery et al., 2012; Siedlok et al., 2024). Community entrepreneurship emphasises local embeddedness and place-based collective action (Peredo and Chrisman, 2006; Tshikovhi et al., 2024), while cooperative entrepreneurship refers to formal, member-owned organisational structures often shaped by policy and regulatory frameworks (Lund, 2012). Solidarity entrepreneurship, in contrast, is rooted in social and solidarity economy traditions that prioritise social justice, inclusion, and democratic governance (Sahakian and Dunand, 2015; ILO, 2024; Gidron and Domaradzka, 2021). Clarifying these conceptual boundaries is necessary to address terminological ambiguity (Dufays and Huybrechts, 2016; Tripathi, 2023; Sibiya, 2025) and to enable cumulative theory development in research on collective entrepreneurship in BRICS Plus economies.

The literature review is structured to move beyond descriptive accounts of collective entrepreneurial activity and towards a critical examination of how community and collective entrepreneurship are theorised and situated within entrepreneurial ecosystems. Particular attention is given to how collective entrepreneurial forms, such as cooperatives, community-based enterprises, and solidarity economy initiatives, are shaped by institutional conditions, social embeddedness, and local ecosystem dynamics in BRICS Plus contexts. The section also interrogates the extent to which dominant entrepreneurship frameworks, predominantly developed in advanced economies, adequately capture the collective, relational, and embedded nature of entrepreneurship in emerging and developing economies.

By organising the literature around community entrepreneurship, collective and cooperative forms, and ecosystem and embeddedness perspectives, this section establishes the conceptual foundations for the systematic review. In doing so, it highlights persistent theoretical limitations and fragmentation in existing scholarship, thereby justifying the need for an integrative and ecosystem-based perspective on community and collective entrepreneurship in BRICS Plus economies. Within this review, community entrepreneurship, collective entrepreneurship, cooperative entrepreneurship, and solidarity entrepreneurship are treated as analytically related but conceptually distinct forms of entrepreneurial organisation. While these concepts overlap in their emphasis on collective agency and shared value creation, they differ in terms of governance structures, institutional positioning, and theoretical grounding. Clarifying these distinctions is essential for addressing conceptual ambiguity and advancing cumulative theory on collective entrepreneurship in BRICS Plus contexts.

Community and Collective Entrepreneurship in BRICS Plus Economies

Entrepreneurship scholarship in emerging and developing economies has increasingly recognised that entrepreneurial activity often extends beyond the actions of individual entrepreneurs to encompass community-based and collective forms of organisations. In BRICS Plus economies, entrepreneurship is frequently embedded within social relations, local communities, cooperatives, and informal collective arrangements that reflect shared socio-economic conditions and collective survival strategies (Sarinsok, 2024). This challenges dominant entrepreneurship models that prioritise individual opportunity recognition, firm growth, and market competition as the primary markers of entrepreneurial success (Gurau & Dana, 2018). Community and collective entrepreneurship in BRICS Plus economies often emerges in response to structural constraints, including high

unemployment, spatial marginalisation, limited access to formal labour markets, and weak or uneven institutional support (Ndjama, 2024). In countries such as South Africa, community-based enterprises and cooperatives have been promoted as mechanisms for township and rural economic development, addressing both employment creation and social cohesion (Meyer et al., 2024). Similarly, in India, collective entrepreneurship frequently takes the form of self-help groups and community enterprises, particularly among women and marginalised populations, where entrepreneurial activity is closely linked to social empowerment and livelihood security (Ahmad and Bajwa, 2023).

In Brazil, solidarity enterprises and community cooperatives have been widely documented as part of broader social and solidarity economy movements aimed at addressing inequality and exclusion. These initiatives often prioritise collective ownership, democratic governance, and social objectives alongside economic outcomes. (Medeiros et al., 2020). Comparable patterns are observed in Indonesia and Ethiopia, where community-based entrepreneurship plays a critical role in rural development, agricultural value chains, and informal service provision, often supported by local networks and community governance structures rather than formal market institutions. (Suryani et al., 2022; Worku, 2021).

Despite the prevalence of such collective entrepreneurial forms, mainstream entrepreneurship research has tended to treat them as peripheral or atypical. Community-based and collective enterprises are frequently positioned within development studies or social economy literature, rather than being integrated into core entrepreneurship theory. (Ahmad and Bajwa, 2023; Gurau and Dana, 2018). This disciplinary fragmentation has limited the cumulative development of theory capable of explaining how collective entrepreneurship functions within diverse institutional and socio-economic environments.

Collective, Cooperative, and Solidarity Entrepreneurship

Collective entrepreneurship include a range of organisational forms, including cooperatives, mutual associations, solidarity enterprises, and informal collective ventures. These forms are characterised by shared ownership, collective decision-making, and the pursuit of both economic and social objectives (Duguid and Sasidharan, 2018). In BRICS Plus economies, collective entrepreneurship is often rooted in historical, cultural, and socio-political contexts that emphasise communal resource sharing and collective action (Littlewood and Khan, 2018). In China, for example, collective entrepreneurship has been observed within village-level enterprises and cooperatives that operate alongside state and private actors, reflecting hybrid governance arrangements (Cui et al., 2018). In Iran, cooperative

entrepreneurship has been promoted as a policy instrument to address unemployment and regional disparities, particularly in semi-urban and rural areas (Tajani et al., 2020). Similarly, Egypt and Saudi Arabia have seen the emergence of collective entrepreneurial initiatives linked to youth employment, social enterprises, and community development programmes aligned with broader national development agendas (Ghalwash et al., 2023).

The solidarity economy literature, particularly prominent in Latin American contexts such as Brazil, frames collective entrepreneurship as an alternative economic model that prioritises social justice, inclusion, and democratic participation (Vanderbergue, 2021). While this perspective provides valuable insights into the normative and social dimensions of collective entrepreneurship, it is often weakly connected to entrepreneurship theory, resulting in limited cross-fertilisation between fields. Across BRICS Plus economies, collective and cooperative entrepreneurship is frequently evaluated through policy or development lenses, focusing on outcomes such as job creation or poverty alleviation, rather than through analytical frameworks that examine entrepreneurial processes, governance dynamics, and institutional embeddedness (Borda-Rodriguez and Vicari, 2024). This has contributed to conceptual ambiguity and inconsistent use of terminology across studies

Embeddedness, Social Capital, and Entrepreneurial Ecosystems

A growing body of literature emphasises the importance of embeddedness and social capital in shaping entrepreneurial activity in emerging and developing economies. Collective entrepreneurship in BRICS Plus contexts is often deeply embedded within local social networks, community norms, and informal governance mechanisms that substitute for weak or inaccessible formal institutions (He and Wang, 2020; Jack et al., 2019). In South Africa's townships, for instance, collective entrepreneurial initiatives frequently rely on trust-based networks, community leadership structures, and shared social norms to coordinate activity and manage risk (Mamabolo and Myres, 2020). In India and Indonesia, social capital plays a critical role in enabling collective access to finance, information, and markets, particularly where formal financial institutions are absent or exclusionary (Bapna and Funk, 2021; Pratono, 2018).

Entrepreneurial ecosystem frameworks offer an opportunity for analysing these dynamics, as they shift attention from individual firms to the broader configuration of actors, institutions, and relationships that enable entrepreneurial activity. However, ecosystem research has largely focused on high-growth, innovation-

driven contexts in advanced economies, with limited application to community-based and collective entrepreneurship in BRICS Plus economies (Roundy, 2020; Wurth et al., 2022). Where ecosystem concepts are applied, they often overlook informal institutions, community governance, and collective agency.

As a result, there remains a gap in entrepreneurship theory regarding how collective entrepreneurship operates within community-level ecosystems characterised by informality, social embeddedness, and institutional complexity (Audretsch et al., 2021). Integrating ecosystem perspectives with collective entrepreneurship offers a promising avenue for advancing context-sensitive theory relevant to BRICS Plus economies. Taken together, these the literature reveals a persistent theoretical gap in entrepreneurship scholarship. While collective entrepreneurship is empirically widespread in BRICS Plus economies, existing frameworks inadequately theorise how collective agency, social embeddedness, and institutional complexity interact within entrepreneurial ecosystems. As a result, collective entrepreneurship remains marginalised within mainstream ecosystem theory, which continues to privilege firm-level and individualistic interpretations of entrepreneurial activity.

Table 1: Conceptualisations of Community and Collective Entrepreneurship in BRICS Plus Economies

Conceptual Focus	Typical Definition in Literature	Disciplinary Origin	Key Limitation
Community entrepreneurship	Entrepreneurship rooted in local communities	Development studies	Weak integration with entrepreneurship theory
Collective entrepreneurship	Joint ownership and decision-making	Management / sociology	Narrow focus on formal cooperatives
Cooperative entrepreneurship	Member-owned enterprises	Policy economics	Over-institutionalised framing
Solidarity entrepreneurship	Social justice-oriented enterprises	Social economy	Normative, limited analytical depth

Source: Authors 2025

Table 1 presents dominant conceptualisations of community and collective entrepreneurship identified in the literature on BRICS Plus economies. The table highlights that research on collective entrepreneurship is dispersed across multiple disciplinary traditions, including development studies, management, economics,

and social economy scholarship. While these perspectives contribute valuable insights, they employ divergent definitions and analytical lenses, resulting in conceptual fragmentation and limited theoretical integration. The comparison reveals that collective entrepreneurship is frequently framed through policy or development-oriented perspectives, with limited engagement with core entrepreneurship theory. This fragmentation constrains cumulative knowledge development and reinforces the marginal positioning of collective entrepreneurship within mainstream entrepreneurship scholarship. The table emphasizes the need for integrative frameworks capable of reconciling these disparate conceptual approaches.

The literature reviewed in this section highlights that community and collective entrepreneurship is widespread and economically significant across BRICS Plus economies yet remains conceptually fragmented and insufficiently integrated into mainstream entrepreneurship research. Collective entrepreneurial forms are often examined through isolated lenses, such as cooperatives, solidarity economy, or development interventions, without a unifying framework that captures their entrepreneurial nature, institutional embeddedness, and ecosystem interactions. These gaps highlight the need for a systematic and integrative review that consolidates diverse strands of literature on community and collective entrepreneurship in BRICS Plus contexts. By integrating existing research and advancing an ecosystem-based conceptual framework, the present study seeks to reposition collective entrepreneurship as a central, rather than peripheral, component of entrepreneurial ecosystems in emerging and developing economies.

Research design and methods

This study adopts a systematic literature review (SLR) methodology to examine community and collective entrepreneurship in BRICS Plus economies. A systematic review approach is appropriate given the fragmented and interdisciplinary nature of scholarship on collective entrepreneurship, which includes entrepreneurship studies, development research, social economy literature, and institutional theory (Snyder, 2019; Xiao and Watson, 2019). The SLR enables a transparent, replicable, and rigorous synthesis of existing research, facilitating cumulative knowledge development and theory building. The review follows PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure methodological transparency in the identification, screening, eligibility assessment, and inclusion of relevant studies (Snyder, 2019; Xiao and Watson, 2019; Page et al., 2021).

A comprehensive search strategy was conducted across major academic databases commonly used in entrepreneurship and development research, including Scopus, Web of Science, and EBSCOhost. These databases were selected due to their broad coverage of peer-reviewed journals in management, entrepreneurship, economics, and social sciences. Search terms were developed using combinations of keywords related to collective entrepreneurship and the BRICS Plus context.

Key search terms included:

- community entrepreneurship
- collective entrepreneurship
- cooperative entrepreneurship
- solidarity economy
- social enterprise
- entrepreneurial ecosystems
- combined with: *BRICS*, emerging economies, developing economies, and individual BRICS Plus country names

Boolean operators (AND/OR) were used to refine the search, and truncation was applied where appropriate to capture variations in terminology (Gusenbauer and Haddaway, 2020). Clear inclusion and exclusion criteria were applied to ensure relevance and quality (Kraus et al., 2020).

Inclusion criteria:

- Peer-reviewed journal articles
- Studies focusing on community, collective, cooperative, or solidarity-based entrepreneurship
- Empirical or conceptual research relevant to BRICS Plus economies
- Articles published in English
- Studies published within the selected review period (e.g. 2000–2024)

Exclusion criteria:

- Non-peer-reviewed sources (e.g. reports, dissertations, conference papers)
- Studies focusing exclusively on individual or high-growth entrepreneurship without a collective dimension
- Articles unrelated to emerging or developing economy contexts
- Purely descriptive policy documents without analytical engagement

The screening process was conducted in four stages in line with PRISMA guidelines. First, duplicate records were removed. Second, titles and abstracts were screened to assess relevance to community and collective entrepreneurship. Third,

full-text articles were reviewed against the inclusion criteria. Finally, eligible studies were retained for qualitative synthesis.

At each stage, studies were excluded if they failed to meet the predefined criteria. The screening process was documented to ensure transparency and replicability, with the final selection reflected in a PRISMA flow diagram. Data were extracted systematically from the selected articles using a structured coding framework. Extracted information included publication details, country context, type of collective entrepreneurship examined, theoretical framework, methodological approach, and key findings. A thematic analysis was employed to identify recurring patterns, dominant conceptualisations, and theoretical gaps across the literature. Coding was both deductive, informed by entrepreneurship and ecosystem theories, and inductive, allowing new themes to emerge from the data (Braun and Clarke, 2019). This approach enabled the identification of dominant analytical lenses, ecosystem configurations, and institutional dynamics shaping collective entrepreneurship in BRICS Plus economies.

To enhance the robustness of the review, included studies were assessed for conceptual clarity, methodological rigour, and relevance to the research objectives. Rather than excluding studies based on methodological hierarchy, the review prioritised conceptual contribution and contextual relevance, consistent with best practices in qualitative systematic reviews (Popay et al., 2006). Findings were analysed narratively and conceptually, enabling cross-study comparison and integration. The analysis informed the development of an ecosystem-based conceptual framework that captures the collective, embedded, and context-sensitive nature of entrepreneurship in BRICS Plus economies.

As with all systematic reviews, this study is subject to certain limitations. The review is restricted to English-language peer-reviewed journal articles, which may exclude relevant insights published in other languages or formats (Mongeon and Hubbard, 2016). Additionally, variability in terminology and conceptual definitions across studies may affect comparability. However, these limitations are mitigated by the transparent and systematic approach adopted in this review.

Results and Findings

This section presents the findings of the systematic literature review on community and collective entrepreneurship in BRICS Plus economies. Thematic analysis of the reviewed studies revealed five dominant themes that characterise how collective entrepreneurship is conceptualised, organised, and embedded within

local entrepreneurial ecosystems. These themes highlight both areas of convergence in the literature and persistent conceptual and theoretical gaps.

Community Entrepreneurship as a Collective Response to Structural Constraints

A prominent theme across the literature is the positioning of community entrepreneurship as a collective response to structural socio-economic constraints. Studies consistently highlight that community-based entrepreneurial initiatives in BRICS Plus economies emerge in contexts characterised by unemployment, poverty, spatial marginalisation, and limited access to formal markets and institutions (Tshikovhi and Netswera, 2025; Littlewood and Holt, 2021). Rather than being driven primarily by opportunity recognition or innovation, community entrepreneurship is frequently motivated by shared survival needs, livelihood security, and local economic resilience (Dahles and Pratono, 2023; Zaharia and Bălăcescu, 2021). The literature indicates that community entrepreneurship often operates at the intersection of economic and social objectives. Collective ventures are designed not only to generate income but also to strengthen social cohesion, address community-level challenges, and provide services that are otherwise unavailable through formal market mechanisms (Mahosi et al., 2025; Ratten, 2024). This dual orientation challenges dominant entrepreneurship frameworks that prioritise profit maximisation and firm-level growth as the primary indicators of entrepreneurial success (Manyapelo, 2025; Xheneti, 2025).

Collective and Cooperative Organisational Forms

A second dominant theme concerns the organisational forms through which collective entrepreneurship is organised. The reviewed studies identify a diverse range of collective structures, including cooperatives, community-owned enterprises, mutual associations, solidarity enterprises, and informal collective ventures (Bhowmik, 2021; Mahosi et al., 2025). These organisational forms are typically characterised by shared ownership, participatory governance, and collective decision-making processes (Dahles and Pratono, 2023).

However, the literature reveals considerable variation in how collective entrepreneurship is defined and operationalised. In some studies, collective entrepreneurship is associated with formal cooperatives, while others adopt broader definitions that include informal and hybrid collective arrangements (Hassan and Rahman, 2024; Ratten, 2024). This inconsistency contributes to conceptual ambiguity and complicates comparative analysis across BRICS Plus contexts (Tshikovhi and Netswera, 2025). Moreover, collective entrepreneurial forms are

often analysed through development or policy lenses rather than being integrated into mainstream entrepreneurship theory (Xheneti, 2025; Littlewood and Holt, 2021).

Table 2: Forms of Collective Entrepreneurship Across BRICS Plus Economies

Country example	Dominant collective form	Sector	Primary function
South Africa	Community cooperatives	Retail, agriculture	Livelihoods & inclusion
India	Self-help groups	Microfinance, crafts	Women's empowerment
Brazil	Solidarity enterprises	Services, recycling	Social inclusion
Indonesia	Community enterprises	Agriculture, tourism	Local development
Ethiopia	Producer cooperatives	Agriculture	Market access

Source: Authors 2025

Table 2 presents illustrative forms of collective entrepreneurship documented across selected BRICS Plus economies, highlighting the diversity of organisational arrangements, sectoral engagement, and functional objectives. The table demonstrates that collective entrepreneurship manifests in varied forms, including cooperatives, self-help groups, solidarity enterprises, and community-owned ventures, shaped by local socio-economic conditions and institutional environments (Elias and Noisette, 2021; Wanyama, 2024). Rather than representing isolated or exceptional cases, these collective entrepreneurial forms appear consistently across BRICS Plus contexts, suggesting that collective organisation constitutes a structurally significant mode of entrepreneurship (Dutta and Banerjee, 2023). The diversity reflected in the table further reinforces the limitations of individual-centric entrepreneurship models and supports the need for context-sensitive, ecosystem-oriented theoretical approaches.

Embeddedness, Social Capital, and Collective Agency

The third theme emphasises the centrality of embeddedness and social capital in shaping community and collective entrepreneurship. Across BRICS Plus economies, collective entrepreneurial activity is deeply embedded within local social networks, trust-based relationships, cultural norms, and informal governance mechanisms (Kimmitt and Muñoz, 2021). These forms of embeddedness enable

collective entrepreneurs to mobilise resources, coordinate action, and manage risk in environments where formal institutions are weak, inaccessible, or unevenly enforced (Sengupta and Sahay, 2022). The literature highlights that social capital functions as a critical substitute for formal institutional support, facilitating access to information, finance, and markets (Barki et al., 2024). Collective agency is defined as the capacity of communities to act jointly in pursuit of shared goals, emerges as a key driver of entrepreneurial persistence and resilience. However, while embeddedness is frequently acknowledged, few studies systematically theorise how social capital and collective agency interact with institutional conditions within entrepreneurial ecosystems (Ugoh and Ukpere, 2021; Venkatesh et al., 2023).

Institutional Contexts and Ecosystem Dynamics

A fourth theme relates to the institutional and ecosystem environments within which collective entrepreneurship operates. The reviewed studies demonstrate that collective entrepreneurial activity in BRICS Plus economies is shaped by regulatory frameworks, state policies, development programmes, and local institutional arrangements (Urbano, Audretsch and Aparicio, 2021). In some contexts, collective entrepreneurship is actively promoted through cooperative policies and community development initiatives, while in others it operates in regulatory grey areas or alongside informal institutions (Mhlanga, 2024). Despite growing recognition of entrepreneurial ecosystems as an analytical framework, the literature reveals limited application of ecosystem perspectives to community and collective entrepreneurship (Spigel, 2024). Where ecosystem concepts are employed, they are often adapted from models developed in advanced economies and fail to account for informality, community governance, and collective ownership structures. This results in an incomplete understanding of how community-level ecosystems function and how they support or constrain collective entrepreneurial activity (Theodoraki, Dana and Caputo, 2022; Gcume and Mohapeloa, 2025).

Table 3: Ecosystem Enablers and Constraints for Collective Entrepreneurship

Ecosystem dimension	Enablers	Constraints
Institutions	Cooperative policies	Regulatory rigidity
Finance	Informal savings groups	Limited formal access
Social capital	Trust & networks	Elite capture
Infrastructure	Shared resources	Spatial marginalisation

Source: Authors 2025

Table 3 summarises key ecosystem-level enablers and constraints influencing community and collective entrepreneurship in BRICS Plus economies. The findings illustrate that collective entrepreneurial activity is shaped by a combination of institutional conditions, access to resources, and social capital embedded within local ecosystems. Enablers such as trust-based networks, shared infrastructure, and supportive community norms often compensate for weak or exclusionary formal institutions. At the same time, the table highlights persistent constraints, including regulatory rigidity, limited access to formal finance, and spatial marginalisation, which shape the strategic choices of collective entrepreneurs. This duality emphasizes the importance of analysing collective entrepreneurship within an ecosystem framework that captures both enabling and constraining forces operating simultaneously.

Marginalisation of Collective Entrepreneurship in Mainstream Theory

The final theme highlights the persistent marginalisation of community and collective entrepreneurship within mainstream entrepreneurship theory. Across the reviewed studies, collective entrepreneurship is frequently positioned as supplementary to individual entrepreneurship, framed as a development intervention, or treated as an exception rather than a core entrepreneurial form (Ben-Hafaïedh et al., 2024). This marginalisation is reinforced by individual-centric theoretical models that inadequately capture collective decision-making, shared value creation, and non-market logics (Dodd et al., 2025; Barki et al., 2024).

The findings indicate that existing entrepreneurship theories offer limited explanatory power for understanding collective entrepreneurial dynamics in BRICS Plus economies. As a result, collective entrepreneurship remains under-theorised, and its contribution to inclusive growth and local economic development is insufficiently recognised within entrepreneurship scholarship (Chowdhury, 2023; Deschamps and Slitine, 2024).

Taken together, the findings reveal that community and collective entrepreneurship in BRICS Plus economies is economically significant, socially embedded, and institutionally shaped, yet remains conceptually fragmented and theoretically marginalised. The literature highlights the importance of collective agency, social capital, and local ecosystems, while simultaneously exposing the limitations of dominant entrepreneurship frameworks in capturing these dynamics. These findings underline the need for an integrative, ecosystem-based conceptual framework that recognises community and collective entrepreneurship as a central component of entrepreneurial ecosystems in emerging and developing economies. The development of such a framework is presented in the subsequent section.

Discussion

This study set out to examine how community and collective entrepreneurship are conceptualised, organised, and embedded within local entrepreneurial ecosystems in BRICS Plus economies. The findings reveal that collective entrepreneurship constitutes a central yet under-theorised form of entrepreneurial activity, one that challenges dominant individual-centric models and calls for a reorientation of entrepreneurship theory towards collective agency, social embeddedness, and ecosystem-level analysis. This discussion interprets the findings in relation to existing theory, highlights key theoretical contributions, and situates community and collective entrepreneurship as a core component of entrepreneurial ecosystems in emerging and developing contexts.

Reframing Entrepreneurship Beyond the Individual Entrepreneur

A central insight emerging from the review is that entrepreneurship in BRICS Plus economies frequently operates as a collective endeavour, rather than as an individual or firm-level activity (Champenois et al., 2024). Community-based enterprises, cooperatives, and solidarity initiatives function as mechanisms through which communities collectively mobilise resources, share risks, and respond to socio-economic exclusion (Siedlok et al., 2025). This finding challenges the prevailing assumption in mainstream entrepreneurship literature that entrepreneurial action is primarily driven by individual opportunity recognition and personal risk-taking. The persistence of collective entrepreneurship across diverse BRICS Plus contexts suggests that individual-centric entrepreneurship models offer limited explanatory power in environments characterised by institutional constraints, labour market exclusion, and resource scarcity. Instead, entrepreneurship in these settings is better understood as a socially embedded

process shaped by collective needs, shared identities, and community-level objectives (Slitine and Vuotto, 2023; Welter et al., 2024). By foregrounding collective agency, this study extends entrepreneurship theory beyond methodological individualism and aligns it more closely with the lived realities of entrepreneurial practice in emerging and developing economies.

Collective Entrepreneurship as an Embedded and Ecosystem-Dependent Process

The findings further highlight that community and collective entrepreneurship are deeply embedded within local ecosystems, relying heavily on social capital, trust-based networks, and informal governance mechanisms (Amoa-Gyarteng and Dhlwayo, 2024). In BRICS Plus economies, where formal institutions may be weak, unevenly enforced, or inaccessible, these social and relational structures play a critical role in enabling entrepreneurial coordination and persistence (Gcume and Mohapeloa, 2025; World Bank, 2024). While entrepreneurial ecosystem frameworks have gained prominence in recent years, they have largely been developed in the context of innovation-driven, high-growth environments in advanced economies (Spigel, 2024; Musiza, 2025). The present study demonstrates that such frameworks require contextual adaptation to capture the dynamics of collective entrepreneurship in BRICS Plus contexts. Specifically, ecosystem models must account for informal institutions, community leadership, collective ownership, and non-market logics that underpin collective entrepreneurial activity. This insight advances ecosystem theory by repositioning community-level ecosystems as analytically distinct from firm-centric or innovation-focused ecosystems.

Theoretical Marginalisation of Collective Entrepreneurship

Despite its prevalence and economic significance, the literature reveals that collective entrepreneurship remains theoretically marginalised within mainstream entrepreneurship research. Collective entrepreneurial forms are frequently framed as development interventions, policy instruments, or social economy initiatives, rather than as legitimate entrepreneurial phenomena warranting theoretical attention in their own right (Siedlok et al., 2025; Enagi and Ukpere, 2022). This marginalisation reinforces a narrow understanding of entrepreneurship that privileges growth, scalability, and formalisation while overlooking alternative forms of value creation (Dodd et al., 2025; Deschamps and Slitine, 2024). The findings suggest that this marginalisation is not due to a lack of empirical evidence,

but rather to conceptual blind spots within dominant entrepreneurship theories. By failing to incorporate collective agency, shared governance, and embeddedness, existing frameworks struggle to explain how collective entrepreneurship functions, persists, and contributes to local economic development (Champenois et al., 2024). Addressing this gap requires a deliberate expansion of entrepreneurship theory to include collective and community-based forms as central analytical categories (Barki et al., 2024).

Implications for Entrepreneurship Theory

This study makes several important contributions to entrepreneurship theory. First, it reconceptualises entrepreneurship as a multi-level and collective process, extending theoretical attention beyond individuals and firms to communities, networks, and ecosystems (Slitine and Vuotto, 2023). Second, it integrates insights from entrepreneurship, development, and social economy literatures to advance a more context-sensitive and inclusive theoretical perspective (Leitão, Amaral and Carvalho, 2024). Third, it demonstrates the need to embed collective entrepreneurship within ecosystem frameworks that recognise institutional complexity, informality, and social embeddedness (Musiza, 2025). By advancing an ecosystem-based perspective on community and collective entrepreneurship, the study complements and extends existing entrepreneurship theories, particularly those concerned with institutional contexts and embeddedness (Urbano, Audretsch and Aparicio, 2021). This theoretical repositioning opens new avenues for research on entrepreneurial processes, governance arrangements, and value creation mechanisms that operate beyond market-centric and individualistic assumptions (Dodd et al., 2025).

Policy and Practice Implications

The findings of this review have important implications for policymakers and development practitioners in BRICS Plus economies. Entrepreneurship policies and support programmes often prioritise individual entrepreneurs and formal firm development, overlooking collective entrepreneurial forms that are already embedded within communities (OECD, 2025; World Economic Forum, 2025). The evidence suggests that such approaches risk undermining existing collective capacities and social capital (Amoa-Gyarteng and Dhliwayo, 2024). Policy interventions should therefore adopt a community-ecosystem-oriented approach, recognising collective entrepreneurship as a viable and sustainable pathway for inclusive growth (KZN EDTEA, 2025). This includes designing support

mechanisms that strengthen collective governance structures, facilitate access to shared resources, and align formal institutions with community-level entrepreneurial practices. Development strategies that acknowledge collective agency are more likely to enhance resilience, social cohesion, and long-term economic participation (World Economic Forum, 2025; Mongabay, 2025).

Link to the Conceptual Framework

The discussion reinforces the need for an integrative conceptual framework that captures the collective, embedded, and ecosystem-dependent nature of entrepreneurship in BRICS Plus economies. The conceptual framework proposed in this study responds directly to this need by positioning community and collective entrepreneurship as a central component of entrepreneurial ecosystems, shaped by institutional conditions and social embeddedness. This framework provides a foundation for future empirical research and offers a more institutionally and socially embedded perspective through which to analyse entrepreneurship in emerging and developing contexts.

Conceptual Framework: A Community-Based Entrepreneurial Ecosystem Model for BRICS Plus Economies

Building on the findings of the systematic literature review, this section advances a community-based entrepreneurial ecosystem framework that reconceptualises entrepreneurship in BRICS Plus economies as a collective, embedded, and ecosystem-dependent process. In contrast to dominant entrepreneurial ecosystem models that foreground individual entrepreneurs and firm-level growth, the proposed framework positions communities and collective agency as the central organising forces shaping entrepreneurial activity in emerging and developing contexts. The framework responds directly to the conceptual fragmentation identified in the literature by integrating insights from community entrepreneurship, collective and cooperative entrepreneurship, institutional theory, and ecosystem perspectives. In doing so, it offers a context-sensitive model that captures how entrepreneurial activity in BRICS Plus economies is embedded within social relations, local institutions, and shared resource arrangements.

Core Logic of the Community-Based Entrepreneurial Ecosystem

Figure 1 presents the Community-Based Entrepreneurial Ecosystem Model for BRICS Plus economies. At the core of the framework lies community and collective agency, reflecting the central role of shared decision-making, collective

ownership, and locally embedded entrepreneurial action. Rather than treating communities as passive contexts for entrepreneurship, the model conceptualises them as active ecosystem actors that shape entrepreneurial opportunities, mobilise resources, and govern collective action. Surrounding the community core are collective organisational forms, including cooperatives, community-based enterprises, solidarity initiatives, and informal collective ventures (Ngwa and Ukpere, 2023). These organisational forms serve as the primary vehicles through which entrepreneurial activity is organised and sustained within the ecosystem. The framework further incorporates ecosystem resources, such as social capital, local knowledge, finance, skills, and infrastructure, as well as the broader institutional environment, including formal policies, regulatory frameworks, informal norms, and cultural practices. The model emphasises that entrepreneurial outcomes in BRICS Plus economies emerge through continuous interaction between community actors, collective organisations, ecosystem resources, and institutional conditions. Entrepreneurship is thus conceptualised as a relational and embedded process, rather than an individualised act of opportunity recognition.

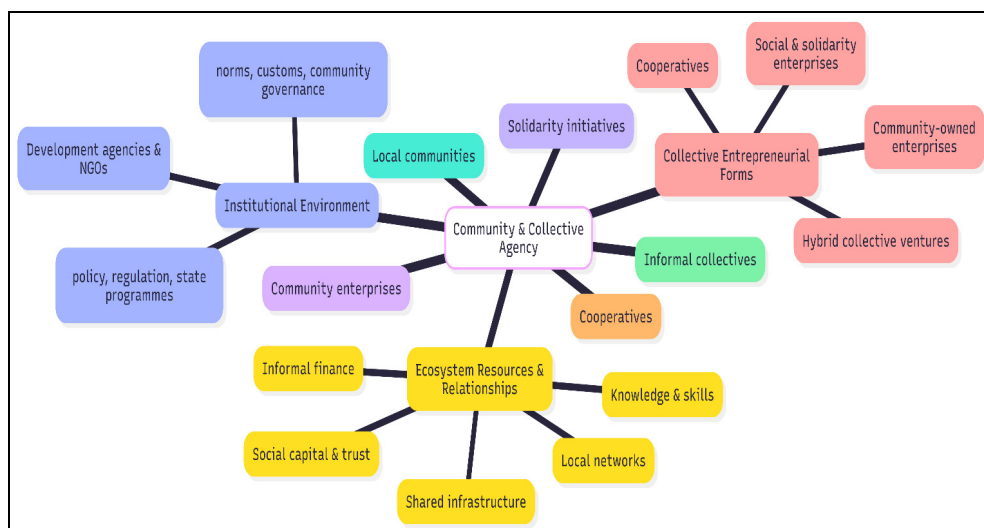


Figure nr 1: Community-Based Entrepreneurial Ecosystem in BRICS Plus Economies

Source: Authors 2025

Governance and Coordination Mechanisms in Community and Collective Entrepreneurship

Figure 2 elaborates the governance and coordination mechanisms that underpin community-based entrepreneurial ecosystems. Unlike individual-centric models of entrepreneurship, collective entrepreneurship relies on participatory governance structures, shared leadership, and community-based accountability mechanisms to coordinate action and manage shared resources. These governance mechanisms play a critical mediating role within the ecosystem. They enable collective enterprises to navigate complex institutional environments, engage with external stakeholders (such as government agencies, NGOs, and market actors), and maintain legitimacy within their communities (Olofinji and Ukpere, 2021). Importantly, governance in this framework is not solely formal or hierarchical; it is often grounded in social norms, trust-based relationships, and locally embedded authority structures. By foregrounding governance and coordination, the framework highlights how collective entrepreneurship in BRICS Plus economies is sustained through relational governance, rather than through purely contractual or market-based mechanisms.

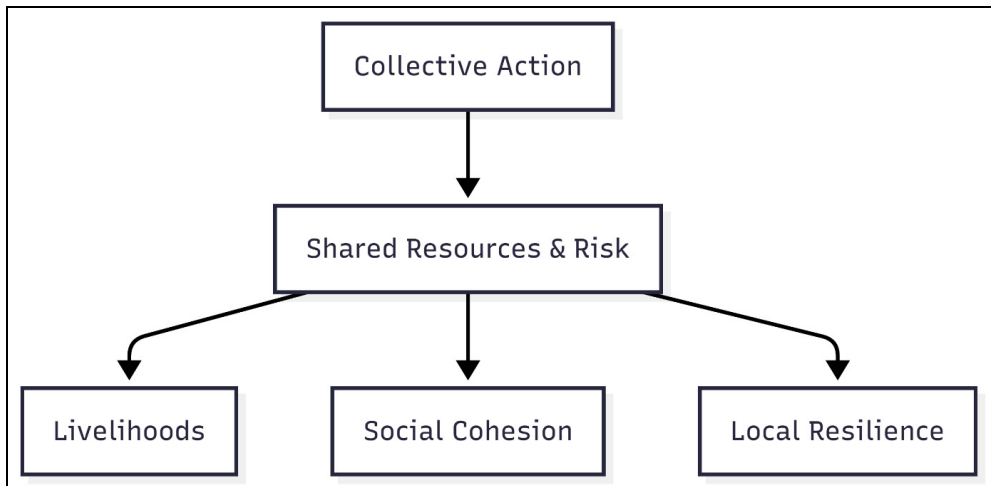


Figure nr 2: Collective Entrepreneurial Value Creation Pathways

Source: Authors 2025

Collective Entrepreneurial Value Creation Pathways

Figure 3 illustrates the collective entrepreneurial value creation pathways within the community-based entrepreneurial ecosystem. The framework demonstrates that value creation extends beyond firm-level growth to include economic, social, and community-level outcomes. These outcomes may include employment creation, livelihood security, social inclusion, skills development, community resilience, and local economic regeneration.

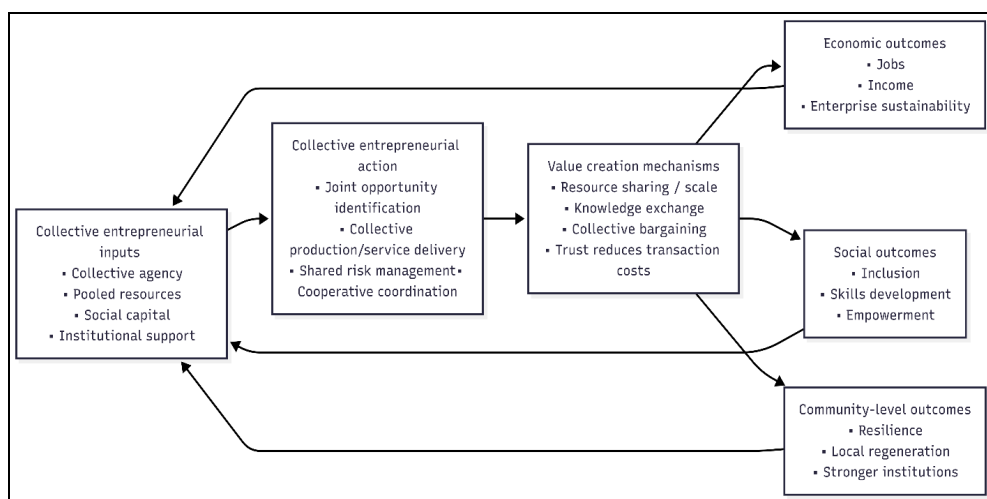


Figure nr 3: Collective Entrepreneurial Value Creation Pathways in BRICS Plus Economies

Source: Authors 2025

Collective action and shared resource mobilisation enable entrepreneurial initiatives to generate value that is distributed across community members, rather than concentrated within individual firms or entrepreneurs (Olofinji and Ukpere, 2021; Gribincea, 2023). The framework thus challenges narrow, growth-centric definitions of entrepreneurial success and foregrounds collective wellbeing and ecosystem sustainability as central outcomes of entrepreneurship in BRICS Plus contexts.

Theoretical Contribution of the Framework

This conceptual framework contributes to entrepreneurship theory by repositioning collective entrepreneurship as a central, rather than peripheral, component of entrepreneurial ecosystems in emerging and developing economies. By integrating community agency, governance mechanisms, and collective value creation within an ecosystem perspective, the framework addresses key theoretical gaps identified in the literature. The model advances a context-sensitive understanding of entrepreneurship that better reflects the lived realities of entrepreneurial activity in BRICS Plus economies, where entrepreneurship is deeply embedded within social relations, community structures, and institutional complexity. As such, the framework provides a foundation for future empirical research, policy design, and ecosystem development initiatives aimed at supporting inclusive and sustainable entrepreneurship in emerging and developing contexts.

Conclusion

This study set out to examine how community and collective entrepreneurship are conceptualised and embedded within entrepreneurial ecosystems in BRICS Plus economies through a systematic literature review. The findings demonstrate that collective entrepreneurship represents a widespread and economically significant form of entrepreneurial activity across emerging and developing economies. Rather than emerging primarily from individual opportunity recognition, community-based entrepreneurial initiatives frequently arise as collective responses to structural socio-economic constraints, including unemployment, spatial marginalisation, and limited institutional support. The review revealed several important patterns within the literature. First, community and collective entrepreneurship in BRICS Plus economies is strongly shaped by social embeddedness, trust-based networks, and shared community resources. Second, collective entrepreneurial activity is organised through diverse institutional arrangements such as cooperatives, solidarity enterprises, self-help groups, and community-owned ventures. Third, the literature demonstrates that existing entrepreneurship frameworks remain heavily individual-centric and often fail to adequately capture collective entrepreneurial dynamics in emerging economy contexts.

By analysing existing literature across entrepreneurship, development, and social economy disciplines, this study proposes an ecosystem-based conceptual framework that positions community and collective entrepreneurship as a central component of entrepreneurial ecosystems in BRICS Plus economies. The

framework highlights how collective agency, social capital, institutional conditions, and ecosystem resources interact to shape entrepreneurial outcomes within communities. From a theoretical perspective, the study contributes to entrepreneurship research by expanding the unit of analysis beyond the individual entrepreneur to include communities, collectives, and ecosystem-level dynamics. This perspective aligns entrepreneurship theory more closely with the realities of entrepreneurial activity in emerging and developing economies, where entrepreneurship is often embedded in social relations and collective governance structures.

The findings also have important policy implications. Policymakers and development agencies frequently prioritise individual entrepreneurs and formal firm creation when designing entrepreneurship support programmes. However, the evidence suggests that community-based and collective forms of entrepreneurship already play a significant role in promoting livelihood creation, social cohesion, and inclusive economic participation. Supporting community-level entrepreneurial ecosystems, strengthening cooperative governance structures, and recognising collective entrepreneurial agency may therefore enhance the effectiveness of entrepreneurship policies in emerging economies. Despite its contributions, this study has several limitations. The review is limited to English-language peer-reviewed journal articles, which may exclude relevant research published in other languages or formats. Additionally, variations in terminology and conceptual definitions across studies present challenges for direct comparison. Future research could address these limitations by incorporating broader sources and conducting empirical studies examining community-based entrepreneurial ecosystems across specific BRICS Plus country contexts.

Further empirical research is also needed to test and refine the conceptual framework proposed in this study. Comparative studies across BRICS Plus economies may provide deeper insights into how institutional environments, governance mechanisms, and social capital influence collective entrepreneurial outcomes. Such research would contribute to the development of more context-sensitive entrepreneurship theory and inform policy strategies aimed at fostering inclusive and sustainable entrepreneurial ecosystems.

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IMPACT OF TOTAL QUALITY MANAGEMENT ON BUSINESS PERFORMANCE IN THE HOSPITALITY SECTOR

**H. O. OJODU¹, V. A. ADEYEYE², I. O. ONIKOYI³,
D. A. MORAKINYO⁴**

¹*Lagos State University of Science and Technology, Department of Business Administration, Ikorodu, Lagos, Tel: +234 803 305 5808, E-mail: omotola808@gmail.com*

²*Lagos State University of Science and Technology, Department of Business Administration, Ikorodu, Lagos, Tel: +234 081 8150 9509, E-mail: vicbayoadeyeye@gmail.com*

³*Osun State University, Department of Business Administration, Osogbo, Nigeria, Tel: +234 803 920 1211, E-mail: idris.onikoyi@uniosun.edu.ng*

⁴*Osun State University, Department of Business Administration, Osogbo, Nigeria, Tel: +234 803 547 6400, E-mail: dauda.morakinyo@uniosun.edu.ng*

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Abstract

This study examines the impact of Total Quality Management (TQM) on business performance within the Nigerian hospitality sector. The study employed a quantitative research design, utilising a structured questionnaire administered to 250 employees drawn from 18 hotels across Lagos, Abuja, and Ibadan, Nigeria. The hotels sampled ranged from three-star to five-star establishments, ensuring representativeness across different tiers of the hospitality industry. Data were analysed using descriptive statistics, Pearson correlation analysis, and multiple linear regression. The findings reveal

statistically significant positive relationships between service quality and business performance ($r = 0.578$, $p < 0.01$), and between leadership commitment and business performance ($r = 0.614$, $p < 0.01$). Regression analysis confirmed that both service quality and leadership commitment are significant predictors of business performance, with leadership commitment exerting a marginally stronger influence ($\beta = 0.421$) than service quality ($\beta = 0.384$). The results indicate that hotels which have institutionalised TQM practices, particularly those underpinned by committed leadership and robust service quality systems, demonstrate superior business performance across financial, operational, and customer-centric metrics. The study recommends that hospitality organisations in Nigeria invest in leadership development programmes, embed continuous improvement cultures, and align strategic planning with TQM principles to enhance long-term performance and competitiveness.

Keywords: Total Quality Management (TQM), business performance, service quality, leadership commitment, Nigerian hospitality sector, hotel industry.

JEL Classification: L25, M10, M19

INTRODUCTION

The hospitality industry constitutes one of the most dynamic and economically significant sectors in the Nigerian economy. Encompassing hotels, resorts, restaurants, and ancillary service providers, this sector plays a pivotal role in generating foreign exchange earnings, fostering employment, and contributing to the nation's socio-economic development (Ogundeji & Abiodun, 2019). Nigeria's hospitality sector has witnessed substantial growth over the past two decades, driven by increasing domestic tourism, a burgeoning middle class, and heightened interest from international investors seeking to capitalise on the country's vast tourism potential (UNWTO, 2022). According to the Nigeria Tourism Development Corporation (NTDC), the hospitality industry contributed approximately 4.6% to the nation's Gross Domestic Product (GDP) in 2023, a figure that is expected to grow as the sector continues to mature and diversify.

Despite this encouraging trajectory, the Nigerian hospitality sector continues to grapple with a range of structural and operational challenges that threaten its capacity to compete effectively on both domestic and international stages. These challenges include inconsistent service delivery, inadequate infrastructure, limited adoption of contemporary management frameworks, and a workforce that, while

skilled, often lacks the institutional support necessary for continuous improvement (Adebayo & Osuagwu, 2020). In an era defined by heightened customer expectations, digital transformation, and global competition, the imperative for hospitality organisations to adopt evidence-based quality management systems has never been more urgent.

Total Quality Management (TQM) has emerged as one of the most widely adopted frameworks for enhancing organisational performance across industries worldwide. Originally conceptualised in the manufacturing sector during the mid-twentieth century, TQM has since been adapted and applied across diverse industries—including hospitality—as a comprehensive approach to achieving excellence in all facets of organisational operations (Slack et al., 2018). At its core, TQM is a philosophy of management that prioritises the continuous improvement of processes, products, and services through the active participation of every member of the organisation, guided by leadership commitment and a relentless focus on customer satisfaction (Oginni et al., 2023; Issack et al., 2017). Kuleto and Gurgu (2023) is another way to ensure continuous improvement of processes through product branding for effective patronage.

The application of TQM in the hospitality industry is particularly relevant given the service-intensive nature of the sector. Hotels and related establishments operate in an environment where the quality of the customer experience is not merely a competitive differentiator but a fundamental determinant of organizational survival. Research conducted in developed hospitality markets—particularly in Asia, Europe, and North America—has consistently demonstrated that TQM adoption is positively correlated with improvements in customer satisfaction, employee engagement, operational efficiency, and financial performance (Bourguignat & Durand, 2021). However, the extent to which these findings can be generalised to the Nigerian context remains an open question, given the unique socio-economic, cultural, and infrastructural realities of the country.

Study Hypothesis

The following hypotheses emerged as a result of the focus of the study

H₁: There is a statistically significant positive relationship between service quality and business performance in Nigerian hotels.

H₂: There is a statistically significant positive relationship between leadership commitment and business performance in Nigerian hotels.

LITERATURE REVIEW

Theoretical Framework

The theoretical foundation of this study rests primarily on two complementary frameworks: the Resource-Based View (RBV) of the firm and the European Foundation for Quality Management (EFQM) Excellence Model. The RBV, as articulated by Barney (1991) and subsequently refined by Wernerfelt (1984), posits that a firm's sustained competitive advantage derives from its possession of valuable, rare, inimitable, and non-substitutable resources and capabilities. In the context of TQM, organisational capabilities such as a skilled workforce, a culture of continuous improvement, and robust quality management systems constitute precisely the kind of intangible resources that, when effectively leveraged, confer a durable competitive edge.

The EFQM Excellence Model provides a more operationally oriented framework, articulating nine criteria—including leadership, strategy, people, processes, and results—that collectively define organisational excellence. The model explicitly recognises leadership commitment and customer focus as foundational enablers, while business performance outcomes are framed as the ultimate measure of organisational achievement. The alignment between these two frameworks and the constructs examined in this study—service quality, leadership commitment, and business performance—provides a robust theoretical basis for the hypotheses and analytical approach adopted. Additionally, the study draws upon the Total Quality Management philosophy itself, which, as conceptualised by Deming (1986) and Juran (1989), emphasises the systematic elimination of variation, the empowerment of frontline employees, and the relentless pursuit of customer satisfaction. These principles underpin the operationalisation of service quality and leadership commitment as key dimensions of TQM within the study's measurement framework.

Conceptual Review: Total Quality Management

Total Quality Management is a holistic management philosophy that seeks to integrate quality considerations into every aspect of organisational activity—from strategic planning and product design to service delivery and post-sale support. The concept was first articulated in the 1950s by W. Edwards Deming and Joseph M. Juran, initially in the context of manufacturing quality control in post-war Japan. Over the subsequent decades, TQM evolved from a narrow technical discipline into a broad organisational philosophy, characterised by its emphasis on continuous improvement, customer orientation, employee involvement, and process thinking (Slack et al., 2018).

In the hospitality industry, TQM has been adapted to address the unique challenges associated with service delivery. Unlike manufacturing, where quality can be assessed against objective physical standards, hospitality services are inherently intangible, heterogeneous, and inseparable from the moment of their production and consumption. These characteristics necessitate a quality management approach that is attuned to the subjective perceptions of customers and the dynamic interactions between service providers and guests (Zeithaml et al., 2006). TQM in hospitality therefore places particular emphasis on empowering frontline employees, fostering a culture of quality awareness, and establishing feedback mechanisms that enable the organisation to identify and rectify service failures in real time.

Service Quality as a TQM Dimension

Service quality is widely regarded as one of the most critical dimensions of TQM in the hospitality sector. Parasuraman, Zeithaml, and Berry (1988) introduced the SERVQUAL model, which measures service quality along five dimensions: tangibility, reliability, responsiveness, assurance, and empathy. These dimensions capture the gap between customer expectations and perceptions, thereby providing a framework for identifying areas in which service delivery falls short. In the hotel industry, high service quality translates into elevated customer satisfaction, increased loyalty, positive word-of-mouth recommendations, and, ultimately, enhanced financial performance (Cronin & Taylor, 1992).

Research by Yin (2018) and Okonkwo and Ayorinde (2020) has demonstrated that hotels which invest systematically in service quality improvement—through staff training, process standardisation, and complaint management systems—outperform their competitors on a range of business metrics. In the Nigerian context, however, service quality remains a significant challenge, with many hotels struggling to maintain consistency across departments and guest touchpoints (NTDC, 2022). This underscores the need for a more structured understanding of the relationship between service quality and business performance within Nigerian hotels.

Leadership Commitment and TQM Implementation

Leadership commitment is consistently identified in the TQM literature as a prerequisite for successful implementation. The rationale is straightforward: TQM requires organisational-wide transformation—encompassing cultural change, resource reallocation, and sustained focus on long-term quality objectives—and such transformation is unlikely to occur without the visible endorsement and active involvement of senior management (Issack et al., 2017). Transformational leaders,

in particular, are seen as uniquely suited to driving TQM adoption, as they inspire followers through their vision, intellectual stimulation, and individualized consideration (Bass & Avolio, 1995).

In the hospitality sector, leadership commitment manifests through a range of observable behaviours: the allocation of budgets for quality programmes, the integration of quality metrics into performance appraisals, the public championing of quality initiatives, and the modelling of quality-conscious behaviour in daily interactions with staff and guests. Studies by Bourguignat and Durand (2021) and Fadare and Igbinoba (2022) have found that hotels in which senior management demonstrates strong commitment to TQM achieve significantly higher levels of employee engagement and customer satisfaction, both of which are positively associated with business performance.

Business Performance in the Hospitality Context

Business performance in the hospitality industry is a multi-dimensional construct that encompasses financial outcomes (such as revenue per available room, operating profit margins, and return on investment), operational outcomes (such as occupancy rates, employee turnover, and process efficiency), and market outcomes (such as customer satisfaction scores, repeat visit rates, and brand reputation). The Balanced Scorecard framework (Kaplan & Norton, 1996) provides a useful conceptual lens for understanding business performance as an integrated function of financial, customer, internal process, and learning and growth perspectives.

In the Nigerian hospitality sector, business performance is influenced by a complex interplay of internal and external factors. While macroeconomic conditions, government policy, and competitive dynamics constitute important external determinants, internal factors—including management practices, workforce capabilities, and operational systems—are widely acknowledged as the primary levers through which organisations can influence their performance outcomes (Uwah & Effiong, 2021). TQM, by systematically addressing these internal factors, is theorised to be a particularly potent driver of business performance improvement.

Empirical Review

TQM and Business Performance: Global Evidence

Issack et al. (2017), in a study of 312 firms across the manufacturing sector in Malaysia, found a statistically significant positive relationship between TQM

practices and firm performance, as measured by both financial and non-financial indicators. The study identified leadership commitment and customer focus as the two strongest predictors of performance, consistent with the emphasis placed on these dimensions in the broader TQM literature. Similarly, Abdel-Rahman (2015) examined 198 hotels in Egypt and concluded that TQM adoption was positively associated with improved customer satisfaction and increased profitability, with service quality playing a particularly mediating role in the relationship. Bourguignat and Durand (2021) conducted a meta-analytic review of 47 empirical studies examining TQM and organisational performance across multiple industries. Their findings indicated that the average effect size of TQM on business performance was moderate to large (Cohen's $d = 0.62$), and that the strength of this relationship was moderated by the degree of leadership commitment and the extent of employee involvement. These findings reinforce the centrality of leadership commitment as both a facilitator of TQM implementation and an independent predictor of performance outcomes.

TQM IN THE HOSPITALITY SECTOR

Within the hospitality sector specifically, a growing body of research has sought to examine the applicability and impact of TQM. Yin (2018) studied 186 hotels in China and found that hotels which had adopted comprehensive TQM programmes achieved significantly higher levels of guest satisfaction and operational efficiency compared to those which had not. The study highlighted the importance of integrating TQM principles into the hotel's strategic planning process and noted that leadership support was a critical success factor.

Cronin and Taylor (1992), in one of the seminal studies on service quality in hospitality, demonstrated that service quality is a significant predictor of customer satisfaction and repurchase intentions. Their work laid the groundwork for subsequent investigations into the mechanisms through which quality management practices translate into business outcomes. More recently, Okonkwo and Ayorinde (2020) applied the SERVQUAL framework to a sample of 145 hotels in Lagos, Nigeria, and found that tangibility and reliability were the dimensions of service quality most strongly associated with customer satisfaction—a finding with direct implications for hotel management in Nigeria.

TQM IN NIGERIAN ORGANISATIONS

The Nigerian context has received increasing attention in the TQM literature, although the majority of studies have focused on the manufacturing or banking sectors rather than hospitality. Uwah and Effiong (2021) examined 220 firms in the

Nigerian manufacturing sector and found a positive relationship between TQM practices and firm performance, moderated by firm size and industry dynamism. Adebayo and Osuagwu (2020) investigated the impact of TQM on operational performance in Nigerian banks and concluded that banks which had institutionalised TQM practices exhibited significantly lower error rates, higher employee satisfaction, and stronger customer retention.

Fadare and Igbinoba (2022) represent one of the few studies to have examined TQM in the Nigerian hospitality context directly. Their study of 95 hotels in Ibadan found preliminary evidence of a positive relationship between TQM adoption and business performance, but the relatively small sample size and the absence of a rigorous inferential statistical framework limited the generalisability of the findings. The present study seeks to address these limitations by employing a larger sample, a more robust measurement instrument, and a more comprehensive analytical approach.

IDENTIFIED RESEARCH GAPS

The foregoing review reveals several important gaps in the existing literature. First, empirical studies examining TQM and business performance within the Nigerian hospitality sector are conspicuously scarce. Second, most existing studies have not adequately disaggregated TQM into its constituent dimensions to examine the differential contributions of service quality and leadership commitment to business performance. Third, the studies that do exist in the Nigerian context tend to rely on smaller samples and less rigorous methodological designs, limiting the reliability and generalisability of their findings. The present study addresses these gaps through its focused empirical investigation within the Nigerian hospitality sector, its disaggregation of TQM into service quality and leadership commitment, and its adoption of a quantitative methodology with a sufficiently large and representative sample.

METHODOLOGY

The study adopted a quantitative, cross-sectional survey design consistent with a positivist epistemological stance to examine the statistical relationships between service quality, leadership commitment, and business performance in the Nigerian hospitality industry. Data were collected using a structured questionnaire administered to employees of hotels rated three stars and above in Lagos, Abuja, and Ibadan. The study population comprised approximately 4,800 hotel employees, from which a pragmatic sample of 250 respondents was selected using a combination of purposive and convenience sampling techniques. Hotels were

purposely chosen to ensure representation across locations and star ratings, while employees from various departments were conveniently sampled. All 250 distributed questionnaires were returned and deemed usable, resulting in a 100% response rate facilitated by management cooperation and on-site administration.

The questionnaire consisted of demographic items and 15 Likert-scale statements measuring service quality, leadership commitment, and business performance, adapted from established instruments in the TQM and hospitality literature. Content validity was ensured through expert review, and a pilot study confirmed satisfactory reliability, with Cronbach's alpha values exceeding 0.80 for all constructs. Data were analysed using SPSS version 28, beginning with descriptive statistics, followed by Pearson correlation to assess bivariate relationships and multiple linear regression to test the joint effects of service quality and leadership commitment on business performance at a 0.05 significance level.

FINDINGS AND DISCUSSION

Demographic Profile of Respondents

Table 1 presents the demographic characteristics of the 250 respondents. The sample was predominantly male (58.8%), reflecting broader patterns of gender distribution in the Nigerian hospitality workforce, although a substantial proportion of female respondents (41.2%) ensures meaningful representation. The largest age cohort was 26–35 years (35.6%), followed by 36–45 years (30.4%), indicating that the sample captured a workforce in its productive prime. In terms of educational qualification, the majority held either a Diploma or Higher National Diploma (38.8%) or a Bachelor's Degree (32.8%), reflecting the growing professionalisation of the hospitality sector in Nigeria. Respondents with less than six years of experience constituted the majority (54.0%), while 4-Star hotels were the most frequently represented (40.8%).

Table 1: Demographic Profile of Respondents

Variable	Category	Frequency	Percentage (%)
Gender	Male	147	58.8
	Female	103	41.2
Age	18–25	42	16.8
	26–35	89	35.6
	36–45	76	30.4
	46–55	33	13.2
	56 and above	10	4.0
Educational Qualification	Secondary School	38	15.2
	Diploma/HND	97	38.8
	Bachelor's Degree	82	32.8
	Postgraduate	33	13.2
Years of Experience	Less than 2 years	44	17.6
	2–5 years	91	36.4
	6–10 years	72	28.8
	Above 10 years	43	17.2
Hotel Star Rating	3-Star	85	34.0
	4-Star	102	40.8
	5-Star	63	25.2

Source: *Field Study*

Table 2 presents the Pearson correlation matrix for the three core constructs. The correlation between service quality and business performance was found to be statistically significant and positive ($r = 0.578$, $p < 0.01$), providing preliminary support for Hypothesis 1. Similarly, the correlation between leadership commitment and business performance was statistically significant and positive ($r = 0.614$, $p < 0.01$), offering initial support for Hypothesis 2. Additionally, a moderate positive correlation was observed between service quality and leadership commitment ($r = 0.652$, $p < 0.01$), suggesting that these two TQM dimensions are related but remain conceptually and empirically distinct.

Table 2: Correlation Matrix

Variable	Service Quality	Leadership Commitment	Business Performance
Service Quality	1.000		
Leadership Commitment	0.652**	1.000	
Business Performance	0.578**	0.614**	1.000

Note: ** Significant at the 0.01 level (two-tailed).

The moderate intercorrelation between the two independent variables ($r = 0.652$) is noted but does not exceed the threshold of 0.80 commonly employed to flag multicollinearity concerns in regression analysis (Hair et al., 2019). It is therefore appropriate to proceed with the multiple regression analysis without further adjustments.

Regression Analysis

A multiple linear regression was conducted to assess the combined predictive power of service quality and leadership commitment on business performance and to formally test the study's hypotheses. Table 3 presents the regression coefficients, while Table 7 presents the ANOVA summary statistics.

Table 3: Regression Coefficients

Source	Coefficient (β)	Std. Error	t-value	p-value	Sig.
Constant	1.246	0.234	5.325	0.001	***
Service Quality (X_1)	0.384	0.089	4.315	0.001	***
Leadership Commitment (X_2)	0.421	0.096	4.385	0.001	***

Note: *** Significant at the 0.01 level.

Table 4: ANOVA Summary

Source	Sum of Squares	df	Mean Square	F-value	p-value
Regression	24.847	2	12.424	18.940	0.001***
Residual	162.382	247	0.657		
Total	187.229	249			

Note: *** Significant at the 0.01 level. $R^2 = 0.133$; Adjusted $R^2 = 0.125$.

The ANOVA results ($F = 18.940$, $p < 0.01$) confirm that the overall regression model is statistically significant, indicating that service quality and leadership commitment, taken together, account for a meaningful proportion of the variance in business performance. The R^2 value of 0.133 indicates that 13.3% of the variance in business performance is explained by the two independent variables, while the Adjusted R^2 of 0.125 suggests that this explanatory power is modest but consistent, even after accounting for the number of predictors.

Turning to the individual predictors, both service quality ($\beta = 0.384$, $t = 4.315$, $p < 0.01$) and leadership commitment ($\beta = 0.421$, $t = 4.385$, $p < 0.01$) emerged as statistically significant predictors of business performance, thereby confirming both hypotheses. Notably, leadership commitment exerted a marginally stronger influence on business performance than service quality, as evidenced by its slightly higher standardised regression coefficient. This finding is consistent with the theoretical proposition that leadership commitment functions as a foundational enabler of TQM implementation and that its effects on business performance may operate both directly and indirectly—through the facilitation of service quality improvement and other quality-oriented initiatives.

Discussion

The findings of this study provide empirical support for the proposition that TQM, as operationalised through service quality and leadership commitment, is positively and significantly associated with business performance in the Nigerian hospitality sector. These results are broadly consistent with the existing international literature on TQM and organisational performance (Issack et al., 2017; Bourguignat & Durand, 2021), but extend the evidence base to the specific context of Nigerian hotels; an important contribution given the relative scarcity of prior research in this setting.

The finding that leadership commitment is a marginally stronger predictor of business performance than service quality is particularly noteworthy. It suggests that the commitment and active involvement of senior management in quality management initiatives is not merely a supporting factor but a decisive determinant of organisational performance. This aligns with the predictions of both Transformational Leadership theory and the EFQM Excellence Model, which identify leadership as a primary enabler of organisational excellence. For Nigerian hotel managers, this finding underscores the importance of visible, sustained leadership engagement in TQM as a prerequisite for achieving superior business outcomes (Oginni et al., 2023).

However, it is important to contextualise these findings within the broader realities of the Nigerian hospitality sector. While the results demonstrate that TQM-related practices are yielding positive results, the relatively modest R^2 value (0.133) indicates that a substantial proportion of the variance in business performance is attributable to factors not captured by the model, including macroeconomic conditions, competitive dynamics, government policy, and technological innovation. This underscores the need for future research to explore additional TQM dimensions and contextual moderators that may further explain variation in business performance within Nigerian hotels.

CONCLUSION

This study has examined the impact of Total Quality Management on business performance in the Nigerian hospitality sector, focusing on the mediating roles of service quality and leadership commitment. Drawing upon a sample of 250 hotel employees across Lagos, Abuja, and Ibadan, and employing a quantitative methodology encompassing descriptive statistics, correlation analysis, and multiple regression, the study has generated several important findings.

First, service quality, as a dimension of TQM, is positively and significantly associated with business performance in Nigerian hotels. Hotels that have invested in establishing and maintaining high standards of service delivery—across tangibility, reliability, responsiveness, assurance, and empathy—report stronger performance outcomes across financial, operational, and customer-centric metrics. Second, leadership commitment is found to be an even stronger predictor of business performance, reinforcing the theoretical proposition that the active involvement and visible endorsement of quality initiatives by senior management is a critical enabler of organisational success. Third, the combined effect of service quality and leadership commitment accounts for a statistically significant proportion of the variance in business performance, although the model's explanatory power suggests that additional factors warrant investigation.

These findings carry significant implications for theory, practice, and policy. From a theoretical perspective, the study provides empirical support for the Resource-Based View and the EFQM Excellence Model within the Nigerian hospitality context, and contributes to the growing body of evidence linking TQM to business performance in developing economies. From a practical perspective, the findings offer clear direction to hotel managers seeking to improve their organisations' performance: invest in leadership development, embed quality into strategic planning, and establish robust systems for monitoring and improving

service delivery. From a policy perspective, the findings suggest that government agencies and industry bodies responsible for hospitality sector development should incorporate TQM principles into their regulatory and incentive frameworks, thereby encouraging broader adoption among hotel operators.

In conclusion, Total Quality Management represents a viable and effective strategy for enhancing business performance in the Nigerian hospitality sector. However, its successful implementation is contingent upon the presence of committed leadership and the sustained investment in service quality improvement. As the Nigerian hospitality industry continues to grow and face intensifying competition, the adoption of comprehensive TQM frameworks will be essential to ensuring the long-term viability and competitiveness of hotels and related establishments.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are put forward for the attention of hotel managers, industry stakeholders, and policymakers:

1. Hotel management should prioritise the development and implementation of comprehensive TQM programmes that encompass all aspects of organisational operations. This includes the establishment of formal quality management systems, the adoption of continuous improvement methodologies such as Kaizen, and the integration of quality metrics into performance measurement and strategic planning frameworks.
2. Senior management should actively champion TQM initiatives and demonstrate visible commitment to quality improvement through their own behaviour and decision-making. Leadership development programmes should be introduced to equip managers at all levels with the competencies necessary for driving and sustaining quality cultures within their departments and across the organisation.
3. Hotels should invest in the training and development of frontline employees, who are the primary interface between the organisation and its customers. Training programmes should address not only technical skills but also interpersonal and emotional intelligence competencies, with a focus on delivering consistently excellent customer experiences.
4. The management of guest complaints and feedback should be elevated to a strategic priority. Hotels should establish accessible, responsive, and effective complaint resolution systems, and should leverage the data

generated through these systems to identify patterns and drive systemic service improvements.

5. Industry associations and government agencies should develop and disseminate best practice guidelines for TQM implementation in the Nigerian hospitality sector. These guidelines should be tailored to the specific challenges and opportunities facing hotels in Nigeria and should be supported by accessible training resources and advisory services.
6. Future research should explore additional dimensions of TQM, including employee involvement, supplier management, and process improvement, and should investigate the role of contextual factors such as hotel size, ownership structure, and competitive environment in moderating the relationship between TQM and business performance.
7. Researchers are encouraged to employ longitudinal designs and mixed-methods approaches to provide a richer and more dynamic understanding of TQM implementation and its effects on business performance over time within the Nigerian hospitality sector.

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POST COVID-19 PANDEMIC BUSINESS TURNAROUND STRATEGIES FOR GUESTHOUSES

**Wilbert MUTOKO¹, Hellen MLOTSWA², Phillis MUTOKO³,
Patrick EBEWO⁴, Knowledge SHUMBA⁵**

¹*Tshwane University of Technology, Staatsartillerie Rd, Pretoria West, Pretoria, 0183, Phone: +27 86 110 2421, E-mail: MutokoRW@tut.ac.za*

²*Tshwane University of Technology, Staatsartillerie Rd, Pretoria West, Pretoria, 0183, Phone: +27 86 110 2421, E-mail: MlotshwaSH@tut.ac.za*

³*369 Paul Kruger Street, Capital Park, Pretoria, 0084, E-mail: miraclemutoko@gmail.com*

⁴*Tshwane University of Technology, Staatsartillerie Rd, Pretoria West, Pretoria, 0183, Phone: +27 86 110 2421, E-mail: EbewoP1@tut.ac.za*

⁵*Tshwane University of Technology, Staatsartillerie Rd, Pretoria West, Pretoria, 0183, Phone: +27 86 110 2421, E-mail: ShumbaK@tut.ac.za*

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Abstract

This study explores business turnaround strategies employed by guesthouses in Gaborone, Botswana, and Pretoria, South Africa, during the COVID-19 pandemic, focusing on challenges faced and coping mechanisms used to survive and recover. The research aimed to assess the state of guesthouses during the pandemic, evaluate influence of government support systems, and explore the relationship between guesthouse operators and small business development institutions. A qualitative case study design was employed, utilising in-depth interviews with eight guesthouse owners and managers, four in Gaborone and four in Pretoria. Purposive and snowball sampling methods were used to identify guesthouses that were operational before, during, and after the pandemic. Data were collected using digital voice-recorded interviews, which were transcribed and analysed using

ATLAS.ti v22. Content and discourse analyses were conducted. The findings revealed significant operational and financial challenges, including loss of income, fear and anxiety, government-imposed restrictions, and insufficient support from governments and entrepreneurial organisations. However, guesthouses employed adaptive strategies: securing financing, accessing government relief funds, extending debt payments, reducing expenses, diversifying services, and adhering to regulations. Governments should improve support mechanisms for small businesses during crises. Guesthouse operators should build financial resilience, service diversification, and strengthen industry collaborations to enhance survival during future disruptions.

Keywords: *tourism, hospitality, guesthouse, Covid-19, Botswana, South Africa*

JEL Classification: L83, M21, L25,O1

1. Introduction

The COVID-19 pandemic severely impacted the global economy, particularly in the tourism and hospitality sectors experiencing some of the most significant disruptions. Policymakers and researchers are particularly interested in how entrepreneurs navigated this period especially in South Africa and Botswana (Rogerson & Rogerson, 2020; Nyawo, 2020). Both countries, heavily reliant on tourism, have faced drastic declines due to lockdowns and travel restrictions. Before the pandemic, South Africa welcomed 10 million visitors annually, but tourism arrivals dropped by 72.6% in 2020 (STATS SA, 2020). Botswana similarly projected a 32.2% contraction in its hospitality sector (UN Botswana, 2020). Global trends show similar impacts, with declines in tourism GDP across continents (UNTWO, 2020; Ugur & Akiyik, 2020). The study aims to examine the effects of COVID-19 on Southern African guesthouses and evaluate government and industry responses, providing insights for recovery strategies. Understanding the role of these stakeholders is critical for post-pandemic recovery (Assaf & Scuderi, 2020; Thomas & Laesser, 2020).

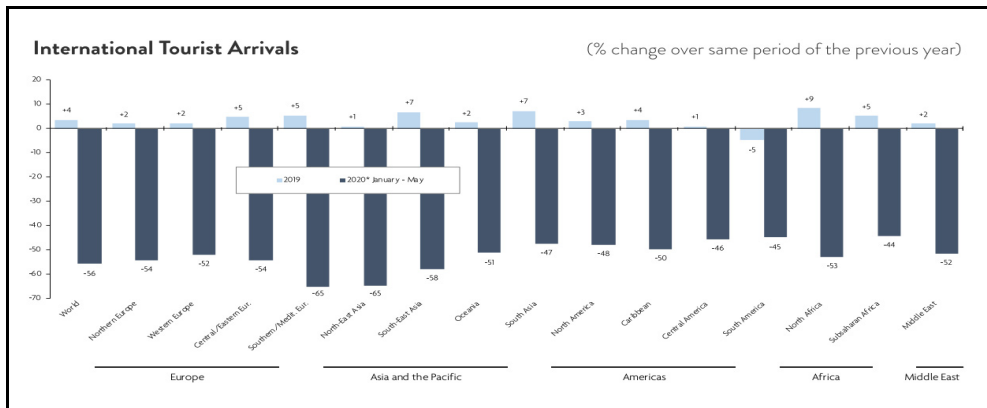


Figure 1: International Tourist Arrivals.

Source: (UNTWO, 2020)

The COVID-19 pandemic has severely impacted the tourism industry in Sub-Saharan Africa, with South Africa and Botswana experiencing significant losses. In South Africa, 69% of small tourism businesses temporarily closed, and 58% downsized, resulting in a 66% revenue decline (Department of Tourism, 2020). Botswana's tourism sector, contributing 12% to GDP, also faced massive setbacks, with only 1.67% of accommodation facilities operating by April 2020 (UN Botswana, 2020). Global lockdowns and travel restrictions shifted focus to the under-tourism crisis, threatening livelihoods (Russo, 2020). Gössling et al. (2020) highlight the pandemic's lasting effects on consumer preferences and tourism models. To revive the hospitality sector, especially guesthouses, this study explores the qualitative impacts of COVID-19 on Botswana and South Africa's guesthouse businesses, offering insights for policymakers to reshape the industry.

From the above-mentioned gap identified above, the research problem is:

This study has four main implications for the literature on hospitality studies and entrepreneurship. Firstly, it extends the scope of COVID-19 tourism studies by looking beyond large hotels. Secondly, it provides a comparative qualitative study of Botswana and South Africa from a cross-national perspective. This provides insights into the role of institutional contexts in shaping crisis response strategies. Thirdly, combining the RBV

perspective with Contingency Theory provides a deeper understanding of how internal capabilities interact with external shocks in small hospitality businesses. Fourthly, it adds to the Annals of Spiru Haret University Economic Series by providing empirical content to the literature on SMEs' resilience, crisis response strategies, and post-pandemic recovery in emerging economies (Popescu & Călin, 2021; Radu, 2022).

Despite several entrepreneurship support structures introduced by government ranging from policy to capacity development institutions during the COVID 19 pandemic, guesthouse businesses in Botswana and South Africa continue struggling to sustain profitable ventures.

2. Research Questions

Following the above research problem, the research questions for the study are:

- (1) What was the state of guesthouse enterprises in Botswana and South Africa during the COVID 19 pandemic?*
- (2) How have government COVID 19 related support systems influenced the survival of guesthouses tourism enterprises in Botswana and South Africa?*

The following are investigation questions:

- How has government policy influenced and shaped guesthouse businessperson' attitudes towards their entrepreneurial ventures during the COVID 19 pandemic?
- How is the relationship between micro guesthouse businessperson and institutions of small business development in Botswana and South Africa?

3. Research Objectives

The objectives of the study are to:

- Assess the state of entrepreneurs who operated guesthouses in Botswana and South Africa during the COVID 19 pandemic (i.e., challenges, and coping strategies); and
- Establish the roles of institutions for small business development and its relationship with guesthouse entrepreneurs in Botswana and South Africa.

4. Literature Review

During the COVID-19 pandemic, the tourism industry worldwide had unparalleled difficulties, with guesthouses in Botswana and South Africa suffering the most. This section of the paper uses the Resource-Based View (RBV) and Contingency Theory theoretical frameworks to better understand their recovery and survival tactics. According to the RBV, internal resources—like cash on hand and managerial prowess—are essential for preserving a competitive edge, especially in times of crisis (Barney, 1991). However, as there is no one-size-fits-all method of management, contingency theory emphasizes the significance of tailoring methods to contextual variables (Taylor & Taylor, 2014). This literature study makes use of these frameworks to examine how guesthouses in these two nations managed external obstacles and made use of their internal strengths to survive the pandemic. The review also examines existing research on the tourism sector's response to the crisis, with a focus on the unique struggles faced by guesthouses.

4.1 Theoretical Framework: Contingency Theory and Resource-Based View (RBV) Two theoretical frameworks—the Resource-Based View (RBV) and Contingency Theory—are used in this study. According to the RBV, internal resources and competencies of businesses are essential for maintaining a competitive edge, particularly in times of crisis (Barney, 1991). Resources like as cash reserves, managerial skills, adoption of new technologies, and customer relationships become crucial elements in determining resilience and recovery in the guesthouse situation after COVID-19 (Popescu & Călin, 2021). Furthermore, Contingency Theory emphasizes that there is no one-size-fits-all method of management; instead, plans must consider the unique conditions and surroundings that companies must operate in (Taylor & Taylor, 2014). This implies that effective turnaround methods for guesthouses in Botswana and South Africa depend on a range of external factors, such as prevailing market conditions, government regulations, and the broader economic climate. These theories make it possible to comprehend how guesthouses can make the most of their own resources while adjusting to outside obstacles in order to survive and prosper in a post-pandemic environment.

The COVID-19 pandemic caused a worldwide catastrophe in the tourism industry, resulting in a notable decline in guesthouses and small tourism businesses. Due to their tiny financial reserves, lack of diversification, and heavy reliance on steady tourist flows, research indicates that small and medium-sized firms (SMEs), particularly in the hotel sector, were among the hardest hit (Booyens

et al., 2022). This is particularly true for South Africa's and Botswana's guesthouses, where tourism is vital to the development of local economies.

4.2 Botswana

Prior to the pandemic, the country's guesthouse industry had to contend with a number of persistent issues, such as inadequate marketing, outdated infrastructure, and cyclical demand (Moswete, 2019). In addition to making these problems more complicated, the pandemic also caused income losses from extended lockdowns and a decline in foreign travel (Masiya et al., 2021). Even though the government's help was vital in reducing some of the financial harm, many guesthouses struggled as a result of its fragmented character (Booyens et al., 2022). Furthermore, many guesthouses found it difficult to access other revenue streams, like domestic tourism, due to their lack of a significant online presence.

4.3 South Africa

In a similar vein, the epidemic severely reduced both domestic and foreign visitor numbers in guesthouses there (Sucheran, 2021). To offer a safety net for failing enterprises, the South African government launched a number of response initiatives, including wage subsidies, tax breaks, and loan programs (Mishi, 2023). Empirical data, however, indicates that bureaucratic bottlenecks and poor financial management frequently prevented smaller businesses from utilizing these methods (Booyens et al., 2022). The guesthouses were forced to make a decision or face closure because they were at a crossroads. While some found temporary respite through creative approaches like providing virtual tours, accommodating vital workers, or turning homes into long-term rental spaces, most did not find durable solutions (Sucheran, 2021).

4.4 Coping Mechanisms

Several proprietors of guesthouses tried to manage the situation by putting a number of coping mechanisms into place despite the serious consequences. In order to draw in domestic tourists, these included lowering operating expenses, laying off employees, renegotiating with landlords, and enforcing stringent health and safety regulations (Booyens et al., 2022). While some guesthouses in South Africa attempted to use digital marketing techniques to target local tourists, others in Botswana investigated joint ventures with regional tour operators and government tourism boards to develop "staycation" packages (Masiya et al., 2021; Radu, 22). While some companies were able to survive thanks to these efforts, the long-term sustainability of guesthouses is still doubtful because of the lingering uncertainty around COVID-19 recovery.

4.5 Synthesis

The COVID-19 pandemic has amplified pre-existing challenges in the guesthouse industry of Botswana and South Africa, such as insufficient marketing, financial reserves, and seasonality (Sucheran, 2021; Booyens et al., 2022). Government interventions, like wage relief and loan schemes, have been unevenly successful, especially for smaller businesses with limited resources (Masiya et al., 2021; Mishi, 2023). Botswana's guesthouses struggled with inadequate infrastructure and marketing (Moswete, 2019), while South Africa faced a slowdown in international travel and funding issues (Sucheran, 2021). Guesthouse owners implemented coping mechanisms like cost-cutting and targeting local markets, but these remained reactive. Future strategies should focus on enhancing digital marketing, developing resilient business models, and partnering with local governments for better support. By strategically utilizing internal resources, guesthouses can achieve long-term sustainability in a post-pandemic world (Booyens et al., 2022; Ionescu & Petrescu, 2023), positioning themselves to handle future crises.

4.6 Knowledge Gap Closed by the Research

Research on the impact of COVID-19 on tourism has largely focused on larger hotels, leaving a gap in understanding how smaller guesthouses in South Africa and Botswana are coping and planning for recovery. Studies have explored immediate coping mechanisms, but there is limited focus on long-term strategic actions for guesthouses to ensure sustainability post-pandemic (Sucheran, 2021; Booyens et al., 2022). This study aims to fill that gap by:

1. Highlighting guesthouses' importance to local economies, often overlooked in favor of larger hospitality establishments.
2. Examining context-specific turnaround strategies in Botswana and South Africa, considering each country's unique infrastructure and economic conditions.
3. Applying theoretical frameworks like the Resource-Based View and Contingency Theory to explore how guesthouses can utilize internal resources and adapt to external challenges for long-term success.
4. Shifting focus from immediate crisis responses to long-term recovery strategies, addressing the need for resilience and sustainability in the uncertain post-pandemic environment.

5. Methodology

To investigate the post-pandemic recovery tactics of guesthouses in Botswana and South Africa, this study adopts a qualitative case study design. A case study methodology facilitates a thorough comprehension of the intricate circumstances that lodging industry enterprises encountered amidst the COVID-19 epidemic (Yin, 2003). In-depth interviews are the main technique of data collection employed in this study because they offer comprehensive insights into the experiences and tactics of guesthouse managers and owners (De Vos et al., 2011). This study attempts to provide a comprehensive overview of the guesthouse sector's response to the pandemic by concentrating on rich, qualitative data.

Context of the study

The study focuses on guesthouses that were open prior to, during, and during the COVID-19 pandemic in Gaborone, Botswana, and Pretoria, South Africa. These areas were chosen because they are both sizable cities with a thriving travel and accommodation sector that experienced comparable pandemic-related difficulties. These regions' guesthouses are essential to the local economy, which makes them good examples to study resilience and recovery. To make sure that only guesthouses that were open prior to, during, and following the pandemic were included, the study used a purposive sample technique. This criterion made sure the information gathered was vital to comprehending how business tactics persisted throughout the pandemic's various stages. 8 people made up the sample in total: participants 1 to 4 from Botswana and participants 5 to 8 from South Africa, who were either managers or proprietors of guesthouses. Snowball sampling was also employed, which allowed for a more effective selection procedure and pertinent data gathering. Guesthouse owners or managers suggested additional possible participants who fit the study criteria. This sampling plan is in line with the recommendations made by Perry (1998) and Eisenhardt (1989) that case studies would be best served by looking at four to fifteen organizations.

Although the sample size appears to be small, it is consistent with qualitative case study research, which focuses on depth, richness, and analytical generalization rather than statistical representation (Eisenhardt, 1989; Yin, 2003). The eight cases were considered adequate to ensure theoretical saturation, which allows for rich within-case and cross-case comparisons between the two nations.

Data collection methods

In-depth, semi-structured interviews with managers and owners of guesthouses in Botswana and South Africa were used to gather data. Depending on the participants' convenience and availability, the interviews were prearranged and may be done in person or virtually. With the participants' permission, each interview was captured on digital voice recorders and transcribed for analysis. The interviews were planned with the purpose of capturing participant experiences, methods, and obstacles both during and after the pandemic, adhering to Creswell's (1998) criteria for case study data collecting.

Data Analysis

Friese (2014) proposed the use of ATLAS.ti v22, a qualitative data analysis program, for the study of the transcribed interviews. Open coding and theme categorization were used in the analytical phase to find important patterns in the data. Discourse and content analyses were carried out with an emphasis on the tactics employed by managers and owners of guesthouses to cope with the issues posed by pandemics. The experiences of guesthouses in Botswana and South Africa were compared using both within-case and cross-case analysis. The Query Tool, Code Co-occurrence Explorer, and Codes-Primary Document Table are a some of the ATLAS.ti tools that were used to identify conceptual frameworks and create robust models of guesthouse recovery techniques (Lewis, 2004). The utilization of an analytical technique guaranteed that the results accurately represented the guesthouse industry's realities in both nations.

Quality Assurance and Validation

The study used member checking, peer debriefing, and triangulation—three of Creswell's (2013) techniques for qualitative research rigor—to guarantee the validity and reliability of the qualitative data. In order to confirm that participants' comments were appropriately recorded, member checking entailed sending the transcribed interviews back to them for approval. To validate the results, triangulation was accomplished by cross-referencing interview data with secondary sources including industry assessments and government records. To sum up, this study's methodology allows for a complete examination of the post-pandemic difficulties and recovery plans of guesthouses in South Africa and Botswana. The qualitative method, which is supported by exacting procedures for data collection, analysis, and sampling, offers insightful information about how these companies have managed the ongoing problem.

6. Findings and Discussions

This study explores the recovery strategies and resilience of guesthouses in South Africa and Botswana following the COVID-19 pandemic. Using a qualitative case study approach, it examined how guesthouse managers and owners navigated pandemic challenges. Eight participants, four from Pretoria and four from Gaborone, were selected based on their operations before, during, and after the pandemic. The participants, experienced hospitality managers, shared insights into how external factors like government support, internal resources, and emergency planning influenced their ability to endure the crisis. The findings highlight the need for addressing ongoing vulnerabilities to ensure long-term sustainability in the guesthouse sector. Participants 1 to 4 were from Gaborone, Botswana; while participants 5 to 8 were from Pretoria, South Africa. However, participant 4, operated in both South Africa and Botswana.

6.1 Nature of Employees Employed by Guest House Entrepreneurs (GHE)

All the guest house entrepreneurs indicated that they use a combination of fulltime and part-time employees. This is reflected by the following remarks;

Participant 1 *“Currently I have employed three members of staff. Two are on fulltime basis and then one is on parttime basis. The fourth one is myself but I’m not fulltime”*.

Participant 2. *“We have three staff, which two of whom are full time. Additionally, we have one temporary staff member who comes in, when the full-time staff are off. We have maintained this structure since the guesthouse was established in 2017”*.

Participant 3. *“The other one is in South Africa. But in Botswana we have two and the employment capacity in the first one we have about three ladies and who are on a permanent basis, and we do get casuals who come in from time to time that’s about two casuals. So basically, we will be operating on a total of staff of about five people”*.

Participant 8. *“When I started with three rooms, I had two employees now I have five rooms and three employees, two full-time and then one works full time, but with less hours”*.

Thesesremarks confirm that the guesthouse entrepreneurs commonly rely on a mix of full time and parttime employees to manage their operations effectively.

6.2 Number of Employees Employed by GHE

The study results revealed that the number of employees employed by each GHE vary widely depending on the type, size, and demand of from guests. The minimum number that is employed GHE is three employees, and the maximum is fifteen employees. This is exhibited by the extracts below.

Participant 1. *“Currently I have three employees. Two fulltime basis and one is on part-time basis. . I also contribute to operations, but I am not fulltime”.*

Participant 2. *“We have three staff members, two full time and one temporary staff who comes in, when necessary. This structure has remained consistent since 2017”.*

Participant 7. *“ Out staff complement is approximately five people”.*

Participant 5. *“I used to have five to six employees. However , I faced financial difficulties and had to reduce my staff, eventually removing one by one”.*

Participant 3. *“ We operate with five staff members in one guesthouse and another five in our second location “.*

Participant 6 *“I currently have about 15 employees”.*

6.3 Challenges Faced by GHE During Covid-19

As illustrated in Figure 2 below, the study results revealed that the challenges faced by GHE during the Covid-19 pandemic are; Covid-19 fear and anxiety, government restrictions, lack of government support, lack of support from entrepreneurial support organisations and loss of income. The assertions agree with the study by South Africa by Mishi (2023). However, the current study differs in that it was specific on GHE rather than enterprises in general. Furthermore, while Mishi (2023) covered only South Africa, the current study compares Botswana to South Africa.

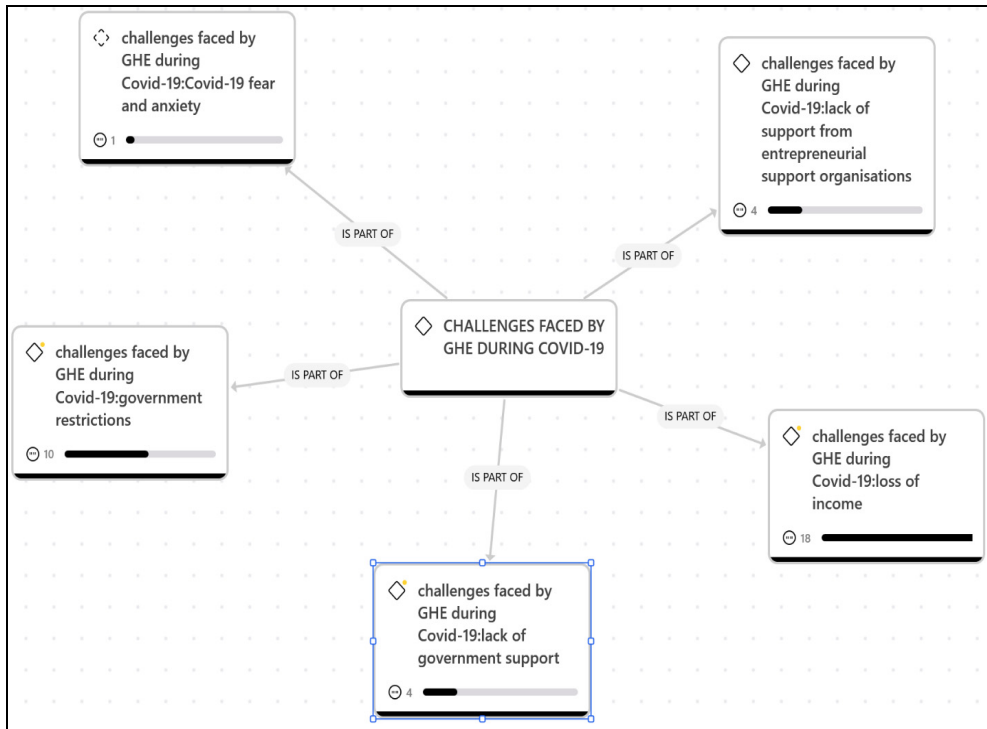


Figure 2: Challenges faced by GHE during Covid-19

Compiled by Authors using ATLAS.ti v22, 2024

6.3.1 Covid-19 Fear and Anxiety

The study findings revealed that GHE experienced Covid-19 and anxiety during the Covid-19 pandemic era. As a result, fear and anxiety shaped how the GHE operated their business. This is evidence by the captured extract below.

Participant 8 “Sometimes we tell them we are closed whilst we are open because we were are also scared because for the employees that they would catch COVID.

6.3.2 Government Restrictions

Government restrictions during the COVID-19 pandemic posed significant challenges for guesthouse enterprises (GHE). In both South Africa and Botswana, only essential goods and services, such as food, healthcare, and municipal services,

were permitted during strict lockdowns. Consequently guesthouse businesses were forced to shut down temporarily, leading to severe financial strain. Participants described implementing difficult measures, such as laying off staff, reducing working hours, and navigating safety protocols like social distancing and mask mandates. Additionally, fear of infection and requirements for guests registration further discouraged visitors, making it challenging to sustain operations. While these restrictions were necessary to control the virus, they had a detrimental impact on guesthouse owners by limiting business activities and reducing customer flow. This is evidence by the following excerpts;

Participant 1. "It really affected me because there was no movement, and we had no guest at all. That is why we had to cut some of our employees. We had to retrench two employees. Then, the other one who was full time I ended up reducing his hours to part time. For the first three months, we were completely shut down and then we started operating on partial basis after three months".

Participant 3 "The disruption of business you know it was understandable. However, we saw a reduced number of clients because we are automatically the conditions that were put there signified that there was not so much there had to be social distancing. And just mere fact that there has to be social distancing people have to wear masks. Furthermore, we had to implement precaution measures such temperature checks. Socialising was not allowed. Because both houses are also to some people the moment to go out just to relax, to rest to recuperate to rehabilitate. When they go out there, they swim they expect to go swim. They go to sit down".

Participant 3 " During the lock down, everything was shut down. When COVID started the response was to shut down businesses communities, and the economy because people were unsure what they were dealing with. "

Participant 8 "It has been so difficult, there were no movement, and government restrictions did not allow visits at guesthouses. People also afraid of contracting Covid-19. Furthermore, when people were registering wherever they go. So, it was a challenge as some customers did not want to register and to be tested. Hence it would become difficult to trace them if they were found to have tested positive to Covid-19".

6.3.3 Lack of Government Support

The study also established that, lack of government support during the Covid-19 pandemic was one of the challenges that were experienced by the GHE. This is evidence by the following excerpts;

Participant 1 “We did not benefit from that, we did not receive anything from government. ”.

Participant 2. “We only received cushioning from the directors just so that it keeps on running. But other than that, it didn't receive any other financial support”.

6.3.4 Lack of Support from Entrepreneurial Support Organizations

The results of the study also reveal that lack of support from entrepreneurial support organisations is one of the challenges experienced by GHE during the Covid-19 pandemic. This has left many GHE struggling to adapt, survive, and recover.

Participant 5. “Not at all, and I really wanted that.”.

Participant 7. Absolutely not. We were just left on our own”.

6.3.5 Loss of Income

Loss of income for the GHE during the Covid-19 pandemic was also proffered as one of the challenges experienced during the pandemic. The Covid-19 pandemic led to significant loss of income for GHEs globally due to a combination of travel restrictions, lockdowns, and other government-imposed measures. The COVID-19 pandemic led to a drastic decline in business for guesthouses, with many reporting near-total losses. Participant 1 had zero income and used personal salary to pay employees for six months. Participant 2 experienced a 95% drop in income with only a few clients, while Participant 3 mentioned total losses during the initial lockdown, causing some hotels to close permanently. Participant 4 reported a 90% income reduction, and Participant 5 had to close their business. Others, like Participant 6 and Participant 7, noted long-term impacts, with recovery expected to take years. Business stagnation was also highlighted by Participant 8.

Participant 1 “It decreased drastic at more than hundred percent. There was zero percent income. I ended up, paying the employees with my own savings. I am still working. So, I used my salary to pay employee salary during the pandemic, for six months I was paying them with my salary”.

Participant 2 “We were not allowed to house guests, because we were supposed to be in our houses. So those first few months were very difficult. The business closed during Covid-19. We did not generate any income during the first three months of Covid-19”.

Participant 3. You could not make money. I think the first three months with those shutdowns, and all were total losses for many people. That is why some hotels have shut down their businesses forever and I know one place which is still not open doors even up to now.”.

Participant 4. “Our business income decreased by 90%”.

Participant 5. “It's been quite a challenge, even to an extent of closing. I closed in the Covid-19 time because there was no customers. Remember we had government lockdown restrictions.”

Participant 6. “Not yet where we supposed to be. I think it will take us another three years. Several people that were able to come for weekend away in our cases, no longer afford to”.

Participant 7 “It did disrupt our business in a very dramatic and drastic way because we were not allowed to conduct business during the Covid pandemic. We could not generate any revenue during the first three months as were in total lockdown with no business being conducted by guest houses. The loss of revenue during those month is still affecting our operations”.

Participant 8 “During Covid, there were no transactions made”. Participant 8.

The above excerpts show that the loss of income for was a result of multiple factors, including travel bans, government-mandated closures, and reduced consumer confidence. Even when restrictions were lifted, the slow recovery of the

tourism sector, combined with new operational costs and shifting travel behaviours, made it difficult for GHE to regain financial stability.

The diagram below summaries the challenges faced by GHE during Covid-19 pandemic.

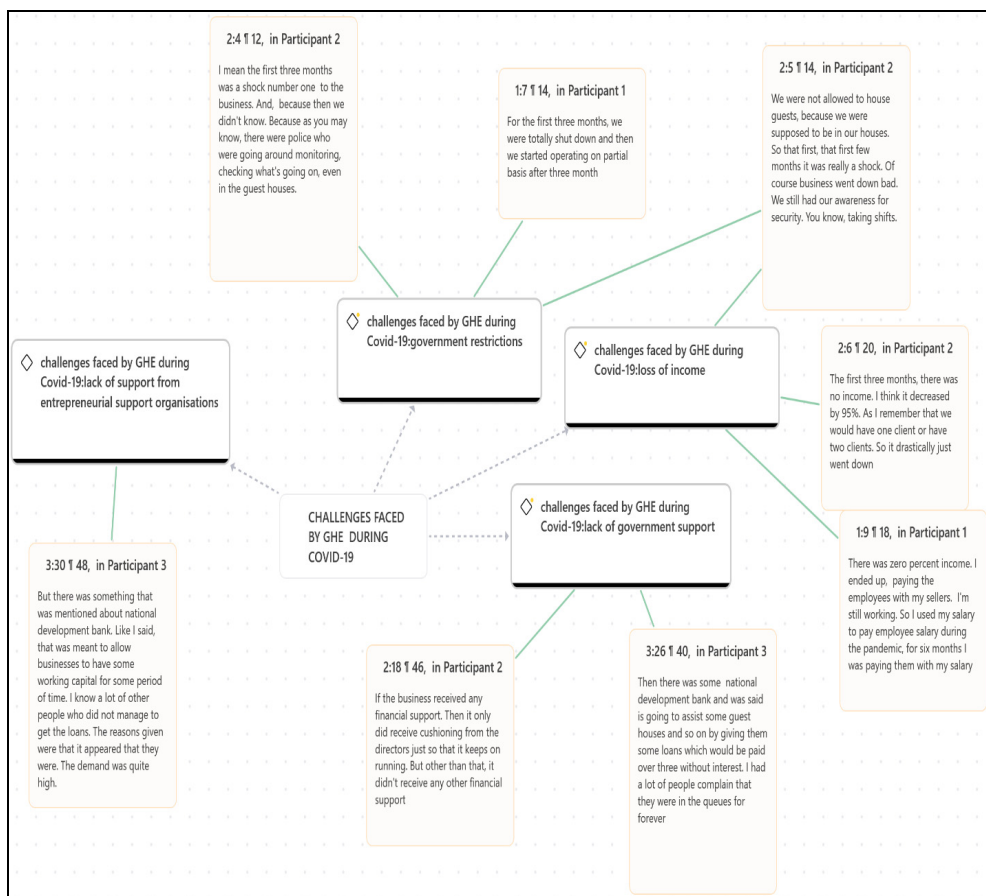


Figure 3: Summary of Challenges faced by GHE during Covid-19

Source: Compiled by Authors using ATLAS.ti v22, 2024

6.4 Guest House Entrepreneur’s Coping Strategies during Covid-19

The study results revealed that the coping strategies that were used by GHE during the Covid-19 pandemic included; access to short term and long-term finance, debt payment extensions, diversification, extensive promotional activities, government relief funds for employees, reduction of operating expenses, secured government contracts, use of personal savings and contingency funds and adherence to Covid-19 regulations set out by the government. These are shown in Figure 4 below.

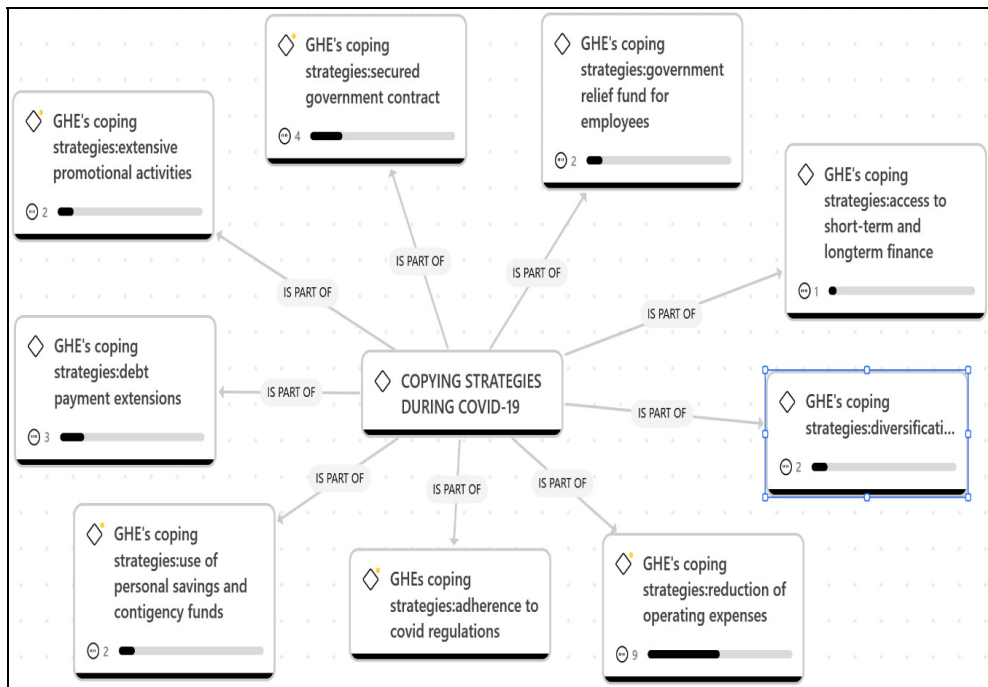


Figure 4: Guest House Entrepreneur’s Coping Strategies during Covid-19

Compiled by Authors using ATLAS.ti v22, 2024

6.4.1 Access to Short Term and Long-Term finance

The study results show that some of the GHE managed to survive during the Covid-19 pandemic as a result to having access to short term and long-term finance. This is in contradiction to the challenges of lack of support from entrepreneurial support organizations and government. This is evidenced by the remark below.

Participant 4 “We got a bank loan for small businesses to help with our property loans”.

6.4.2 Debt Payment Extensions

The study results also revealed that debt payment extensions for the GHE helped them to survive during the Covid-19 pandemic. The extracts below show that various forms of debt payment extensions were offered to GHE by banks, financial institutions, and governments. These debt relief measures helped ease the immediate financial burden, allowing GHE to survive during the pandemic. During the COVID-19 period, debt relief measures provided businesses with much-needed flexibility. Participant 2 highlighted how creditors were lenient, allowing negotiations for future payment plans. Participant 3 noted that government initiatives encouraged banks to prioritize people over profit, offering reprieves to struggling debtors. Participant 7 mentioned that loans helped keep businesses afloat and pay staff, though repayment with interest continues. These efforts helped businesses manage financial challenges during the crisis.

Participant 2 “Our creditors were lenient with us during the Covid-19 pandemic. They extended our payment periods We had to sit down and make, negotiations for future event plans”.

Participant 3 “I know a number of banks participated in giving some of their debtors who were facing financial challenges some reprieve of sort. It was all in that spirit that the government tried to say to people let's go this direction which is a positive approach. Let's not put profit ahead of people right. Money ahead of people's lives and all that but be considerate. So that was something that benefited everybody. So, in a way we also benefited from that, and we are grateful to the government”..

Participant 7 “I think the flexibility of the loan, like I said, we had to take out loans so that we can at least stay afloat and pay staff. So that was helpful. However, we need to pay it back with interest, but we did have some type of arrangement with the bank. So, yes, we are slowly getting there, slowly paying off the loan”.

6.4.3 Diversification

The results of the study revealed that diversification is one of the strategies that was used by the GHE during the Covid-19 pandemic. Diversification enables the entrepreneurs to explore new offerings in the tourism sectors and also to satisfy the ever-changing needs in times of the pandemic.

Participant 4 “During the Covid-19 pandemic we had time to build a pizza oven which has been a great improvement at our restaurant”.

Participant 5 “I am trying to put a restaurant, on the guest house. I am trying to put a restaurant and then I think that is all. I don't have enough income to, to do everything, which was”.

6.4.4 Extensive Promotional Activities

Extensive promotional activities were also proffered as one of the coping strategies that were used by the GHE during the Covid-19. This is in line with Booyens et al., (2022) who found that in South Africa, enterprises had to find coping measures during the pandemic. However, the results below go beyond that because this is a comparative study which proves coping activities in both South Africa and Botswana. Participant 2 expressed optimism about improved marketing efforts, expecting positive results within two months. Participant 3 mentioned targeting busy professionals, such as those attending COVID-related seminars or traveling for work, to maintain business during the pandemic.

“So, hosting these events, I think will bring a portion also the marketing personnel, we are just discussing with the directors that we need to market it a bit more. But to answer your question, I think in the next two months, we should be singing a different song”. Participant 2.

“If so, we tried to market a lot to those because those were the people who were going to work and those were the people who were very busy and traveling going from one point to another attending seminars in relation to COVID or coming you know from different hospitals and so on. So those were people would try to now say okay these are the guys who are still playing the game”. Participant 3.

The above remarks show that GHE engaged in extensive promotional activities to attract guests despite the significant decline in tourism and hospitality. With traditional travel largely halted due to lockdowns, travel restrictions, and fear of the virus, guesthouse owners had to get creative to generate income and keep their businesses afloat. The restrictions as suggested by Masiya et al., (2021) negatively affected business operations.

6.4.5 Government Relief Funds for Employees

Government relief funds for employees also emerged as one of the major incentive that helped GHE to copy and survive the threats that were posed by the Covid-19 pandemic. This agrees with Sucheran (2022) which suggested that entrepreneurs needed support from the government. This is shown in the excerpt below;

Participant 3. Other than the payments that were made to employees during the time when there were some subsidies that were made in terms of salaries. Yes, there was that for that period of time and yeah that was to some extent helpful. However, if it would have been more it could have been more right. It was not a full salary. It was a certain percentage if I'm not mistaken. It could have been about half or so. They did something about the situation and save some lives. That's great. Other governments they didn't they did nothing so at least they try.

The above shows that governments around the world introduced various relief programs to support businesses, including GHE in order for them survive the challenges of the Covid-19. This helped the GHE to retain their employees despite the economic downturn. Thus, Government relief funds for employees played a crucial role in helping GHE retain their workforce during the COVID-19 pandemic.

6.5.6 Reduction of Operating Expenses

Reduction of operating expenses by the GHE also emerged as one of the copying strategies that helped the entrepreneurs to survive during the Covid-19 pandemic. The extracts below were captured;

Participant 1. "When I started, I had five employees, but had to retrench some of them because of Covid-19 I have also drilled a borehole to reduce water costs,

and I have also installed solar panels as a backup supply of electricity to reduce the costs of operating a generator when there is loadshedding”.

Due to COVID-19, guesthouse owners reduced staff to cut costs, with Participant 1 downsizing from five employees and exploring cost-saving initiatives like installing a borehole, switching to solar energy, and creating a self-sustaining garden. Participant 3 highlighted efficiency improvements by using fewer staff and relying on technology. Similarly, Participant 5 reduced staff from six to one, struggling to pay salaries without guests.

6.5.7 Secured Government Contracts

Securing government contracts was proffered as one of the coping strategies that were used by some of the GHE during Covid-19 pandemic. As a result of strict government regulations and loss of customers during the Covid-19 pandemic, some turned to securing government contracts as an alternative revenue stream. These contracts were primarily related to providing accommodation for essential services, quarantine facilities, or emergency response efforts.

Despite strict health regulations, some guesthouses found unexpected benefits during the pandemic. Participant 2 emphasized the rigorous compliance measures, while Participant 3 noted that government quarantining programs brought new business, boosting sales. Participant 4 added that their guesthouse survived by accommodating the South African Army, which ensured compliance with COVID-19 restrictions, keeping operations running during the crisis.

“Compliance, after each and every group left, we had to thoroughly sanitize and have our employees tested for Covid-19.” Participant 2.

“The government introduced systems of quarantining people in guest houses. So that became a positive factor in the sense that the very guest house is that had initial of clients was now beginning to reap something out of situations such that it became an advantage in the situation which has disadvantages. People also started making money to some extent through the government who would send its people who are quarantined there and the soldiers were coming, the police were coming, the rest were coming and the ordinary people.” Participant 3.

“The guest house almost closed down, it only survived due to business received from the South African Army as we had to accommodate a large number of people from the army during that period, as the army had to make sure that the residents adhere to the Covid-19 restrictions so our guesthouse was chosen to accommodate

them. Most guesthouse had to minimize operation or completely shut down during that period.” Participant 4.

6.5.8 Use of Personal Savings and Contingency Funds

The study results also show that during the Covid-19 pandemic, some of the GHE were forced to rely heavily on their personal savings and contingency funds to sustain their business operations.

“There was zero percent income. I ended up, paying the employees with my sellers. I am m still working. So, I used my salary to pay employee salary during the pandemic, for six months I was paying them with my salary.” Participant 1.

6.5.9 Adherence to Covid-19 Regulations

The study results also revealed that GHE had to adhere and comply with the Covid-19 regulations. During the pandemic, guesthouses implemented strict hygiene measures to ensure safety. Participants 2, 3, 4, 6, and 7 emphasized enhanced cleaning protocols, social distancing, and protective gear for staff, including masks and sanitizers. Some guesthouses even required COVID-19 certificates from guests. These precautions helped businesses reopen and regain customer trust. Rooms were regularly sanitized, humidifiers were introduced to purify air, and strict distancing guidelines were followed to prevent infections.

“We just had to bring the experts to just come in clean, you know, the beds, you know, and just sanitize and sterilize the whole environment to clear any infections, which would have contaminated the area and there was no access to all of the clients who were in the rooms to ensure that our staff are kept safe, always the sanitizers, and they have the security gears on the wearing them masks.” Participant 2.

“But then the second stage now you could also make money when there was a better understanding that if you take certain precautions and so on you people would go through this and some people would say then that's when people started opening doors again that they had initially shut down to welcome people. I think one thing the tourists wanted to see is that you have conscious of COVID right? And you have places for people to wash their hands when they come there. You have got to have done some marks on this space or areas of your guest house to show that people can do some good social distancing, and that you have got your staff that are wearing masks, and you've got available you know sanitizers, and you have got thermometers to check temperatures, and you know your rooms are clean,

and there's good lighting around for people to know that the place is clean where they're sitting and where they are walking". Participant 3.

"Maintained at least a 1 meter distance from other staff and guests. We ensured that we avoided hugging, kissing, or shaking hands, however sometimes in the hospitality industry it is very difficult to avoid the 1-meter distance, so we encouraged all staff and guests to wear a fabric mask. If one of our guests developed symptoms of COVID-19, (fever, dry cough or tiredness) it was our responsibility to a doctor or local clinic/hospital. If the person was tested and was positive for Covid-19, the sick person would be isolated in a room, alone, or at least 1 meter away from others. Staff would also move people traveling with the sick person to a different room, if possible. During this time, we also made sure that all our rooms were cleaned, disinfected and sanitized this made us aware and extra careful with our cleaning procedures". Participant 4.

"We had to ensure our guesthouse is really open again, that they are welcome to come. And in terms of COVID certificate, if you have had the first injection, then they're welcome to come to our guest house. We first tell them that we've gone through training safety, safety measures. Health and Safety Department is coming to our BnBs to give us training in terms of ensuring that we keep our rooms and everywhere, our environment clean, you know". Participant 6.

"We had to make sure that our place is highly hygienic, we had to start putting up things like sanitisers, we had to just rethink how we can restore hygiene, we started putting humidifiers in our rooms, so that it can clean the air. So, yes, our guests have been very, very pleased with that type of service". Participant 7.

The following diagram summaries the coping strategies that were used by GHE during the Covid-19 pandemic.

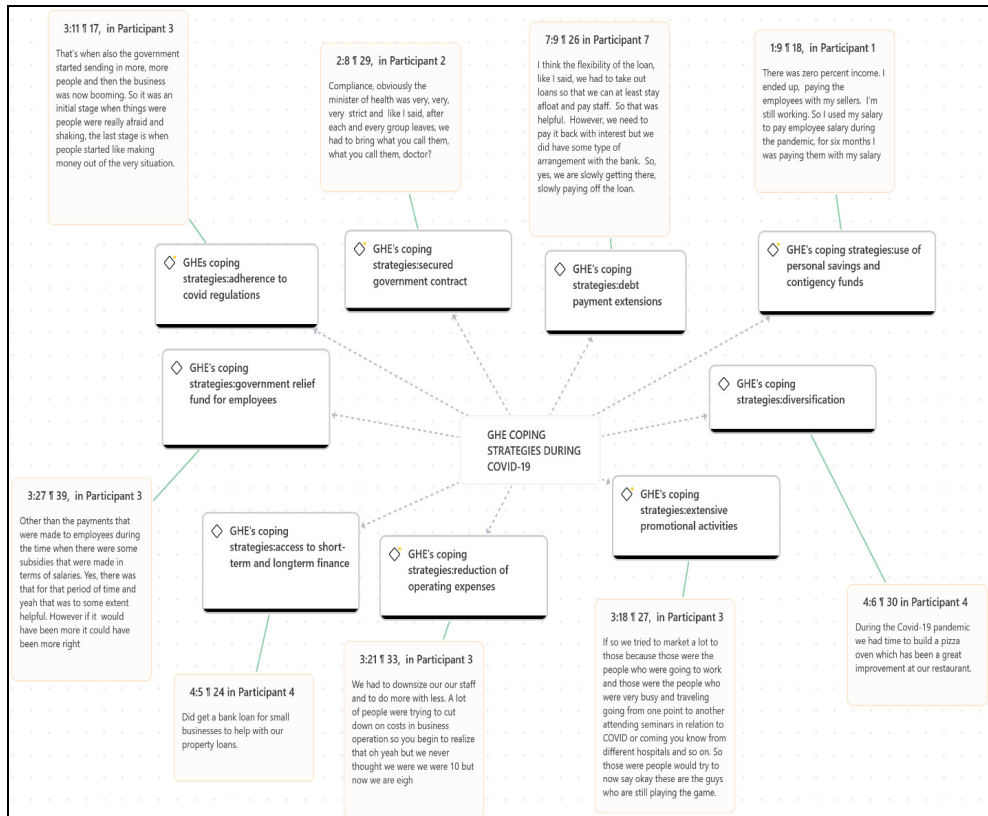


Figure 5: Summary of Guest House Entrepreneur's Coping Strategies during Covid-19
Compiled by Authors using ATLAS.ti v22, 2024.

7. Discussion of The Results

The study findings reveal that the COVID-19 pandemic had a significant impact on guesthouse entrepreneurs (GHE) in Botswana and South Africa, leading to financial losses, employment cuts, and operational disruptions due to government-imposed restrictions (Sigala, 2020). Entrepreneurs struggled with limited government support and access to financial aid, forcing many to downsize their workforce or shut down temporarily (Gössling et al., 2021). Additionally, the loss of income was severe, with some businesses reporting a 90-100% decline in revenue, further exacerbating their financial struggles (Baum & Hai, 2020). However, in response to these challenges, GHEs adopted various coping mechanisms, such as securing loans, renegotiating debt payments, and diversifying their business offerings (Sharma et al., 2021). Many entrepreneurs also leveraged social media and digital marketing to attract local clients, highlighting the growing role of technology in business survival during crises. Despite the hardships, the pandemic resulted in positive transformations, including enhanced hygiene practices, digitalization of marketing, and increased financial risk awareness, which are expected to shape the future of the hospitality industry (UNWTO, 2021).

8. Implications for Policy and Practice

Developing Government Support Systems: More comprehensive and inclusive government initiatives that are suited to the unique requirements of small hospitality businesses are desperately needed. Clear standards, prompt financial assistance, and post-pandemic support are all necessary for policies to help guesthouses recover and become resilient in the long run.

Improving Small Business Development Organizations' Role: In order to provide guesthouse owners with more effective financial, operational, and strategic guidance especially during times of crisis entrepreneurial support organizations must fortify their relationship with these owners. Improved business continuity planning and improved resource accessibility can result from closer collaborations between these organizations and companies.

Encouraging Entrepreneurial adaptability: The guesthouse industry's successful coping mechanisms, such as diversification and obtaining alternate funding, underscore the significance of entrepreneurial adaptability. Guesthouse owners may find it easier to handle future crises if they participate in training programs that prioritize financial literacy and adaptable methods.

Developing Crisis Resilience: Guesthouses should build flexible operating methods that can be quickly deployed in the event of an unanticipated interruption, as well as crisis preparedness into their business models by setting aside funds for emergencies. Their competitiveness and long-term sustainability will increase as a result of this proactive strategy.

It is recommended that crisis-resilient structures for SME support be institutionalized by governments, going beyond immediate support by incorporating fast-access finance, streamlined compliance, and hospitality-focused support. Small Business Development Institutions need to move from transactional support to relational support by providing crisis-resilience training, financial literacy, and digital marketing skills. At the firm level, the crisis-resilience strategies for the guesthouse entrepreneurs need to be integrated into their business models.

9. Limitations and Directions for Future Research

This study's limitations include its qualitative approach and small sample size, which limit generalizability. However, this study's approach was a deliberate methodological decision to gain an in-depth understanding of guesthouses' experiences during this unprecedented crisis. The study's analysis covers a specific time frame within and immediately after the COVID-19 pandemic; as such, the long-run resilience pattern may vary.

A quantitative or mixed-methods study could be conducted to examine the pervasiveness and effectiveness of specific turnaround strategies. A longitudinal study could be conducted to better understand the development of resilience in guesthouses beyond the immediate post-crisis recovery period. Furthermore, comparative studies could be conducted across additional emerging economies to gain a better understanding of this topic from both theoretical and practice-oriented perspectives.

10. Conclusion

The study has provided valuable insights into the effects of the COVID-19 pandemic on guesthouse entrepreneurs (GHE) in Botswana and South Africa, highlighting the challenges faced, coping strategies adopted, and the broader transformations experienced by the industry. The findings reveal that COVID-19 had a profound impact on guesthouse businesses, leading to financial losses, employee layoffs, and operational disruptions due to government restrictions and decreased consumer confidence. Entrepreneurs struggled with fear and anxiety,

lack of government support, and insufficient assistance from entrepreneurial support organizations (ESOs), which exacerbated their financial vulnerabilities. Many businesses faced severe revenue declines, with some forced to shut down operations entirely. Despite these challenges, GHEs demonstrated resilience and adaptability by implementing various coping strategies such as accessing short-term and long-term financing, negotiating debt extensions, diversifying their services, reducing operational expenses, and leveraging government relief funds. Some entrepreneurs secured government contracts for quarantine accommodations, while others turned to digital marketing and social media platforms to attract local guests. The study also identified increased hygiene practices and a shift towards technology-driven business models as key positive transformations arising from the pandemic. Additionally, the study highlighted the role of ESO support, including debt relief programs and wage subsidies, in providing temporary relief to entrepreneurs. However, gaps in financial accessibility and inconsistent policy interventions underscored the need for stronger governmental and institutional support mechanisms to help GHEs recover and sustain their businesses post-pandemic.

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A SEGMENTED STOCHASTIC MORTALITY FRAMEWORK FOR LIFE INSURERS: EVIDENCE FROM CONTRAST TREE ANALYSIS

Godson Chukwunwike MESIKE¹, Leke Ebenezer AKINDIPE²

¹*University of Lagos, Department of Actuarial Science and Insurance, University Road, Akoka, Yaba, Lagos, Nigeria,
Phone: +234 1 280 2489, +234 814 728 2316,*

E-mail: lekelymome8@gmail.com

²*University of Lagos, Department of Actuarial Science and Insurance, University Road, Akoka, Yaba, Lagos, Nigeria,
Phone: +234 1 280 2489, +234 814 728 2316,*

E-mail: lekelymome8@gmail.com

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Abstract

Accurate mortality modelling is critical for the solvency, pricing, and risk management of life insurers, particularly in emerging markets where demographic patterns are heterogeneous and data quality is limited. This study develops a segmented stochastic mortality framework for life insurers, integrating contrast tree analysis to identify subpopulations with divergent mortality patterns. By combining stochastic modelling with segmentation, the framework captures uncertainty and structural changes in mortality trends more effectively than traditional aggregate approaches. Applying the model to Nigerian life insurance data, the study demonstrates how segmentation improves predictive accuracy, informs pricing and reserving decisions, and enhances solvency assessment. The results provide actionable insights for actuaries and regulators, highlighting the importance of locally tailored mortality models that account for regional, gender, and socio-economic heterogeneity, while safeguarding against overfitting in sparse datasets.

Keywords: *stochastic mortality, life insurance, segmentation analysis, contrast trees, actuarial risk management, mortality forecasting, emerging markets*

JEL Classification: G22; C53; I10; D81

1.1 Introduction

Mortality modelling plays a central role in the valuation, pricing, and risk management activities of life insurance companies. Accurate mortality projections are critical for ensuring the solvency and sustainability of life insurers, particularly in emerging markets where demographic dynamics are rapidly evolving and data systems may be underdeveloped (Haberman & Renshaw, 2012). Traditional deterministic mortality approaches, while operationally simple, fail to capture the inherent randomness and uncertainty in future mortality trends and can understate the true extent of longevity risk the risk that policyholders live longer than expected or conversely, mortality shocks arising from epidemics and socio-economic disruptions (Lee & Carter, 1992; Cairns et al., 2006). The life insurance sector in Nigeria has witnessed significant growth over the past decade, driven by increased financial awareness, regulatory reforms, and expanding middle-class demand for risk mitigation instruments (Oyinlola & Adesola, 2017). However, this growth has not been accompanied by commensurate improvements in mortality analytics. Nigerian insurers continue to rely heavily on international mortality tables or extrapolated life tables, which may not reflect local mortality patterns shaped by endemic diseases, infrastructural constraints in healthcare delivery, and socio-cultural determinants of health (Onwujekwe et al., 2013; World Bank, 2020). Consequently, the misalignment between assumed mortality and actual experience jeopardizes technical reserves, pricing adequacy, and overall actuarial soundness of life portfolios.

Stochastic mortality models are increasingly recognized as superior tools for capturing uncertainty and structural change in mortality trends (Currie et al., 2006; Booth et al., 2006). These models allow actuaries to quantify the risk of future deviations from historical mortality patterns and to incorporate risk margins into pricing and reserving. Yet, most stochastic mortality frameworks have been developed and validated on populations in developed countries, with abundant historical data and stable demographic regimes (Booth & Tickle, 2008). Applying such models directly to Nigerian mortality data may overlook important segmentation features such as rural versus urban differentials, gender disparities,

and socio-economic stratification that drive heterogeneous mortality behaviour across subpopulations (Pison et al., 2018). Segmentation analysis, coupled with stochastic modelling, provides a promising pathway for uncovering latent structures in mortality data that aggregate models might conceal. Contrast tree analysis, a non-parametric machine learning technique, enables the identification of subgroups where mortality outcomes significantly diverge, supporting more tailored and credible mortality projections (Segal & Xiao, 2011). Integrating contrast trees with stochastic mortality frameworks can improve predictive performance while safeguarding against overfitting, particularly in contexts with limited and noisy data a characteristic feature of mortality datasets in many Nigerian states (Adebayo & Olowookere, 2019).

Mortality assumptions constitute one of the most critical inputs in life insurance pricing, reserving, and solvency assessment. Inaccurate mortality projections can lead to under-reserving, pricing distortions, and ultimately threaten insurer solvency (Lee & Carter, 1992; Cairns, Blake & Dowd, 2006). While stochastic mortality models have significantly improved longevity forecasting in developed economies, their application in developing countries particularly Nigeria remains limited and methodologically underdeveloped. In Nigeria, life insurers often rely on adapted foreign mortality tables or aggregated national life tables that may not accurately reflect local mortality experience. Mortality patterns in Nigeria are highly heterogeneous, shaped by regional disparities, gender differences, income inequality, epidemiological transitions, and healthcare access constraints (World Bank, 2020). Aggregated stochastic mortality models such as the Lee–Carter model assume population homogeneity and may therefore obscure significant subgroup variations that materially affect actuarial valuations.

This study, therefore, proposes a segmented stochastic mortality framework that leverages contrast tree analysis to improve mortality modelling for Nigerian life insurers. By addressing segmentation in mortality risk and introducing robust stochastic forecasting, the research aims to fill key gaps in both actuarial practice and academic literature, offering insights that are directly applicable to pricing, reserving, risk management, and regulatory capital assessment in the Nigerian life insurance industry.

2.0 Literature Review

The conceptual framework for the study integrates stochastic mortality theory with data-driven segmentation to improve actuarial forecasting and risk management within Nigeria’s life insurance industry. The framework is structured

around five core components: risk determinants, segmentation mechanism, stochastic mortality modelling, actuarial outcomes, and insurer performance implications. The risk determinants are observable demographic and socio-economic risk factors that influence mortality experience in Nigeria which include: Age, gender, geographic location, Socio-economic status, policy characteristics as well as Health-related indicators. Mortality theory suggests that these variables systematically influence death probabilities (Ronald Lee & Lawrence Carter, 1992). However, in developing contexts such as Nigeria, these effects may interact nonlinearly due to healthcare inequality, epidemiological transitions, and economic disparities (World Bank, 2020).

The second component introduces contrast tree analysis, a recursive partitioning technique that identifies statistically significant differences in mortality experience across subgroups (Segal & Xiao, 2011). Unlike traditional actuarial classification methods that impose predefined groupings such as male against female, contrast trees allow the data to determine optimal splits based on mortality contrasts by showing where mortality differences are more pronounced in specific age–region combinations, Gender disparities vary by socio-economic status, and how certain policy types exhibit structurally different mortality trends. This stage produces homogeneous mortality clusters, reducing within-group variance while maximizing between-group differences.

For each identified cluster, stochastic mortality models are estimated to capture time-varying mortality trends, Longevity improvements, random mortality shocks and forecast uncertainty. This treats mortality as a probabilistic process rather than a fixed deterministic schedule (Cairns et al., 2006). By modelling each segment separately, the framework captures both structural heterogeneity (from segmentation), and temporal uncertainty (from stochastic modelling). This will show forecasted mortality rates with confidence intervals for each segment.

The actuarial outcome focuses on segment specific mortality forecast that directly influence technical reserve estimates, net premium calculations, longevity risk measures and solvency capital requirements. Improved mortality accuracy often reduces pricing bias and reserve misestimation, which are major drivers of underwriting volatility in life insurance portfolios. This suggest that segmented stochastic mortality modelling will bring about Improved mortality forecast accuracy and then lead to more accurate reserves and pricing as well as enhanced solvency stability. Insurer performance and risk management implication which is the final component of the conceptual framework connects actuarial output to insurer performance metrics such as underwriting performance, capital adequacy,

risk-based capital compliance, portfolio stability and long-term financial sustainability. This is expected to reduce mortality mis-specification risk and enhance insurers' resilience against longevity risk and mortality shocks.

The study is anchored on three interrelated theories which are stochastic mortality theory, risk pooling and heterogeneity theory, longevity risk and capital adequacy theory. The stochastic mortality framework originates from the seminal work of Ronald Lee and Lawrence Carter (1992), which introduced a time-series based decomposition of mortality rates into age-specific and period components. Extensions such as the Cairns–Blake–Dowd model further incorporated multi-factor stochastic processes to capture mortality uncertainty (Cairns et al., 2006). These models recognize mortality as a dynamic and probabilistic process rather than a fixed deterministic function. This theory supports the study's emphasis on modelling mortality volatility and uncertainty in Nigeria. Risk pooling and heterogeneity theory assumes homogeneity within risk pools; however, heterogeneous risk characteristics lead to adverse selection and mispricing. When mortality risk varies systematically across subgroups, aggregated modelling can produce biased parameter estimates and inefficient capital allocation. Segmentation theory therefore supports dividing insured populations into more homogeneous clusters to enhance actuarial fairness and solvency stability. Longevity risk theory posits that systematic improvements in life expectancy expose insurers to long-term financial strain if not properly modelled and capitalized (Blake et al., 2014). Under emerging risk-based capital frameworks in developing markets, accurate quantification of mortality uncertainty becomes critical for solvency sustainability. A segmented stochastic model enhances risk-sensitive capital measurement.

3.0 Methodology

This study adopts a quantitative, actuarial time-series research design to develop and evaluate a stochastic mortality framework suitable for Nigerian life insurers. The methodology focuses exclusively on parametric stochastic mortality modelling. The objective is to estimate, validate, and apply statistically rigorous mortality models that capture both age patterns and time dynamics in Nigerian mortality experience, and to assess their implications for actuarial valuation and longevity risk measurement. The empirical analysis is based on secondary longitudinal mortality data obtained from life insurers' experience investigations, regulatory publications, and national demographic sources. Let $D_{x,t}$ denote the

observed number of deaths at age x during year t , and $E_{x,t}$ denote the corresponding exposure-to-risk. The central death rate is computed as:

$$m_{x,t} = \frac{D_{x,t}}{E_{x,t}}$$

To stabilize variance and align with standard stochastic mortality literature, modelling is conducted on the logarithmic scale of central death rates. The baseline stochastic mortality specification follows the model introduced by Ronald Lee and Lawrence Carter (1992). The Lee–Carter model decomposes log mortality into age and period components:

$$\ln m_{x,t} = a_x + b_x k_t + \varepsilon_{x,t}$$

Where a_x represents the average age-specific mortality profile over time, b_x measures the sensitivity of mortality at age x to changes in the time index, k_t is the mortality improvement index capturing overall mortality trends, and $\varepsilon_{x,t} \sim N(0, \sigma_\varepsilon^2)$ is the error term.

To ensure parameter identifiability, the following constraints are imposed:

$$A = \sum_t K_t = 0, \sum_x b_x = 1$$

Estimation is performed using singular value decomposition (SVD) applied to the centered log-mortality matrix. The time index k_t is subsequently modelled as a stochastic time-series process. Consistent with empirical mortality literature, it is assumed to follow a random walk with drift:

$$k_t = k_{t-1} + d + u_t$$

Where d is the drift parameter representing the average rate of mortality improvement, and $u_t \sim N(0, \sigma_k^2)$ is white noise. Parameters of the time-series process are estimated using maximum likelihood methods, and model adequacy is assessed via information criteria and residual diagnostics. Forecasts of the mortality index for horizon h are generated as:

$$\hat{k}_{t+h} = k_t + hd$$

with forecast variance

$$\text{Var}(\hat{k}_{t+h}) = k_t + h\sigma_k^2$$

Projected mortality rates are then computed as:

$$\hat{m}_{x,t+h} = \exp(a_x + b_x \hat{k}_{t+h})$$

Prediction intervals are constructed by incorporating the variance of both the time index and the residual term. To account for potential cohort effects that may influence mortality in the Nigerian context, an Age–Period–Cohort (APC) extension is estimated as a robustness check. The APC model is specified as:

$$\ln m_{x,t} = a_x + k_t + \gamma_{t-x} + \varepsilon_{x,t}$$

where γ_{t-x} captures cohort-specific mortality deviations associated with year of birth $(t - x)$. Identification constraints are applied to address the linear

dependency among age, period, and cohort terms. Estimation is conducted using generalized linear modelling under Poisson assumptions:

$$D_{x,t} \sim \text{Poisson}(E_{x,t}, m_{x,t})$$

With long link function

$$\ln E[D_{x,t}] = \ln E_{x,t}$$

The population for this study comprised mortality records drawn from life tables and national health statistics spanning the years 1994 to 2024. The data covered age ranges between 18 and 100 years, ensuring that both early-adult mortality (characterized by the accident hump) and old-age mortality were adequately represented. This population was chosen because it provided longitudinal observations across multiple cohorts and calendar years, enabling the study of temporal dynamics in mortality risk. The study utilized a secondary dataset consisting of 2,822 observations (cells) derived from annual mortality records between 1994 and 2024. Each observation represented a unique combination of calendar year and age. The dataset included exposures and deaths for both sexes, but for the purpose of this research, only the male population was retained. The data analysis was carried out using Python (Jupyter Notebook), employing statistical approach. The dataset was stratified into three age groups 18–29, 30–60, and 61–100 to capture distinct mortality dynamics such as the accident hump, working-age mortality, and old-age mortality. A 70–30% split was applied between training and testing sets using stratification to preserve proportional representation of age groups. This strategy ensured robust model validation and mitigated sampling bias (Zhang & Yang, 2023). Traditional statistical models were adopted, Lee-Carter (LC) model, which extracts latent time trends in mortality via singular value decomposition and Poisson regression (Brouhns et al., 2002) and Age Period Chot (APC) model, which decomposes mortality variation into three components for interpretability (Alai & Sherris, 2014). Diagnostics were applied to assess model fit and predictive performance. Key measures included: Residual analysis to check systematic deviations, Goodness-of-fit (R^2) to quantify explained variation and Model selection criteria (AIC, BIC) for statistical models. To complement traditional diagnostics, Contrast Trees were implemented. This technique partitions the age–year space into regions of homogeneous discrepancy, allowing visualization of localized errors (Friedman, 2020). Subsequently, Contrast Boosting was employed to iteratively reduce discrepancies, thereby improving predictive accuracy across all age groups.

4.0 Results and interpretations

Preprocessing and transformation of mortality data for males aged 18 to 100 years from 1994 to 2024 was the first step in the empirical study. The traditional actuarial method was used to transform the dataset's annual mortality counts and associated risk exposures into central death rates.

$$m_{x,t} = \frac{D_{x,t}}{E_{x,t}}$$

Where $D_{x,t}$ represents the number of deaths observed at age x in year t and $E_{x,t}$ denotes the exposure to risk.

The resulting dataset comprised 2,822 age–year observations, allowing the construction of a longitudinal mortality panel suitable for stochastic modelling. A cohort dimension was introduced by defining the birth cohort as:

$$c = t - x$$

where c denotes the birth cohort, t the calendar year, and x the age. This

transformation enabled the analysis of cohort-specific mortality patterns. To capture heterogeneity across life stages, the dataset was stratified into three age categories: 18–29 years, 30–60 years, and 61–100 years. These groupings reflect well-known mortality dynamics in demographic literature, including the accident hump in early adulthood, the working-age chronic disease transition, and age-related degenerative mortality at older ages.

Mortality Dynamics across Age Groups

Descriptive analysis reveals distinct mortality patterns across the three age groups. The 18–29 age group exhibits relatively low mortality levels but higher variability over time. This pattern is consistent with mortality driven largely by external causes such as accidents, injuries, and behavioural risk factors. Consequently, mortality rates in this group display irregular fluctuations that are difficult for parametric mortality models to capture.

The 30–60 age group shows smoother mortality trajectories with a gradual upward slope. Mortality in this age range is influenced primarily by chronic diseases, lifestyle-related conditions, and occupational hazards. Improvements in healthcare access and disease management appear to have moderated mortality growth within this group over the study period.

In contrast, the 61–100 age group exhibits the steepest increase in mortality rates. Mortality at these ages is dominated by biological ageing processes and degenerative diseases, producing a relatively predictable upward trajectory consistent with classical actuarial life-table patterns.

The cohort analysis further indicates that younger and middle-aged cohorts exhibit lower mortality levels than earlier generations, suggesting gradual improvements in health outcomes and disease control over time. However, the

cohort effect becomes less pronounced at advanced ages, where biological ageing remains the dominant mortality determinant.

Model Diagnostics and Comparative Performance

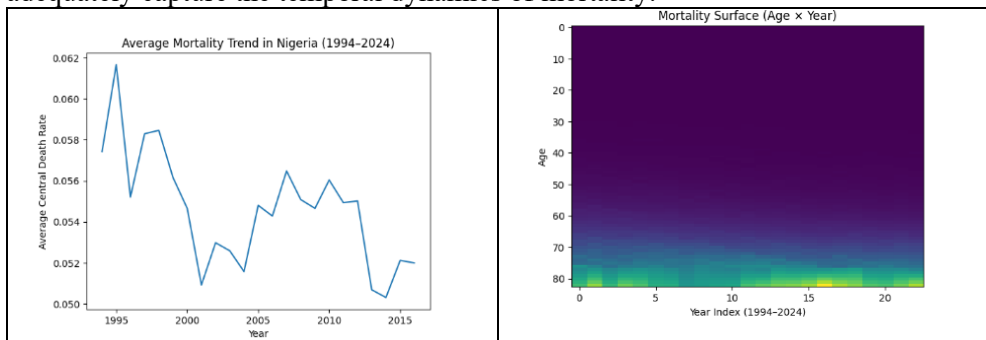
Two primary stochastic mortality models were evaluated: the Lee–Carter (LC) model and the Age–Period–Cohort (APC) model. Model performance was assessed using standard statistical diagnostics including the coefficient of determination (R^2), Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and the Ljung–Box test for residual autocorrelation.

Table 2: Unified diagnostic Summary

Model	R^2	AIC	BIC	Ljung–Box Stat	p-value
LC Base	0.9774	-7080.37	-7032.95	3.50	0.624
LC Boosted	0.9977	-9010.35	-8962.93	5.58	0.350
APC Base	0.9670	-6757.65	-6710.23	4.87	0.432
APC Boosted	0.9978	-9062.81	-9015.40	2.95	0.707

Source: Author’s computation

The results demonstrate that both models provide very strong explanatory power, with R^2 values exceeding **0.96**. The Lee–Carter model slightly outperforms the APC model in its base specification, reflecting its ability to capture dominant mortality trends through a parsimonious age–period structure. However, improvements in model diagnostics are evident after boosting adjustments. Both boosted models exhibit higher goodness-of-fit and substantially lower information criteria values, indicating improved predictive performance. The Ljung–Box test statistics show no significant residual autocorrelation, suggesting that the models adequately capture the temporal dynamics of mortality.



Average Discrepancies in Mortality Rates

To evaluate predictive accuracy across different life stages, average discrepancies between observed and predicted mortality rates were computed. At **younger ages (18–29)**, discrepancies remain relatively small in absolute terms but exhibit higher percentage variation. This outcome reflects the inherent difficulty of modelling mortality driven by unpredictable external events.

For the **30–60 age group**, both models perform reasonably well, although small increases in discrepancy indicate that additional heterogeneity in chronic disease risk may not be fully captured. The 61–100 age group demonstrates the most significant improvement in predictive accuracy after boosting, with discrepancies reduced by more than 50 percent across models. This suggests that stochastic models capture age-related mortality patterns more effectively at older ages where mortality dynamics follow more regular biological trajectories.

Prediction Accuracy: RMSE and MAPE

Further evaluation was conducted using Root Mean Squared Error (RMSE) and Mean Absolute Percentage Error (MAPE). The results indicate that prediction errors decline significantly at older ages, confirming that mortality models perform best when mortality follows more stable actuarial patterns. At younger ages, higher RMSE and MAPE values reflect the influence of behavioural and environmental risk factors that introduce substantial randomness into mortality outcomes. Overall, the findings indicate that stochastic mortality models provide reliable mortality forecasts for actuarial valuation, particularly for middle-aged and elderly populations where insurance liabilities are most concentrated.

Model Misfit Analysis using Contrast Trees

Contrast tree diagnostics were applied to identify localized regions of model misfit across the age–year mortality surface. The visualization highlights areas where predicted mortality rates deviate significantly from observed values.

The results reveal that model discrepancies are concentrated primarily in two regions:

1. Younger ages (18–29), where accident-related mortality produces irregular patterns.
2. Extreme old ages (**above 90**), where mortality data become sparse and subject to greater statistical noise.

In contrast, the 30–80 age range shows strong model alignment, indicating that the stochastic models effectively capture mortality dynamics across the core insured population.

These findings suggest that segmentation approaches and additional explanatory variables may further enhance predictive performance for populations with irregular mortality patterns.

5.0 Summary, Conclusions and recommendations

This study developed and evaluated a stochastic mortality modelling framework for Nigerian life insurers using mortality data spanning the period **1994–2024**. The empirical analysis applied the **Lee–Carter and Age–Period–Cohort models** to examine mortality dynamics across different age groups and to assess the predictive performance of stochastic mortality models in the Nigerian context. The results demonstrate that both models provide strong explanatory power and reliable mortality forecasts. The Lee–Carter model offers a parsimonious representation of mortality trends, while the APC model provides additional insights into cohort-specific mortality effects. The analysis further reveals that mortality dynamics vary substantially across age groups. Mortality rates at younger ages exhibit irregular fluctuations due to behavioural and environmental factors, whereas mortality at older ages follows more stable biological patterns that are well captured by stochastic models. Overall, the findings confirm that stochastic mortality modelling provides a robust analytical framework for improving mortality projections in the Nigerian life insurance industry. By capturing both age-specific patterns and temporal mortality trends, these models can significantly enhance actuarial pricing, reserving, and risk management practices.

Based on the empirical findings, the following recommendations are proposed: Nigerian life insurers should transition from deterministic mortality tables to stochastic mortality frameworks such as the Lee–Carter and APC models in order to better capture mortality uncertainty and longevity risk. Regulatory authorities and insurers should collaborate to develop comprehensive national mortality databases that reflect Nigerian demographic realities. Improved data quality will enhance the accuracy of actuarial modelling and mortality forecasting. Mortality modelling should incorporate segmentation based on demographic and socio-economic characteristics in order to capture heterogeneity in mortality risk across populations.

Insurance companies should invest in actuarial analytics infrastructure and training to support advanced mortality modelling and risk assessment. Mortality projections derived from stochastic models should be incorporated into solvency and capital adequacy assessments to improve the resilience of the life insurance sector against longevity risk.

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COMPLETION TIME OF PHD PROGRAMS AND ITS IMPLICATIONS FOR HIGHER EDUCATION EFFICIENCY

Ganiyu Oluwaseyi QUADRI¹, Amos Olorunwa AGBOJO², Wilfred Isioma UKPERE³

^{1&3}*University of Johannesburg, Department of Industrial Psychology and People Management, School of Management, College of Business and Economics, D Ring 434, University Road, Auckland Park, Johannesburg, South Africa. Telephone: +278034089810 & +27735295587, E-mail:*

¹gquadri@uj.ac.za, ³wiukpere@uj.ac.za

²Federal University Oye, Faculty of Education, Department of Educational Management, Oye Ekiti State, Nigeria. Telephone: +2347034215711,

Email: ²agbojoolorunwa@gmail.com

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Abstract

Due to the cost involved, lecturers, supervisors, and students strive to complete the Doctor of Philosophy (Ph.D.) programme within five years (10 semesters). The National Universities Commission (NUC) sets the time frame. Nonetheless, research indicates that most Ph.D. candidates at public universities in southwest Nigeria (PUISWN) fail to finish their courses on time. Consequently, the completion time of doctoral programmes (CTDP) in faculties of education (FoE) in selected PUISWN was investigated in this study. Vroom's expectancy theory served as the anchor, while the survey design was adopted. The multi-phase sampling process was used. Four were chosen (Ekiti, Lagos, Ogun and Oyo) out of six states in southwestern Nigeria, using the simple random sampling method. Four 80.0% public universities (PUs) having FoE with the highest Ph.D. registration were purposively

selected. Out of the 623 students in the 2015–2016 cohort, 146 had dissertation titles certified within five years (W5Y). Data were collected using the CTDP Questionnaire (CTDPQ). The quantitative data were analysed using simple percentages. The study found that a majority of the respondents, 66.0%, were male, and 23.3% (145) completed their programmes W5Y, while 76.7% (478) were still on the programmes. Based on the findings of the study, students, supervisors and faculty involved in doctoral programmes must work together to improve the timely completion of Ph.D. courses in FoE in PUiSWN.

Keywords: *completion time, Ph.D. programme, faculties of education, student factors, institutional factors.*

JEL Classification: K420, K240, K2

1. Introduction

The degree, Ph.D is a basic requirement for a career in academia. Globally, Ph.D is financially and intellectually demanding; candidates must possess a high level of academic resilience and motivation to pursue this advanced study and research. This is because the primary purpose of doctoral programmes (DP) is to train their recipients on how to think logically, creatively and empirically. Only 1% of those aged 25 to 64 who have completed university hold a Ph.D. on average. Accordingly, a Ph.D. seems to be uncommon in general. 2% of people in the US, UK, Australia, Sweden, and Germany have a PhD (Organisation for Economic Co-operation and Development (OECD)). The largest percentages of people holding Ph.Ds are found in Slovenia and Switzerland, with 4% and 3%, respectively (OECD, 2023).

In most countries, CTDP ranges from three to six years. A Ph.D. at the University of Cambridge takes three to four years of full-time study (FTS) to complete. Likewise, at least five years of part-time study may be required (PTS) (Cambridge University, 2025). However, 100% completion of the Ph.D programme is yet to be attained in Cambridge (Prentice, 2025).

In South Africa, according to the Council on Higher Education (CHE, 2024) report on the state of Ph.D programmes offered by twenty-three PUs and five private institutions, 19% of a particular cohort of Ph.D students in 2014 dropped out W5Y. Similarly, within the same five years, another institution had a dropout rate of 22%. In all, most of the students completed their DP in a considerably longer time.

The CTDP in Nigeria lasts for at least three years. Likewise, the maximum term for FTS and PTS is five years, respectively. The DP is not administered as a sandwich; applicants must finish it within the allotted time (University of Nigeria, 2025). The Needs Assessment Report (FGN, 2010) on universities disclosed that Nigeria needed at least 76,000 Ph.D degree holders to meet the minimum teaching standard in its higher education institutions (Academic Staff Union of Universities, 2011). The projection of the NUC to produce 76,000 holders of Ph.D across disciplines might take Nigeria over 100 years to achieve. This is because, as of 2010, Nigerian universities produced 760 Ph.D holders annually. Hence, by the time Nigeria meets its goal of producing 76,000 Ph.D holders in this number of years, another level of development will have been set to make previous targets obsolete.

Furthermore, the Needs Assessment Report (FGN, 2014) indicates that 43% of academic staff in Nigerian universities have a doctorate qualification, which was far below the 75% recommended by the NUC. The report further reveals that Nigerian PUs have a teacher-to-student ratio of 1:33. In contrast to a few highly regarded institutions, like Massachusetts Institute of Technology (1:9), Harvard University (1:4), Yale University (1:4), and Cambridge University (1:3), it was concluded that Nigerian universities were understaffed and need more doctoral-level staff. However, elongation of CTDP could mar the effort to bridge the identified gap in the teacher-to-student ratio in Nigerian university education.

Thesis examinations often take a longer time in Africa. Whenever a doctoral candidate tells you that he/she has submitted his/her thesis, the next logical question that comes to mind is, when is your viva coming up? Or when are you graduating? This is because after the student has done everything within his/her control to finish, there are some bureaucracies that go beyond his/her control. Some doctoral students (DSs) waited for one and a half years after submitting their thesis for a viva, some even two years (Yusuf & Aina, 2018). This situation is the case in many universities, while it might not be the case for some others. The bureaucratic huddle may not only elongate the CTDP but also contribute to programme inefficiency (Agbojo, Quadri & Ukpere, 2025).

The average CTDP at the University of Ibadan (UI), Nigeria's top institution, was nine years (Olubusoye & Olusoji, 2014); (Mosanya, et al. 2022). In addition, the authors disclosed the following faculties' median completion time: Pharmacy was ten years; Technology, ten years; Basic Medical Sciences, nine and a half years; Agriculture, nine years; Arts, nine years; the Social Sciences,

nine years; Science, nine years; Education, nine years; Veterinary Medicine, eight years; and Public Health, five years. Meanwhile, the normal duration for a DP in UI should be between three and seven years (PG School, UI, 2016). The information above demonstrates how different faculties' Ph.D. programme durations vary.

Therefore, university officials should conduct a study to determine the source and reason for time waste in DP and take steps to reduce it (Ogunlana & Govender, 2025). This is premised on the fact that in the aftermath of the elongation of CTDPs, numerous potential candidates could be discouraged from enrolling if they consider the real and opportunity costs. In addition, this delay may limit the colleges' ability to admit students. The argument is that there will not be room for new candidates because of the number of individuals who have been enrolled in the course for a long time. Supervisors will waste their valuable time as noted by (Aina, 2017). Similarly, after years of participating in the programme, the supervisees can be deterred from continuing. This will lead to a shortage of Ph.D holders in Nigeria and consequently result in over-utilisation of the existing academic staff, which could adversely affect their health vis-à-vis the university system.

Another development is the lack of knowledge regarding the likelihood of completing a full-time DP in three to five years at a high percentage (Owoade, 2021). In addition, in recent times, the average year for timely completion (TC) in PUISWN is yet to be determined, which was the major gap filled by this study. Having empirical information on the certainty of achieving TC of Ph.D and the average year of finishing will be of immense benefit to stakeholders.

This study would assure DSs of the possibility of completing Ph.D in record time, thereby encouraging potential applicants to register for it. The information and recommendations that were suggested for obtaining the Ph.D degree at the expected time from the study can, therefore, be used to improve their academic success. The findings of this research will give departments, faculties, supervisors and DPs administrators in postgraduate colleges the ability to organise and coordinate human and material resources in such a way that would engender favourable DPs completion so that the recipients of the programmes can complete them in record time.

University administrators are provided with factual data on the Ph.D completion and potential strategic improvements by means of this study's results. University management (Quadri, Salami & Ukpere, 2025) will be informed about the degree of goal actualisation and make necessary adjustments based on

the information obtained from DSs who were enrolled in the programmes. This study's findings will also function as a progress report on the degree of compliance of DPs with postgraduate colleges' policies. In addition, the findings from this research will show the average duration and percentage of completion for Ph.D, as well as where and why time is lost and how to reduce it to improve time management. Lastly, it is expected that this research finding will increase public awareness, and the federal and state governments, as well as non-governmental organisations administering DP sponsorship schemes, will be kept abreast of useful information for effective decision-making.

A significant obstacle for educational actors seems to be the low rate of TC and the apparent incapacity of many PhD students to graduate within the anticipated time frame. Therefore, this study examined CTDPs in the FoE in PUiSWN.

Research Questions

1. What is the average CTDPs in FoE in PUiSWN?
2. What is the percentage of DSs that were able to complete the registration of title of thesis W5Y in FoE in PUiSWN?
3. What is the percentage of DSs that were unable to complete the registration of their title of thesis W5Y in FoE in PUiSWN?

Purpose of Research

The specific objectives of this study are to:

1. estimate the average CTDPs in FoE in PUiSWN;
2. evaluate the percentage of students whose title of thesis were registered W5Y in FoE in PUiSWN; and
3. determine the percentage of DSs that were unable to complete the registration of their title of thesis W5Y in FoE in PUiSWN.

Theoretical Framework

The 1964 proposal of Vroom's expectation theory serves as the foundation for this essay. The basic idea behind this concept is that an employee's actions would be determined by their own goals.

The idea of Valence-Instrument-Expectancy (VIE) is the foundation of the theory. According to Vroom's (1964) expectancy theory, the value an individual place on an expected outcome is referred to as valence, which could either be

negative or positive. Whereas instrumentality is the chance that an incentive with a valence would be given as a reward for a measure of productivity, expectancy is the feeling that a given performance will yield a specific outcome. Generally, employees are motivated to perform in a particular way if the performance is rewarded. When there is a positive performance, it is referred to as high valence, and if there is a tendency to achieve the intended level of outcome, it is a high expectation.

The expectations of the three primary stakeholders—the student, the supervisor, and the institution—are what make expectancy theory relevant. They serve as the foundation for each contributor's degree of involvement in the timely completion of the Ph.D. The doctoral students are urged to work harder. They are also expected to perform at a high level if they are certain that their efforts will be rewarded and that those benefits will help them achieve their life objectives. Therefore, there's a chance that Ph.D. applicants who enrol for job and promotion considerations will be motivated to complete within the timeframe. This is because they have different expectations than those who sign up for self-actualisation. As a result, valence, instrumentality, and expectation determine the Ph.D. TC.

Methodology

This study adopted an explanatory survey using a structured questionnaire. This approach included the collection and analysis of quantitative data to elucidate and determine the average CTDP. Among them are the proportion of PhD candidates whose theses were registered W5Y and those who failed to finish the registration process within that time frame. The cohort for 2015–2016 consists of 623 students. Only 145 of these students from Ekiti State University FoE, Olabisi Onabanjo University, the University of Lagos, and UI had their thesis titles registered W5Y. The CTDPQ was used to gather data. There were three research questions posed and addressed. Simple percentage, mean, and standard deviation (SD) were used to examine the quantitative data.

Result and discussion

This aspect presents the finding to the data collected from the field using the research questions.

Answer to the Research Questions (RQ)

RQ 1: What is the average CTDP in the PUiSWN?

Table 1: CTDp in PUisWN

	N	Minimum	Maximum	Mean	SD
Years of completion	145	4.00	5.00	4.8690	0.37740
Valid N (listwise)	145				

The findings shown in Table 1 indicate that the minimum duration required to complete Ph.D. studies in education at PUisWN is four years (4.00). The table also shows that the greatest amount of time that Ph.D. degrees in FoE at PUisWN may be completed is five years (5.00). The table further reveals that the average duration of Ph.D. studies at FoE in PUisWN is 4.87 years. As a result, PUisWN's Ph.D. studies typically take 4.8 years to complete on time.

RQ 2: What is the percentage of DSs that were able to complete the registration of their thesis titles W5Y in FoE in PUisWN?

Table 2: Number of Sampled Ph.D. Students in FoE in PUisWN

Sample		Respondents	
States sampled	Universities Sampled	FoE	Total No of Ph.D. Students Registration
Oyo	UI	1	444
Lagos	UNILAG	1	96
Ekiti	EKSU	1	48
Ogun	OOU	1	35
Total 4	4 out of 5	4	623

Table 2 shows that 623 students from all selected universities are enrolled in the DP. Table 1 reveals that 145 Ph.D. applicants completed their coursework W5Y. Consequently, 145 out of 623 PhD students, equivalent to 23.27%, successfully completed the registration of their thesis titles W5Y designated period.

RQ 3: What is the percentage of DSs who were unable to complete the registration of their thesis titles W5Y in FoE in PUisWN?

Table 2 reveals that 623 individuals are registered in the DP spanning all universities within the FoE. Table 1 demonstrates that 145 Ph.D. applicants completed their studies in W5Y. The number of those who were unable to complete the registration of their thesis titles W5Y is $623-145=478$. Therefore, the percentage of DSs that were unable to complete the registration of their theses after five years in FoE in PUISWN is $478/623(100)$, which is 76.7%. This suggests that most doctoral candidates in education departments at PUISWN could not finish registering their thesis titles within the allotted five years.

Discussion of Findings

An analysis of the data gathered is provided in this section. The study's goals and research questions are also presented, along with its findings in relation to relevant earlier research on factors influencing the completion of PhD degrees.

Average CTDTP

The average CTDTPs in PUISWN were evaluated in the study. The results show that PUISWN's Ph.D. programmes in education take four to five years to complete. The findings also revealed that PUISWN Ph.D. programmes took an average of 4.8 years to finish on time. This aligns with Spronken-Smith, Cameron, and Quigg's (2017) research. According to Spronken-Smith *et al.* (2017), full-time students need an average of 4.1 years to get a degree and 3.4 years to finish their curriculum. Furthermore, the Higher Education Funding Council for England's Shepherd (2007) research expressed that CTDTP timescales differ significantly among institutions. In England, doctoral degrees are often anticipated to last four years. At some universities, 75% of Ph.D students are still not regarded as "doctors" after seven years. The DSs' FTS schedule could have had an impact on this outcome. It states that failure to register the title of their theses within ten semesters or five years would result in the termination of their studies.

Percentage of Doctoral Programme Timely Completion

The investigation on the percentage of DSs who were able to complete their thesis title registration within 5 years in FoE in PUISWN was carried out. The results showed that 623 students in all of the institutions of study were registered for PhD programmes. In addition, it was reported that 145 of those applicants successfully finished their coursework W5Y. Therefore, the percentage of DSs that were able to complete thesis title registration W5Y was $145/623(100) = 23.3\%$. It means that one out of four DSs completed their DP W5Y of

commencement. The results support Motseke's (2016) assertion that not all South African Ph.D applicants finished their programmes on time and one in three did not finish within the five years allotted for completion. Olubusoye and Olusoji (2014) found that just 10% of DSs had a predicted completion probability of between 0.4 and 0.94 years, which is in contrast to the data above. This is because 23.3% of Ph.D. candidates had predicted a probability of completion between three and five years. The student's interest in obtaining a Ph.D. might have contributed to the significant increase in the percentage of timely CTDPs, as the majority of them registered for employment and promotion purposes, which is one of the driving forces as propounded by Vroom's Expectancy theory.

Percentage of Doctoral Programme Late Completion

An investigation on the percentage of DSs who were unable to complete their thesis title registration W5Y in FoE in PUISWN was carried out. The results showed that 623 students in all the institutions of study were enrolled in PhD programmes, and 478 applicants were unable to complete their studies in five years. Therefore, the percentage of DSs who were unable to complete thesis title registration W5Y was $478/623(100) = 76.7\%$. It means that three out of four DSs could not complete their DP W5Y of commencement. The results support the findings of Olive, Fred, Bakkabulindi, and Hilary (2019), who found that institution-related constraints prevented many PhD candidates in Nigerian institutions from completing their degrees in record time. The three months of ASUU industrial actions experienced by all the DSs in their various institutions, coupled with their funding status, might have led to the findings. This is because the focus group discussion and key informants interviewed attested that financing a Ph.D. by themselves really hindered the TC of their DPs.

Conclusion

The current research indicates that just 23.3% of doctoral students completed their thesis title registration W5Y, while 76.7% failed to do so in the same timeframe. This conclusion implies that the majority of the students were unable to complete in the record time and that only one out of four DSs completed their DPs W5Y of commencement in FoE in PUISWN.

Recommendations

This research recommends measures for enhancement in the TC of PhD courses in FoE in PUISWN; stakeholders in DPs must work together to prioritise

student, supervisory, and institutional variables. This is due to the fact that the majority of the DSs could not complete their programmes in record time. In addition, as each student contributed significantly to the TC of the Ph.D. in the FoE of PUiSWN, stakeholders in DP-related actors need to be given priority.

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