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Generativity is a Core Value of the ESJ: A Decade of Growth

Erik Erikson (1902-1994) was one of the great psychologists of the 20th century¹. He explored the nature of personal human identity. Originally named Erik Homberger after his adoptive father, Dr. Theodore Homberger, he re-imagined his identity and re-named himself Erik Erikson (literally Erik son of Erik). Ironically, he rejected his adoptive father's wish to become a physician, never obtained a college degree, pursued independent studies under Anna Freud, and then taught at Harvard Medical School after emigrating from Germany to the United States. Erickson visualized human psychosocial development as eight successive life-cycle challenges. Each challenge was framed as a struggle between two outcomes, one desirable and one undesirable. The first two early development challenges were 'trust' versus 'mistrust' followed by 'autonomy' versus 'shame.' Importantly, he held that we face the challenge of **generativity** versus **stagnation in middle life**. This challenge concerns the desire to give back to society and leave a mark on the world. It is about the transition from acquiring and accumulating to providing and mentoring.

Founded in 2010, the European Scientific Journal is just reaching young adulthood. Nonetheless, **generativity** is one of our core values. As a Journal, we reject stagnation and continue to evolve to meet the needs of our contributors, our reviewers, and the academic community. We seek to innovate to meet the challenges of open-access academic publishing. For us,

¹ Hopkins, J. R. (1995). Erik Homburger Erikson (1902–1994). *American Psychologist*, 50(9), 796-797. doi:<http://dx.doi.org/10.1037/0003-066X.50.9.796>

generativity has a special meaning. We acknowledge an obligation to give back to the academic community, which has supported us over the past decade and made our initial growth possible. As part of our commitment to generativity, we are re-doubling our efforts in several key areas. First, we are committed to keeping our article processing fees as low as possible to make the ESJ affordable to scholars from all countries. Second, we remain committed to fair and agile peer review and are making further changes to shorten the time between submission and publication of worthy contributions. Third, we are looking actively at ways to eliminate the article processing charges for scholars coming from low GDP countries through a system of subsidies. Fourth, we are examining ways to create and strengthen partnerships with various academic institutions that will mutually benefit those institutions and the ESJ. Finally, through our commitment to publishing excellence, we reaffirm our membership in an open-access academic publishing community that actively contributes to the vitality of scholarship worldwide.

Sincerely,

Daniel B. Hier, MD

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Coupling Coordination between Innovation Capability and Financial Competitiveness in China's Energy Enterprises under the Belt and Road Initiative

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Abstract

The Belt and Road Initiative has accelerated the overseas expansion of Chinese energy enterprises, yet the synergy between their technological innovation and financial competitiveness remains under-explored. This study examines the coupling mechanism between innovation capability(defined as a comprehensive embodiment of the dual dimensions of innovation resource input and innovation outcome output) and financial core competitiveness (defined as a composite of operational efficiency, profitability, and growth potential) of these firms. Using entropy-weighted TOPSIS, coupling coordination, and grey relational models, we analyse panel data from eight major energy enterprises from 2018 to 2024. The results show a stark asymmetry: innovation capability increased steadily, while financial competitiveness fluctuated sharply, plummeting to 0.103 in 2020 before rebounding to 0.270 in 2024. As a result, the coupling coordination degree evolved from a mild imbalance through antagonistic growth to short-term adjustment, indicating a fragile yet progressive synergy. This study concludes that enhancing the precision of technology investment and cross-border financial coordination are key to strengthening the innovation-finance nexus,

offering quantitative insights for the sustainable growth of energy enterprises in complex international contexts.

Keywords: Coupled coordinated development; enterprise innovation; financial core competitiveness; “Belt and Road”; energy enterprises

Introduction

Since its proposal in 2013, the Belt and Road Initiative has grown into one of the most extensive and influential international cooperation platforms globally. As a core pillar of the Belt and Road Initiative, energy cooperation leverages complementary resource endowments along the routes to build a diversified and multi-level investment system. (National Energy Administration, 2024). Driven by both policy impetus and market demand, Chinese energy enterprises have continuously expanded their transnational investment layout. This trend not only enhances their capabilities in technology export and industrial chain integration, but also fosters a cooperative pattern featuring the coordinated development of traditional energy and new energy.

From the perspective of investment practice, Chinese enterprises have leveraged their technological advantages in oil and gas exploration, pipeline construction, and other fields to help resource-rich countries along the Belt and Road improve their energy development efficiency. In the new energy sector, they have delivered landmark projects through innovative models such as “EPC + financing”. Chinese energy equipment, exported to over 200 countries and regions, now supplies more than 80% of the photovoltaic modules and 70% of the wind power equipment to the “Belt and Road” region, significantly reducing the global levelized cost of electricity (LCOE) for renewable energy.

The Belt and Road energy partnership expanded from 29 countries in 2019 to 34 countries in 2024. The third Belt and Road Energy Ministers’ Meeting issued the “Belt and Road Green Energy Cooperation Action Plan (2024-2029)”, which identified green energy technology innovation cooperation and green energy financial services as core tasks. Currently, Chinese energy enterprises commonly lack sufficient synergy between technological innovation and core financial competitiveness in their investments under the Belt and Road Initiative, an issue that manifests in both the traditional energy and new energy sectors. Studies have shown that while technological innovation can enhance enterprises’ excess returns, it may inhibit short-term operational efficiency and has no significant positive impact on enterprise value, which reflects the contradiction between the input of innovation resources and short-term financial performance. (Zhang, Y.J et al.). Energy projects require substantial upfront investment and have long payback

periods. The contradiction between short-term financial liquidity and the long-term nature of innovation investments leads to delayed updates in R&D equipment for some projects. The combination of technical compatibility and financial risks in multinational projects exacerbates financial instability. Addressing this issue is a policy requirement for the construction of the “Belt and Road” initiative and a key to achieving high-quality cooperation among enterprises.

Literature Review

Research on the Correlation of Enterprise Innovation Capability and the Core Competitiveness of Enterprise Finance

In the theoretical framework of corporate innovation, Lawson and Samson (2001) posited that innovation capability is the core competence enabling enterprises to continuously transform knowledge and creativity into new products, processes, and systems that benefit both themselves and stakeholders. The way organizations seek new ideas during innovation processes is critical. Laursen and Salter (2006) showed that the breadth and depth of firms’ external knowledge search—key components of their external search strategies—are critical for innovation performance, and this external search complements rather than substitutes for internal R&D investments. To address the theoretical fragmentation in the study of innovation capability, Narcizo et al.(2017) proposed a maturity-based three-tier framework that conceptualizes innovation capability as a progressively developing continuum, this framework encompasses the following hierarchical levels: the descriptive model, which defines fundamental components; the comparative model, which establishes assessment criteria to measure relative capability levels; and the prescriptive model, which provides developmental roadmaps and best practices. Its core contribution lies in shifting the perspective from the static element view to the dynamic evolutionary view, offering a coherent theoretical pathway for subsequent research—from identification and evaluation to the systematic enhancement of innovation capability.

Scholars have conducted extensive research on methods to enhance corporate innovation capabilities. Regarding the driving mechanisms and methodological innovations of corporate innovation, Porter and Kramer (2011) point out that if companies redefine their objectives as creating “shared value” and re-integrate business with society, they can achieve a win-win situation for corporate success and social progress through three approaches: re-imagining products and markets, redefining productivity in the value chain, and establishing supportive industrial clusters in their locations. The driving approaches to corporate innovation capability extend beyond internal organizational optimization; they also require alignment with external collaboration and sustainable value orientation. In the context of cross-border

cooperation, Wang et al. (2023) identified two practical pathways through which innovation capability delivers its value: green technology-oriented innovation investment, and collaboration-driven enhancement of innovation efficiency. This finding suggests that integrating internal R&D with cross-border resource linkage can more effectively transform innovation capability into a driving force for sustainable development. From the perspective of digital transformation, Xu et al.(2024) have empirically verified through research on 476 Chinese manufacturing enterprises that digital transformation is a key driver of corporate innovation performance, primarily through a dual-mediator pathway: first, by strengthening corporate capabilities in data collection; second, by promoting organizational flattening. Demir and Lux (2025) examined the practices of 11 enterprises engaging with co-working spaces, using them as the case studies. They argued that businesses can bolster their innovation capabilities via differentiated collaboration pathways. Functioning as open innovation platforms, co-working spaces facilitate resource integration; through activities like scanning, scouting, and community building, they also enable enterprises to access external innovation components and translate their own innovation awareness and capture capacities into actionable outcomes.

In terms of the components of innovation capability, Lianto et al.(2023), through systematic screening, identified 14 key elements in intellectual capital that drive innovation. The conclusion points out that companies must transcend reliance on a single dimension and enhance innovation capability systematically through the synergy of human, organizational, and relational capital. Suarez-Barraza et al.(2024) systematically analyzed innovation data from 135 countries using the Bayesian model averaging method. To address the fragmentation of factor frameworks, they screened out 27 robust core factors from 62 candidate elements. They found that the composition of innovation capability is a dynamic collaborative system, with "public-private R&D collaboration" and "high-skilled talent" as internal engines, and "intellectual property protection" and "industrial clusters" as external foundations.. The components of corporate innovation capability include seven aspects: vision and strategy, integration of capability foundations, organizational intelligence, creativity and creative management, organizational structure and systems, culture and atmosphere, and technology management, all of which collectively underpin the implementation and improvement of corporate innovation activities (Zhang et al.,2025).

In the field of enterprise management and development research, financial core competitiveness, as a key component of corporate financial management systems, has long attracted academic interest. In the 1990s, Hamel first introduced the concept of corporate core competitiveness. Core

competitiveness, he argued, enables enterprises to integrate resources effectively and represents the collective learning capacity of an organization, which can significantly enhance production efficiency. Given that core competitiveness delivers strong market value and is difficult to replicate, related research has expanded significantly. Regarding its theoretical foundation, Chikan (2008) defines corporate competitiveness as the sustainable ability to achieve dual objectives: meeting customer needs while ensuring profitability. Sun et al. (2021) have verified the transmission mechanism of “from core competence to financial strength and then to corporate behavior”. This provides a theoretical basis for conceptualizing financial core competence as not an isolated element, but a critical link connecting an enterprise’s overall core competence with its financial performance and strategic objectives. This approach directly establishes “profitability” as the core baseline of competitiveness, highlighting financial performance as the fundamental attribute of competitive advantage (Chikan et al.,2022).

Regarding the components of corporate financial core competitiveness, a critical element of corporate financial core competitiveness is maintaining financial flexibility and robust internal financing capacity. Companies that adhere to priority financing principles and avoid value dilution inherently possess competitive advantages through their financial practices (Myers & Majluf, 1984). Chen (2009) proposed incorporating financial competitiveness analysis into evaluation systems. He developed an indicator framework for assessing listed companies’ financial core competitiveness, using data from 15 steel enterprises on the Shenzhen Stock Exchange to conduct comprehensive analysis. The study ultimately proposed actionable recommendations for enhancing financial core competitiveness. Agazu & Kero (2024) integrated the conclusions of multiple empirical studies. They confirm that innovation strategy serves as the core driving force of financial competitiveness, and this driving effect must be realized through specific financial performance indicators, indicating that the performance-based components of financial competitiveness, specifically include profitability sustainability, financial security and solvency, and capital allocation efficiency. This perspective reveals that financial core competitiveness encompasses not only value creation but also risk management abilities.

The dynamic interplay between enterprise innovation capability and financial core competitiveness constitutes a pivotal research stream in contemporary management studies. Existing literature primarily elucidates this relationship through three interconnected lenses: driving effects, enabling conditions, and reciprocal reinforcement. From the perspective of innovation driving finance, scholars posit that sustained innovation activities serve as a critical engine for enhancing financial competitiveness. Yet this positive

correlation is not linear but subject to a threshold effect—only when the intensity of R&D investment exceeds a certain critical value can technological achievements be effectively transformed into profit growth and market premium, whereas insufficient innovation input may even exert a crowding-out effect on short-term corporate performance (Zhang et al.,2025). From the perspective of finance enabling innovation, Brown et al.(2012) utilized global corporate data to demonstrate that financing constraints significantly inhibit firms' R&D investment, particularly in high-tech enterprises. Meanwhile, the efficient allocation of resources to high-potential projects supports this argument.Stein (1997) discussed the reallocation of capital from low-growth departments to high-growth, high-potential sectors or projects (often including innovation initiatives), thereby enhancing overall firm value. Furthermore, recent scholarship conceptualizes their interaction as a mutually reinforcing, co-evolutionary coupling. A higher level of innovation capability can optimize a firm's cost structure and create premium value, thereby strengthening its financial foundation and market position. In turn, superior financial health and strategic resource allocation empower more ambitious and sustained innovation investment, forming a virtuous cycle (Sempere-Ripoll et al.,2020).

In conclusion, existing research on enterprise innovation capability and financial core competitiveness has yielded substantial insights, yet further exploration remains warranted. Particularly in emerging market contexts, the synergistic mechanism between innovation and financial competitiveness has not been thoroughly examined, and empirical studies focusing on specific industries—such as the energy sector—are still lacking. Therefore, this study aims to investigate the coupling mechanism between innovation capability and financial core competitiveness within Chinese energy enterprises. By doing so, it seeks to address the gaps in current research regarding contextual applicability and industry heterogeneity, and to provide a reference for theoretical advancement and managerial practice.

The Coupling Mechanism between Corporate Financial Core Competence and Corporate Innovation Capability

Originating from the physics concept of “coupling”—which describes the interaction, mutual influence, and energy or information exchange between different systems—Coupling Coordination Theory has been progressively developed. Its conceptual foundations and quantitative methods have evolved along key research trajectories, such as system interactions and sustainable coordination frameworks (Kikkawa, K. et al.,1999). The conceptual foundations and quantitative methods of coupling coordination analysis have evolved incrementally along research trajectories including system interactions and sustainable coordination frameworks. Costanza et al. (1997) innovatively quantified the interactive relationship between ecosystem

services and human economic systems; the indicator system and value assessment logic they developed laid the core methodological foundation for subsequent coupling analysis in the ecological-economic domain. Building on this work, Norgaard (2001) proposed a theoretical framework for economic-ecological coordinated development from a systems theory perspective, emphasizing the dynamic equilibrium properties of multi-system synergy. The logic underlying its coordination degree measurement aligns with that of later-developed coupling coordination degree models, thereby expanding the theoretical boundaries of cross-system coordination research. Gonzalez-Benito et al.(2006), in turn, employed structural equation modeling to quantify the coupling relationship between corporate environmental management and stakeholder pressure. This application facilitated the extension of coupling coordination analysis from macro-level contexts to the micro domain of management, enabling the quantitative expansion of the method's utility.

In the field of social sciences, scholars have introduced this theory into research areas such as regional economy, industrial integration, and urban-rural development (Turner et al.,2003; Folke et.al.,2005; Seto et.al.,2012). By constructing a coupling degree model, the interaction intensity between two or more subsystems can be measured quantitatively—this approach helps reveal the co-evolution mechanism of different subsystems in the dynamic evolution process. Building on this foundation, subsequent scholars introduced the coupling coordination degree index to evaluate the quality and sustainability of coupling relationships (Fang et al.,2016; Zhang et al.,2024). The index is designed to identify the optimal development path that maximizes overall system benefits.

The coupling and coordination mechanism between corporate innovation capability and financial core competence is essentially a dynamic and in-depth interactive relationship. Regarding how innovation capability propels financial core competitiveness, da Silva et al.(2018), in their analysis of Brazilian energy enterprises, demonstrated how low-carbon energy technologies and digital-intelligent production control optimize operations: the former replaces traditional power supply and matches energy demand, reducing procurement costs and energy waste; the latter optimizes equipment parameters in real time, lowering energy consumption per unit of production by 18%-22% and reducing the proportion of energy costs. Furthermore, innovation-driven equipment intelligence upgrades and supply chain digital transformation enhance operational efficiency indicators such as fixed asset turnover and inventory turnover. The accumulation of innovative assets like technological patents and R&D outcomes also strengthens the appreciation potential of corporate assets, thereby improving the asset operation dimension of financial core competitiveness (Zhang et al.,2025). Conversely, financial core competitiveness exerts a significant feedback effect on innovation

capability. Brown et al.(2009) argued that internal cash flow—particularly the stable cash flow of firms with strong financial strength—is a key funding source for R&D investment. The R&D expansion of young high-tech firms is highly dependent on internal cash flow and retained earnings; the funding stability derived from financial core competence directly alleviates innovation’s financial constraints. Ample and efficient capital supply ensures the continuous advancement of R&D projects, precise financial resource allocation prioritizes funding for high-potential innovative areas, and mature risk hedging mechanisms increase corporate confidence in pursuing disruptive innovations (Illmeyer et al.,2017).

When the coupling between a firm’s innovation capability and financial core competence exceeds a critical threshold, it generates systemic synergy. For Chinese energy enterprises, this threshold is even industry-specific, Yang & Zhang (2020) found that energy firms only achieve positive innovation-to-financial performance conversion when their R&D investment intensity crosses a critical value, otherwise redundant innovation input may erode profit margins. This synergy not only enables lower-cost resource acquisition and higher-efficiency value realization but also establishes a self-reinforcing cycle where innovation and finance mutually drive upgrades. (Guo, Z et al.,2022) Ultimately, this process constructs a unique market barrier centered on this synergistic advantage, forming a sustainable and hard-to-replicate competitive position. (Ren, Y & Li, B., 2023; Chen, J.et al.,2024).

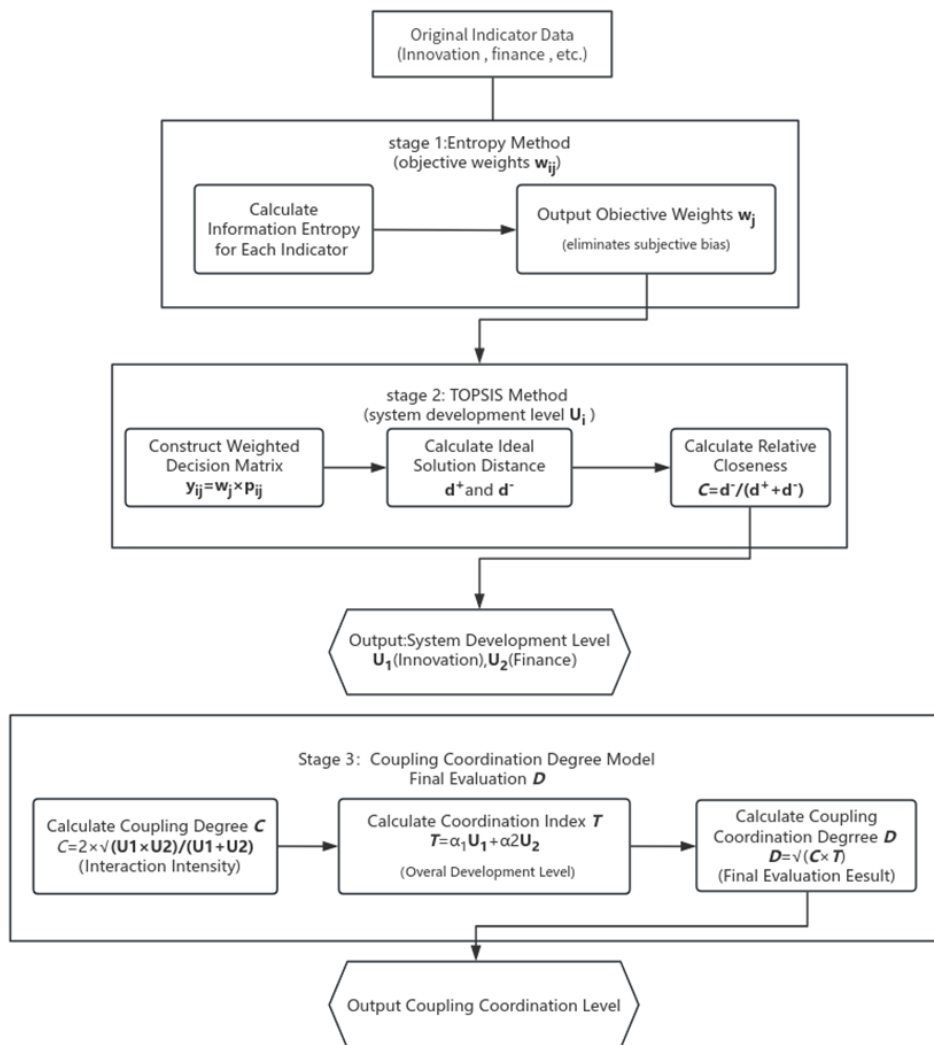
Existing research on the coupling between innovation capability and financial competitiveness in China’s energy enterprises exhibits significant gaps. Theoretically, it lacks a framework that integrates policy-driven dynamics and industry-specific traits, and fails to apply coupling coordination theory specifically to the innovation-finance interplay. Empirically, studies overlook the unique context of energy firms, such as their cost structures and long-cycle green innovation value logic. Methodologically, there is a mismatch in evaluation indicators and a reliance on static approaches, unable to capture the long-term, dynamic evolution of this relationship.

Research Methods

To systematically examine the coupling and coordinated development mechanism between innovation capability and financial core competitiveness of Chinese energy enterprises under the Belt and Road Initiative, this study establishes a structured research framework progressing through “indicator weighting-system evaluation-coupling analysis-driver identification.” First, the entropy method is adopted to objectively assign weights to evaluation indicators within the innovation and financial subsystems, thereby mitigating subjective bias and clarifying the relative importance of each indicator in the integrated assessment. Second, the TOPSIS method is applied to compute the

annual comprehensive development levels of the two subsystems, which quantifies their relative developmental status by measuring proximity to the ideal solution. Subsequently, a coupling coordination degree model is employed to assess the interaction strength (coupling degree) between the two systems and their synergistic development level (coordination degree), thus elucidating the quality and phased characteristics of their dynamic interaction. Finally, gray relational analysis is used to identify key determinants affecting system coordination, thereby informing evidence-based policy recommendations.

Figure 1: Three-Stage Modeling Flowchart for Evaluating the Coupling Coordination of Innovation and Financial Systems



Note: Author's own work.

Entropy Method

The entropy method constitutes a cardinal step in research on inter-system coupling and coordination, where it is utilized to objectively derive weights for the constituent evaluation indicators (Shannon, 1948). This objective weighting establishes the basis for aggregating indicators into a composite measure of development for each system.

First, since the units of each index are different, it is necessary to standardize the index.

$$X_{ij} = \begin{cases} \frac{A_{ij} - \min(A_{ij})}{\max(A_{ij}) - \min(A_{ij})} & A_{ij} \text{ is positive indicator} \\ \frac{\max(A_{ij}) - A_{ij}}{\max(A_{ij}) - \min(A_{ij})} & A_{ij} \text{ is negative indicator} \end{cases}$$

Suppose there are i sample observations, with the maximum value being g , and j evaluation indicators, with the maximum value being h . A_{ij} represents the original measure indicator sequence, X_{ij} represents the standardized measure indicator sequence, and $\min(A_{ij})$ and $\max(A_{ij})$ are the minimum and maximum value, A_{ij} respectively.

Calculate the proportion of the feature for the n th sample value under the n th indicator: Second, calculate the proportion of the i_{th} year under the j_{th} indicator.

$$p_{ij} = \frac{X_{ij}}{\sum_{i=1}^g X_{ij}}$$

Calculate the information entropy of the first indicator using the entropy calculation formula (in which $0 \leq e_j \leq 1$):

$$e_j = \frac{1}{\ln n} \sum_{i=1}^g p_{ij} \ln p_{ij}$$

Calculate the coefficient of variation D_j for the j_{th} indicator based on e_j .

$$D_j = 1 - e_j$$

Calculate the weight w_j of the g_{th} indicator using D_j .

$$w_j = \frac{D_j}{\sum_{j=1}^h D_j}$$

TOPSIS Method

The TOPSIS method is used in coupling coordination studies to compute a “comprehensive closeness score” for each subsystem, based on its distance from ideal reference points (Li, Y et al., 2025). This score objectively reflects each subsystem’s development level and provides a clearly interpretable, standardized measure for calculating the coupling coordination index. Thus, the index evaluates both the strength of system interactions and their joint advancement toward an ideal state.

First, based on the calculated weight w_j and the proportion p_{ij} of the g_{th} indicator, a weighted decision matrix y_{ij} is established.

$$y_{ij} = w_j \times p_{ij}$$

Secondly, the positive ideal solution is determined according to the maximum value of the matrix index, and the corresponding ideal solution vector is constructed.

$$Y^+ = (y_1^+, y_2^+, \dots, y_n^+)$$

The maximum y_{ij} value in the range y_j^+ .

$$y_j^+ = \{(\max_i y_{ij} | j \in \text{positive indicator}), (\min_i y_{ij} | j \in \text{negative indicator})\}$$

$$y_j^- = \{(\min_i y_{ij} | j \in \text{positive indicator}), (\max_i y_{ij} | j \in \text{negative indicator})\}$$

Third, calculate the Euclidean distance, with the positive and negative ideal solutions of each indicator serving as evaluation criteria, and compute the Euclidean distances between the indicators of each evaluation scheme and the positive/negative ideal solutions.:

$$d_i^- = \sqrt{\sum_{j=1}^m (y_{ij} - y_j^-)^2}, i = 1, 2, \dots, n$$

$$d_i^+ = \sqrt{\sum_{j=1}^m (y_{ij} - y_j^+)^2}, i = 1, 2, \dots, n$$

Finally, the degree of closeness between the evaluation b_i object and the optimal value is calculated as the comprehensive level score, and the order is made.

$$b_i = \frac{d_i^-}{d_i^+ + d_i^-}, 0 \leq b_i \leq 1$$

Coupling Coordination Degree Model

The Coupling Coordination Degree Model operationalizes the abstract concept of “synergistic development” into a quantifiable, comparable single index with clear policy implications (Zhao, X., & Chen, B., 2008). Its core contribution lies not merely in measuring the intensity of interaction between systems, but more critically in evaluating whether such interaction leads to an upward developmental trajectory for the system as a whole.

To assess the coupling coordination development stage between innovation and financial core competitiveness for the industry leader, the coupling degree and coupling coordination degree models were constructed and applied.

This subsystem has two components, so the calculation formula is:

$$C_{12} = \frac{2\sqrt{U_1 U_2}}{U_1 + U_2}$$

C reflecting the coupling degree between systems, the value ranges from 0 to 1. The magnitude of the value only indicates the mutual coupling degree between corporate innovation and financial core competitiveness or their respective internal elements. A higher value suggests better coupling, while a lower value indicates poorer coupling. However, high coupling does not equate to high coordination; it must be comprehensively evaluated in conjunction with the coordination index T .

The coupling degree reflects the degree of interaction between the enterprise innovation system and the financial core competitiveness or the internal elements. In order to accurately determine the relationship between the subsystems, the following coordination model is established:

$$T_{12} = \alpha_1 U_1 + \alpha_2 U_2$$

$$D_{12} = \sqrt{C_{12} \times T_{12}}$$

In the formula: D_{12} represents the coupling coordination degree between corporate innovation capability and financial core competitiveness, ranging from 0 to 1; T_{12} is the comprehensive evaluation index of the innovation capability of selected pipeline energy enterprises; α_1 and α_2 are respectively undetermined weight coefficients, and $\alpha_1 + \alpha_2 = 1$.

Gray Relational Analysis (GRA)

This study adopts the Gray Relational Analysis method in order to identify the key factors influencing the “innovation-finance” coupling coordination system of energy enterprises and to evaluate the convergence in the temporal trajectories of their element sequences (Kuo, Y. et al., 2008). Suitable for uncertain systems characterized by “small samples and poor information”, this method does not require data to follow a typical distribution and can effectively measure the order of strength of correlations between various factors in the system. It is highly compatible with the characteristics of this study, such as limited sample size and complex system relationships.

The specific procedures are as follows:

$$\xi_i(K) = \frac{\min_i \min_k |y(k) - x_i(k)| + \rho \max_i \max_k |y(k) - x_i(k)|}{|y(k) - x_i(k)| + \rho \max_i \max_k |y(k) - x_i(k)|}$$

$$S_i = \frac{1}{n} \xi_i(K)$$

Where : $\xi_i(K)$ denotes the relational coefficient of the i_{th} comparison series at the k_{th} point. $|y(k) - x_i(k)|$ denotes the absolute value of the difference between the evaluated indicator and the reference indicator, ρ is the distinguishing coefficient, with a value of 0.5.

Data Sources and Standardization

Through research, enterprises engaged in energy cooperation with countries along the Belt and Road Initiative from 2018 to 2024 were selected. In the traditional oil and gas sector, three companies—China Petroleum, China Petrochemical, and China National Offshore Oil Corporation (CNOOC)—were chosen, their overseas oil and gas resource cooperation projects have an extensive presence along the Belt and Road Initiative. In the new energy sector, five state-owned enterprises, including China Energy Engineering Corporation, Power China, China General Nuclear Power Group, Guanghui Energy, and Jinko Solar, were selected, these enterprises serve as key players in new energy investment, engineering construction, and technology transfer within Belt and Road cooperation. The selection of these enterprises was primarily based on the following criteria:

Participation in the “Belt and Road” Initiative

First, the proportion of overseas business revenue. In 2023, the sample companies had an average overseas business revenue share of 32.6%, significantly higher than the overall level of Chinese energy enterprises (about 15%). Among them, China Energy Engineering Corporation had an overseas business share of 38.2%, and Jinko Energy had over 60% of its business overseas, covering more than 40 countries and regions along the “Belt and Road.” This indicator ensures that the operating activities of the sample companies are truly profoundly influenced by the practice of the “Belt and Road.”

Second, participation in landmark projects. The eight companies collectively participated in over 200 “Belt and Road” energy projects, covering landmark projects such as the Central Asian natural gas pipeline, the China-Russia crude oil pipeline, and the Rabigh photovoltaic power plant in Saudi Arabia, providing rich practical scenarios for examining the interaction between innovation capability and financial performance.

Industry Leading Position

In the traditional oil and gas sector, the three central enterprises, PetroChina, Sinopec, and CNOOC, occupy more than 90% of the domestic oil and gas exploration and development market and have undertaken most oil and gas resource cooperation projects along the “Belt and Road.” By the end of 2023, the three major oil companies operated over 100 oil and gas cooperation projects along the “Belt and Road,” forming five major oil and gas cooperation zones. These companies have accumulated extensive experience in technological innovation and financial management, and their “innovation-financial” coupling characteristics can represent the highest level of internationalization of Chinese energy enterprises.

In the new energy sector, China Energy Engineering Corporation and China Power Construction are the world's largest power engineering general contractors, constructing over 60% of coal, hydro, and renewable energy projects along the “Belt and Road” route; CGN is the world’s third-largest nuclear power operator; Guanghai Energy is the only domestic private enterprise that owns coal, oil, and gas resources simultaneously; and Jinko Energy is one of the world’s largest photovoltaic module manufacturers, ranking first in global photovoltaic module shipments for five consecutive years. This combination ensures that the sample can reflect the differentiated characteristics of various types of energy enterprises in the “innovation-financial” coupling mechanism.

Industry Specificity

Energy enterprises are characterized by significant asset-intensive and technology-intensive features, which imposes higher requirements on sample selection:

The asset-intensive feature requires that sample companies must have large-scale fixed assets and operating capital to examine the core role of operational capacity in financial core competitiveness. By the end of 2023, the total assets of all eight companies exceeded 100 billion yuan, exhibiting typical characteristics of asset-intensive enterprises. The technology-intensive feature requires that sample companies have sustained and representative R&D investment and technological innovation. In 2023, the average R&D intensity of the eight companies reached 3.2%, higher than the average level of Chinese industrial enterprises (about 1.5%).

The relevant data mainly came from the National Bureau of Statistics website, annual financial statements of various companies, CNNIC, and Guotai An database. For missing data, the mean method was used for valuation. Due to the diversity of data sources and the existence of differentiated data units in the indicator system, indicators were categorized into positive indicators and moderate indicators, with the latter undergoing moderation treatment.

Empirical Result

Evaluation Index System and Weight of Enterprise Innovation Capability

The construction of the innovation capability index system in this study is based on Cohen & Levinthal (2015)’s theory of “absorptive capacity” and Lawson & Samson’s (2001) framework of “dynamic innovation capability.” Cohen & Levinthal (1990) pointed out that a company’s innovation capability depends on its ability to identify and utilize external knowledge, which needs to be cultivated through continuous R&D investment and talent accumulation. Based on this, this study decomposes innovation

capability into two dimensions: “innovation input capability” and “innovation output capability.” Among them, innovation input capability covers three aspects: capital investment, talent input (proportion of R&D personnel, proportion of personnel with a master’s degree or above), and platform support , so as to comprehensively reflect the intensity and structural quality of enterprises’ allocation of innovation resources. Innovation output capability focuses on patent achievements, distinguishing between the number of patent applications and the number of authorized patents to reflect differences in the quantity and quality of innovation achievements. This index system takes into account the “input-output” logical chain of the innovation process while responding to the theoretical proposition of Narcizo et al. (2017) to shift from a static element perspective to a dynamic evolutionary perspective. The weights of each index are obtained by entropy weight method, as shown in Table 1.

Table 1: Weight of the indicators of innovation ability

primary indicator	index weight	secondary indicator	Indicator selection	index weight
Innovation investment capacity	60.4014%	R&D funding input	Total R&D investment	15.1152%
			R&D investment increased year-on-year	14.9825%
			Proportion of R&D personnel	4.5817%
		R&D human input	Proportion of individuals with a master’s degree or higher	13.3590%
			Number of national R&D platforms	12.3630%
			Number of patent applications	18.8829%
Innovation output capacity	39.5985%	Patent development capabilities	Number of granted patents	20.7156%

Based on the indicator weights shown in the tables, innovation resource input is the core support for state-owned energy enterprises' innovation capability. Among these inputs, financial input accounts for the highest weight, followed by talent input and R&D platforms—this reflects that “finance + talent + platforms” are the core elements of innovation input. In terms of output, patent quality (rather than quantity) is the core evaluation dimension for innovation output.

Evaluation Index System and Weight of Enterprise Financial Core Competitiveness

The construction of the core financial competitiveness indicator system mainly refers to Rappaport (1986)’s value driver framework and

Chikán et al. (2022)'s enterprise competitiveness model. Rappaport (1986) pointed out that the creation of enterprise value originates from the synergy of profitability, operational efficiency, and growth capability; Chikán et al. (2022) further emphasized that financial competitiveness is the sustainable ability of an enterprise to achieve profitability while meeting customer needs, and its core components include value creation ability and risk management ability.

The evaluation system comprises four primary indicators and 15 quantifiable metrics, covering four key financial dimensions: profitability, operational efficiency, growth potential, and solvency. These metrics comprehensively capture the essential financial indicators for listed energy companies, as detailed in the table below. The weight of each indicator is determined using the entropy weight method, as shown in Table 2.

Table 2: Weight of Financial Core Competitiveness Indicators

Primary indicator	index weight	secondary indicator	index weight
profitability	8.6018%	Operating Profit Margin (%)	4.7393%
		Return on Assets (%)	2.666%
		Return on Net Assets (%)	1.1965%
operation capacity	73.0507%	Fixed assets turnover rate (times/year)	26.4184%
		Current assets turnover (times/year)	30.6020%
		Inventory turnover rate (times/year)	10.8302%
		Accounts receivable turnover rate (times/year)	8.7850%
		Total assets growth rate (%)	4.8775%
Growth potential	7.47%	turnover of net assets (%)	2.5925%
		current ratio (%)	3.9381%
debt paying ability	6.2496%	quick ratio (%)	1.673%
		asset-liability ratio (%)	1.6385%

The results indicate that the financial core competitiveness of state-owned energy enterprises exhibits a distinct structural characteristic: operational efficiency occupies the dominant position, with current asset turnover and fixed asset turnover serving as the key driving factors, whereas the weights assigned to profitability, growth potential, and solvency are relatively low. This finding is highly consistent with the industry-specific attribute of energy enterprises as asset-intensive and capital-intensive entities. Such enterprises hold substantial volumes of fixed assets and current assets; their financial health and sustainability depend more on the efficiency of asset turnover rather than merely on profit scale or leverage level. Therefore, the high-weight structure reveals that, in advancing the Belt and Road Initiative, the financial strategy of state-owned energy enterprises tends to consolidate core competitiveness by enhancing asset operational efficiency. Meanwhile,

the overall debt-servicing risk of the industry remains controllable, providing a financial safety margin that enables enterprises to focus on long-term asset optimization and intensive development.

Comprehensive Development Level of the Dual Systems Based on the TOPSIS Method

After determining indicator weights via the entropy method, this study applies the TOPSIS method to calculate the comprehensive development level of the two subsystems. The TOPSIS method measures the “closeness degree (*C*)” of each sample to the ideal solution, where a higher *C* indicates a better comprehensive development level of the system.

Table 3: Comprehensive evaluation levels of the dual systems

a particular year	Comprehensive evaluation level of the innovation capability system			Comprehensive evaluation level of financial core competitiveness		
	ideal solution distance d^+	negative imaginary solution distance d^-	close degree C	ideal solution distance d^+	negative imaginary solution distance d^-	close degree C
2019	0.3252	0.1056	0.2430	0.4316	0.0760	0.1422
2020	0.3215	0.1105	0.2528	0.4317	0.0773	0.1436
2021	0.3056	0.1314	0.2958	0.4357	0.0606	0.1198
2022	0.3058	0.1359	0.3102	0.4342	0.0616	0.1231
2023	0.3081	0.1359	0.2973	0.4281	0.0789	0.1531
2024	0.3063	0.1451	0.3155	0.4059	0.1204	0.2157

The closeness degree (*C*) of the innovation capability system shows a steady upward trend, rising from 0.2430 to 0.3155, reflecting the gradual transformation of B&R energy enterprises’ innovation inputs into improved innovation capability. In contrast, the *C* value of the financial core competitiveness system fluctuates more notably, it slightly declines in 2021-2022 before surging to 0.2157 in 2024. This volatility echoes the energy industry’s sensitivity to external shocks such as international energy price fluctuations, while the 2024 rebound signals a recovery in financial operational efficiency.

Coupling Degree Model

This paper draws on the classification criteria for coupling degrees used by Shi, T. et al. (2020) in their research on economic and environmental systems. As shown in the table below:

Table 4: Criteria for classifying coupling degrees

Group number	degree of coupling	coupling type
1	$C=0$	at arm’s length

2	$0 < C \leq 0.3$	low level coupling
3	$0.3 < C \leq 0.5$	antagonist
4	$0.5 < C \leq 0.8$	breaking-in period
5	$0.8 < C \leq 1$	high level coupling
6	$C = 1$	good resonance type

The improvement of corporate innovation promotes the enhancement of financial core competitiveness, and the improvement of financial competitiveness drives the innovative operation of enterprises. This study assigns equal weight to the two based on the following theoretical logic ($\alpha_1 = 0.5, \alpha_2 = 0.5$):

1. **Theoretical Grounding:** From a systems coupling perspective, innovation capability and core financial competitiveness share a symbiotic and interdependent relationship. Innovation drives financial performance, while financial strength provides the bedrock for sustained innovation (Brown et al., 2012; Illmeyer et al., 2017). Neither is logically subordinate to the other.
2. **Research Objective Alignment:** This study aims to investigate the “coupling coordination mechanism”—the dynamic, mutually reinforcing evolution between the two systems. Assigning unequal weights would predetermine the superiority of one system, which contradicts the core principle of coupling coordination, which is to achieve a system-wide optimum. Equal weights ensure an unbiased assessment of their synergistic parity.
3. **Methodological Convention:** In the absence of strong theoretical or empirical justification for prioritizing one subsystem in dual-system coupling studies, it is standard practice to adopt an equal weighting scheme as the baseline model (Fang et al., 2016; Shi et al., 2020). This ensures model simplicity and provides a clear benchmark for robustness testing.

Table 5: Criteria for Coupling and Coordination

broad heading	coupling coordination degree	coordination level
phase of decline	0.00—0.10	extreme dysregulation
	0.10—0.20	major maladjustment
	0.20—0.30	moderate dysregulation
	0.30—0.40	mild dysregulation
	0.40—0.50	approaching deficit
transition period	0.50—0.55	coordinated coupling
	0.55—0.60	primary coupling coordination
	0.60—0.65	intermediate coupling coordination
coordinated development period	0.65—0.70	Good coupling coordination
	0.70—1.00	high quality coupling coordination

Coupling and Coordination Relationship Analysis

The development of corporate innovation capability in China is closely linked to the enhancement of financial core competitiveness. Corporate innovation capability optimizes resource allocation and improves management efficiency, thereby driving the growth of financial core competitiveness. Meanwhile, the strengthening of financial core competitiveness provides enterprises with the necessary financial, human, and managerial support for the advancement of innovation capabilities.

Table 6: Results of Coupling Coordination Measurement of Enterprise Innovation and Financial Core Competitiveness Development from 2018 to 2024

A particular year	The overall level of corporate innovation capability	The comprehensive level of core financial competitiveness of enterprises	C	T	D
2018	0.2362	0.1348	0.1748	0.1855	0.1819
2019	0.2614	0.1371	0.1893	0.1992	0.1924
2020	0.2770	0.1027	0.1686	0.1789	0.1789
2021	0.3396	0.1064	0.1901	0.2230	0.2058
2022	0.3628	0.1397	0.2252	0.2512	0.2378
2023	0.3445	0.2699	0.3049	0.3072	0.3060
2024	0.3551	0.1189	0.2054	0.2370	0.2207

From 2018 to 2020, the innovation capabilities of the sample enterprises showed a steady growth trend (increasing from 0.236 to 0.355), while the financial core competitiveness exhibited significant volatility, especially with a notable decline in 2020. This asymmetry in development is key to understanding the coupling relationship between the two. The steady growth in innovation capabilities is largely attributed to the policy-driven “Belt and Road Initiative” and continuous technological catch-up, which aligns with Wang et al. (2023)’s view that cross-border cooperation and green technology-oriented investment are important paths to enhance innovation capabilities. However, the sharp fluctuations in financial competitiveness reflect the inherent vulnerability of the energy industry as an asset and capital-intensive sector. This not only confirms Zhang, Y.J. et al.’s perspective that technological innovation may suppress short-term operational efficiency but also reveals at the macro level the direct impact of exogenous shocks such as geopolitics, international energy price fluctuations, and global public health events on corporate financial performance. As a result, the growth rates of the coupling degree C, coordination index T, and coupling coordination degree D were relatively slow, indicating that although the innovation level of enterprises has improved, the positive impact of innovation on financial competitiveness remains limited, and a mechanism for coordinated development has yet to be formed. This may be due to the fact that innovation investment is still in its early stages and has not yet fully translated into

economic benefits, or that enterprises have not effectively allocated financial resources to support innovation activities. This coexistence of “policy-driven stable innovation” and “market-driven volatile finance” constitutes a unique stage-specific feature of energy enterprises along the “Belt and Road”.

Analysis of Key Influencing Factors Based on Gray Relational Degree

Table 7: Grey Correlation Degree of Various Influencing Factors

Evaluation items	Average Correlation Degree	Overall ranking
Patent authorization quantity	1.000	1
R & D personnel ratio	0.757	2
Fixed asset turnover rate	0.751	3
Total R & D investment	0.713	4
Return on Equity (ROE)	0.628	5

Grey relational analysis further reveals the intrinsic driving mechanism of coupling coordination. The number of patent authorizations (with a correlation degree of 1.00) serves as the core driving factor, confirming that the quality of innovation output is the bridge connecting technology and finance. High-quality patents not only signal a company’s technological strength but can also be directly converted into financial resources and market advantages through methods such as patent pledge financing and technology licensing (Chen, J. et al.,2024). The significance of the proportion of R&D personnel echoes the viewpoint of Liato et al. (2023) that human capital is a core element of innovation. High-level talents are crucial for achieving technological breakthroughs and efficiently absorbing external knowledge.

It is particularly worth noting that the fixed asset turnover ratio, as the indicator with the highest weight (26.42%) in the financial subsystem, also becomes a key factor driving the coupling and coordination. This profoundly reveals the special logic of energy enterprises: in asset-intensive industries, strong operational capabilities (efficiently converting huge fixed assets into revenue) are not only the cornerstone of financial competitiveness but also the cash flow that supports continuous high-intensity innovation investment. Only when assets operate efficiently can stable and abundant internal cash flow be provided for long-cycle and high-risk innovation activities, thereby alleviating financing constraints (Brown et al., 2012).

Strategic Suggestions for Improving the Innovation Ability and Financial Synergy of Enterprises

Based on an empirical analysis of the phased characteristics and existing problems in the coupled and coordinated development of corporate innovation capability and financial core competitiveness, and in the context of the new “dual circulation” development paradigm and the high-quality

development requirements of the “Belt and Road” Initiative, this study proposes targeted strategies from three dimensions: micro-level corporate operations, meso-level regional guidance, and the macro-level refinement of research methods.

Building a Closed Loop of “Innovation-Finance” Synergy to Enhance the Internal Linkage Ability of Enterprises

Establishing an innovation-finance closed-loop system and strengthening internal corporate synergy requires focusing on three dimensions: indicator prioritization, financial innovation, and industrial chain coordination. Empirical results demonstrate that total R&D investment (15.12% weighting) and patent grants (20.72% weighting) contribute to innovation capacity, while operational capability (73.05% weighting) serves as the cornerstone of financial core competitiveness.

To address the decline in financial core competitiveness caused by sudden changes in the external environment, enterprises need to optimize R&D budget management and establish a dynamic cycle model of “innovation investment—project profitability—cash flow reinvestment”. Specifically, the quality of innovation output and cash flow returns should be incorporated into the financial budget evaluation system. Through technology transfer, patent pledge financing, and other methods, the liquidity of innovation assets can be enhanced, transforming technological advantages into tangible financial benefits. To mitigate the decline in financial in 2024, financial stability can be improved through asset securitization to activate existing assets and cross-border settlement to hedge exchange rate risks. At the management level, accounting elements can also be restructured to include more intangible assets in the reporting system. Furthermore, incentive policies for innovation talent, such as innovation compensation expenditures and R&D equipment design investments, demonstrate better effects in enhancing innovation compared to traditional financing constraint mitigation approaches. Enterprises should strive to establish an “innovation partner database” and collaborate with universities and research institutions along the Belt and Road to jointly build laboratories, forming stable relationships for shared knowledge creation.

Strengthening Regional Coordination Mechanism to Promote Efficient Allocation of Resources and Factors

To strengthen regional coordination mechanisms and promote efficient allocation of resources and factors, efforts should be made from both platform construction and factor mobility. On one hand, it is necessary to establish a transnational energy industry alliance, uniting energy enterprises and research institutions along the route to create a regular communication and coordination mechanism, thereby optimizing the sustainability and technical compatibility

of power projects. For example, by combining expert consultations, SWOT analysis, and the analytic hierarchy process, the alliance can systematically assess the opportunities and challenges of coal, hydropower, and wind power projects, facilitating precise alignment between corporate needs and scientific research technologies, and providing decision-making support for the institutional development of energy cooperation. The ASEAN “10+5” region has established a diversified cooperation mechanism encompassing bilateral, sub-regional, intra-regional multilateral, and extra-regional multilateral frameworks, promoting the inter-connectivity of energy infrastructure such as power grids and oil and gas pipelines, breaking down transmission barriers, and enhancing resource allocation efficiency. On the other hand, it is essential to facilitate the inter-regional flow of technological, human, and financial factors. By establishing technology trading markets and improving evaluation and transfer services, technology transactions can be promoted to optimize technology allocation. In terms of financial factor allocation, efforts should focus on building a financial support system characterized by “policy guidance—market dominance—cross-border linkage”. Through deepening institutional cooperation with financial institutions in countries along the Belt and Road, a comprehensive service platform integrating cross-border settlement, green credit, and energy futures should be established to provide energy enterprises with full-cycle financing solutions.

Optimizing the Evaluation Method System and Consolidating the Technical Foundation of Coupling Research

The core objective of coupling research is to elucidate the interaction mechanisms and synergistic effects among different systems, such as those involving talent, capital, and technology. It is crucial to move beyond the limitations of single-indicator evaluations and establish a systematic methodological framework. By applying complex systems theory, regional factor allocation can be conceptualized as a complex dynamic system structured around “factor flow—institutional environment—industrial demand.” Building on traditional input-output indicators, spatial spillover effects, network correlations, and dynamic evolutionary features are incorporated to construct a three-dimensional evaluation framework that encompasses “static state, dynamic process, and network structure.” This approach significantly enhances the dynamic assessment of inter-factor correlations. Secondly, research on factor coupling exhibits strong interdisciplinary characteristics. Future studies must transcend traditional disciplinary boundaries through profound methodological innovation, thereby overcoming the linear assumptions inherent in single-discipline approaches. Thirdly, establishing a data-driven empirical research paradigm requires the integration of multi-source heterogeneous data. Techniques such as natural

language processing (NLP) can be employed to extract control variables from policy texts, while geographic information systems (GIS) can map the spatial distribution of factor flows. This addresses common limitations in traditional evaluations, such as unidimensional data and update lag. Furthermore, developing counterfactual assessments and policy simulations—for instance, through agent-based modeling—enables researchers to evaluate the impact of different policy combinations on factor allocation efficiency, providing a pathway for the iterative refinement of evaluation methodologies. By deeply integrating quantitative techniques with domain knowledge, this paradigm achieves both representational accuracy and theoretical generalizability. Fourthly, expanding cross-scale correlation analysis necessitates the establishment of an integrative framework that links multi-scale data. This systems perspective is essential for clarifying the transmission pathways and mutual influences of factor coupling across different spatial and organizational levels. Fifthly, the adaptability analysis of policy tools should be enhanced. Based on simulation results, tailored policy combinations should be designed for different stages of coupling development, supported by mechanisms for dynamic monitoring and adjustment to align with evolving needs. Finally, methodological innovation should be actively advanced by integrating insights and tools from complex network theory, machine learning, and econometrics. Such synthesis is key to elevating the overall scientific rigor and explanatory power of research in this field.

Conclusion

This study examines the coupling coordination mechanism between innovation capability and financial core competitiveness in eight major Chinese energy enterprises under the Belt and Road Initiative from 2018 to 2024, using entropy-weighted TOPSIS, coupling coordination degree models, and grey relational analysis.

Key Empirical Findings

The results reveal a pronounced asymmetry in subsystem development. Innovation capability demonstrated steady growth of 50.4% (from 0.236 to 0.355), while financial competitiveness exhibited significant volatility—plummeting to 0.103 in 2020 before rebounding to 0.270 in 2024. Consequently, the coupling coordination degree (D) evolved from mild imbalance (0.18) through antagonistic growth (0.23) to short-term adjustment (0.30), indicating a fragile yet progressively synergistic relationship. Grey relational analysis identifies patent grants (correlation: 1.00) and fixed asset turnover (0.75) as the primary drivers of system coordination, highlighting that innovation-finance synergy ultimately depends on quantifiable technological achievements and operational efficiency.

Theoretical Contributions

This study makes three principal contributions. First, it extends coupling coordination theory to the micro-level context of energy enterprises, revealing how policy-driven internationalization shapes the innovation-finance nexus in emerging market multinationals. Second, it provides empirical evidence of industry-specific coupling characteristics—particularly the dominant role of operational efficiency (73.05% weighting) in financial competitiveness, reflecting the asset-intensive nature of energy firms. Third, it identifies threshold dynamics where innovation investments require sustained commitment to overcome short-term financial disruption and achieve synergistic benefits.

Limitations and Future Research

Several limitations warrant acknowledgment. The sample of eight enterprises, while representative of industry leaders, constrains statistical generalizability and precludes sectoral subgroup analyses. The seven-year observation period (2018–2024) may not fully capture long-term cyclical patterns in innovation-finance dynamics. Data availability limitations required mean imputation for missing values, potentially introducing estimation bias. Future research should expand sample coverage to include small and medium-sized energy enterprises, extend the temporal horizon, and employ advanced methods such as spatial econometrics or machine learning to capture nonlinear interactions and cross-border spillover effects.

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A Comparative Study of Bayesian Portfolio Optimization: Evidence from U.S. Large-Cap AI-Related Stocks

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Abstract

This paper conducts a comparative analysis of portfolio optimization methods, focusing on Bayesian approaches, applied to U.S. AI-related stocks (2020–2025). While the classical Markowitz model relies on fixed estimates of return and risk, the Bayesian framework incorporates parameter uncertainty through priors on expected returns, soft portfolio concentration constraints, and weights parameterized via Dirichlet or softmax transformations. Posterior inference is conducted using Hamiltonian Monte Carlo with the No-U-Turn Sampler (NUTS), allowing more adaptive and probabilistically informed decision-making. Portfolio performance is evaluated using risk-adjusted returns, measured by the Sharpe ratio, and supplemented with conditional volatility and beta dynamics via the conditional CAPM and DCC-GARCH framework. In the reported experiment, the Markowitz model achieved the highest Sharpe ratio (0.049 in-sample; 0.089 out-of-sample), but this result is limited by the narrow stock universe, daily frequency, zero risk-free rate assumption, and the exclusion of transaction costs. Advanced Bayesian models showed improved risk-adjusted performance relative to early Bayesian specifications, reaching up to 0.038 in-sample and 0.084 out-of-sample Sharpe ratios, while simultaneously reducing conditional volatility and market beta.

Keywords: Bayesian portfolio optimization; Markowitz Mean-Variance Optimization; AI Stocks; Conditional beta; DCC GARCH; Parameter uncertainty; Posterior inference; Regularization; Portfolio concentration

Introduction

1.1 Background

Artificial intelligence (AI) has rapidly transformed industries and financial markets, enabling new tools for portfolio management and asset pricing. In particular, AI-related companies have exhibited high growth and volatility, posing challenges for traditional portfolio optimization methods. Classical approaches, such as Markowitz Mean-Variance Optimization (MVO), often suffer from estimation errors, unstable allocations, and concentrated portfolios when applied to small or volatile stock universes.

Bayesian portfolio optimization offers a potential solution by incorporating parameter uncertainty, regularizing extreme weights, and allowing soft constraints on portfolio concentration. These features can improve out-of-sample performance, reduce portfolio volatility, and mitigate excessive exposure to single assets.

This study compares classical MVO with a series of Bayesian portfolio optimization models applied to a portfolio of 10 large-cap U.S. AI-related stocks using daily returns. In addition to evaluating risk-adjusted performance via the Sharpe ratio, the research examines conditional volatility and market risk exposure using the conditional CAPM and DCC-GARCH framework. By explicitly modeling parameter uncertainty and penalizing concentrated allocations, the Bayesian framework provides insights into more robust portfolio construction under uncertainty.

1.2 Objective

The primary objective of this study is to conduct a comparative analysis of Bayesian portfolio optimization models applied to U.S. AI companies. In addition to evaluating risk-adjusted performance, the study examines portfolio volatility and market risk exposure using the conditional CAPM framework, complemented by DCC-GARCH to capture time-varying dynamics.

1.3 Significance

This research provides insights for institutional and retail investors by demonstrating how Bayesian portfolio optimization can improve allocation decisions under parameter uncertainty. The inclusion of conditional CAPM and DCC-GARCH allows for a detailed assessment of time-varying market risk and volatility, making the findings relevant for stakeholders interested in both performance and dynamic risk management in AI-focused equity portfolios.

II Literature Review

2.1 Literature Review

To begin with, the Modern Portfolio Theory (MPT) was initially introduced by Harry Markowitz in his article "Portfolio Selection", which was published in the *Journal of Finance* in 1952. The theory advocates for a portfolio that is diversified by incorporating assets that are poorly correlated, meaning that they behave differently in different market conditions. Markowitz's most significant contribution lies in his ability to translate the concepts of "risk" and "profitability" into mathematical terms and the development of the Markowitz Mean-Variance Optimization (MVO) model, which is going to be tested in the current research as well.

The foundation of the Bayesian framework can be traced back to the 18th century with the work of Thomas Bayes, whose theorem was later formalized and extended by Pierre-Simon Laplace (Bayes, 1763; Laplace, 1812). In the context of modern statistics and financial modeling, Bayesian methods have gained prominence due to their ability to incorporate prior beliefs and update them with new information. Zellner and Chetty (1965) were among the first to apply Bayesian techniques to econometric models, demonstrating their flexibility and robustness in estimating uncertain parameters. The Bayesian framework treats unknown parameters, such as expected returns and covariances in finance, as random variables with probability distributions. This approach enables analysts to formally incorporate uncertainty and derive posterior distributions that reflect both prior beliefs and observed data, offering a dynamic alternative to classical estimation methods. Olivier Ledoit and Michael Wolf (2003) propose a shrinkage estimator of the covariance matrix that combines the sample covariance matrix with a structured target to reduce estimation error. They show that this approach produces more stable covariance estimates and improves out-of-sample portfolio performance compared to traditional mean-variance optimization based on the sample covariance matrix.

Recent advancements in machine learning have significantly expanded the toolkit available for financial data analysis, particularly through the integration of Bayesian methods. Fischer Black and Robert Litterman (1992) introduced a model, which combines market equilibrium returns with investor views within a Bayesian framework to generate more stable and intuitive portfolio allocations. Lorenzo Garlappi, Raman Uppal, and Tan Wang (2007) develop a portfolio selection framework that explicitly incorporates both parameter uncertainty and model uncertainty using a multi-prior (ambiguity-averse) approach. They show that when investors account for uncertainty about expected returns and model specification, optimal portfolios become more conservative and better diversified compared to standard mean-variance solutions. Bade, Frahm, and Jaekel (2008) applied the portfolio optimization

models under the Bayesian framework and compared this methodology with traditional portfolio optimization models, resulting in better performance and finding that prior investors' information has a crucial role in the model's outcomes. Pfarrhofer (2024) further advances this approach by using multivariate Bayesian machine learning models for scenario analysis in macro-financial environments, emphasizing the importance of accounting for nonlinearities and asymmetries in the relationships between economic and financial indicators. In a related line of research, Gonzalez et al. (2019) explore the application of Gaussian processes and Bayesian optimization in financial contexts, such as interest rate modeling and trend-based investment strategies, highlighting the ability of Bayesian methods to improve forecasting accuracy and decision-making under uncertainty. Hoffman and Gelman (2014) introduce the No-U-Turn Sampler (NUTS), an adaptive extension of Hamiltonian Monte Carlo that automatically tunes path lengths to improve sampling efficiency and convergence without manual parameter calibration. The method significantly reduces tuning complexity while maintaining accurate posterior inference in high-dimensional Bayesian models

Subsequently, the capital asset pricing model (CAPM) was developed by Sharpe (1964) and Lintner (1965), and their papers significantly contributed to financial analysis by providing a simple yet powerful framework to understand the relationship between risk and expected return. The model introduced the concept of systematic risk, captured by the beta coefficient, and established that the expected return of an asset is determined by its sensitivity to the overall market return, as well as the risk-free rate. Black (1972) presents a model of capital market equilibrium with restricted borrowing, extending the traditional Capital Asset Pricing Model (CAPM) by incorporating constraints on investor borrowing and its impact on asset prices. Fabozzi and Francis (1978) introduce one of the major changes to the standard capital asset pricing model (CAPM) is the replacement of the constant beta by a time-varying beta, which can be named as the emergence of the conditional CAPM.

Nevertheless, there are various methods to estimate the time-varying beta. Engle (2000) proposes the Dynamic Conditional Correlation model, a straightforward enhancement of multivariate GARCH models, which enables the modeling of time-varying correlations between multiple financial time series, which could aid in the estimation of beta. Jain (2011) proposes the Heterogeneous Autoregressive Beta model to capture time-varying betas, providing a more adaptable approach to modeling dynamic risk exposures by incorporating diverse responses across various assets. Corradi, Distaso, and Fernandes (2013) investigate the connection between conditional alphas and realized betas, emphasizing the significance of time-varying risk measures in explaining asset returns and performance beyond conventional asset pricing

models. Engle (2016) develops the Dynamic Conditional Beta model, which expands upon traditional asset pricing models by incorporating time-varying betas to capture dynamic risk exposures in financial markets. Zhang and Choudhry (2016) compare GARCH models and the Kalman Filter in forecasting the daily time-varying beta of European banks during the crisis period, highlighting the advantages and limitations of both approaches in capturing dynamic risk exposures. In conclusion, Aloy et al. (2020) conducted a comparative analysis of various techniques for modeling time-varying conditional betas, focusing on their application to Real Estate Investment Trusts (REITs), demonstrating the advantages and limitations of different approaches in capturing dynamic risk exposures.

III Empirical analysis

3.1 Methodology

While this study aims to analyze portfolio optimization approaches, it is essential to start with the traditional method, which is known as Mean-Variance Optimization (MVO) as proposed by Harry Markowitz in 1952. MVO is implemented as a benchmark model using sample estimates of expected returns and the covariance matrix computed from daily stock returns. The vector of expected returns is defined as the arithmetic sample mean of asset returns, while portfolio risk is measured using the empirical covariance matrix. The optimization problem maximizes the Sharpe ratio under a fully invested, long-only constraint.

$$\max \frac{w^T \mu}{\sqrt{w^T \Sigma w}} \quad (1)$$

Subject to:

$$\sum_{i=1}^N w_i = 1, \quad 0 \leq w_i \leq 1,$$

Where μ is the vector of sample mean returns and Σ is the sample covariance matrix. The risk-free rate is set to zero in the baseline specification, making the objective equivalent to maximizing the excess return per unit of volatility. The justification on the risk-free rate is given further, and for the robustness check the study implies Sharpe ratio with risk-free adjustment as well.

This formulation ensures that the resulting portfolio balances both expected return and volatility in a way that maximizes efficiency. In this study, the adjusted Markowitz model served as a benchmark to compare against Bayesian strategies.

Bayesian portfolio optimization in this study is implemented within a decision-theoretic framework rather than through a fully specified generative likelihood model for asset returns. Instead of modeling the return-generating process directly, the Bayesian approach is applied to portfolio weights by combining prior beliefs with a utility-based objective function.

In classical mean–variance optimization, portfolio weights are determined using point estimates of expected returns μ and covariance matrix Σ . In contrast, the Bayesian framework treats portfolio weights as random variables and introduces prior distributions to regularize allocation decisions and incorporate parameter uncertainty. Bayes’ rule is formally defined as:

$$P(\theta|X) \propto P(\theta)P(\theta) \tag{2}$$

Where θ denotes model parameters and X represents observed data. However, in the present study, the likelihood term does not correspond to a fully generative distribution of returns. Instead, a utility-based specification is constructed from the Sharpe ratio objective. Specifically, the portfolio utility function is defined as:

$$U(w) = \frac{w^T \mu}{\sqrt{w^T \Sigma w}} \tag{3}$$

The posterior distribution over portfolio weights is then defined as:

$$P(w|X) \propto \exp \{U(w)\} \times P(w) \tag{4}$$

Where $P(w)$ denotes the prior distribution on weights. Depending on the model specification, weights are parameterized using Dirichlet or softmax transformations to ensure they sum to one and remain within admissible bounds. Posterior inference is conducted using Hamiltonian Monte Carlo with the No-U-Turn Sampler (NUTS), allowing efficient exploration of the weight space under the specified utility structure. This formulation corresponds to Bayesian decision modeling, in which the posterior reflects optimal allocation under uncertainty and regularization, rather than standard Bayesian inference on a parametric likelihood for asset returns.

Furthermore, to examine the conditional volatility and market risk exposure under the time-varying concept, the conditional CAPM model was implemented. Recall that the beta coefficient is derived from the classical CAPM, where it reflects the stock’s exposure to market risk. The CAPM formula is presented below:

$$E(R_e) = R_f + \beta(R_m - R_f) \tag{5}$$

Where $E(R_e)$ is the expected return on the equity, R_f – risk-free rate, R_m – return on the market portfolio. β – beta coefficient, which can be calculated as it is written below:

$$\beta = \frac{cov(R_m, R_i)}{var(R_m)} \tag{6}$$

The CAPM is a remarkable framework, crafted by a diverse group of scholars. However, it has a significant drawback — it relies on static variables, which often lead to unrealistic outcomes. To address this issue, a subsequent version of the model was developed, giving rise to the Conditional CAPM. This version incorporates the dynamic nature of financial data, incorporating it into the formula. The model adopts a different perspective:

$$E_t(R_{i,t+1}) - R_f = \beta_{i,t}[E_t(R_{m,t+1}) - R_f] \tag{8}$$

Sometimes, the equation (7) can be expressed more conveniently in the following form:

$$E_t(\tilde{r}_{i,t+1}) = \beta_{i,t}E_t(\tilde{r}_{M,t+1}) \tag{9}$$

Where $E_t(\tilde{r}_{i,t+1}) = E_t(R_{i,t+1}) - R_f$, $E_t(\tilde{r}_{M,t+1}) = E_t(R_{m,t+1}) - R_f$, meaning the conditional expectation of the net excess return of asset i and of the market. Here, it is important to say that the new return is calculated as follows:

$$r = \ln\left(\frac{Price_{t+1}}{Price_t}\right) \tag{10}$$

Thus, the return is calculated as the log division of price change. Furthermore, in the context of a conditional CAPM model based on time-series data, the beta coefficient also becomes time-varying and can be expressed as follows:

$$\beta_{i,t} = \frac{cov_t(R_{m,t+1}, R_{i,t+1})}{var_t(R_{m,t+1})} \tag{11}$$

There are various methods for calculating the conditional variance and conditional beta, however, the current study will apply the GARCH(1,1) and Dynamic Conditional Correlation GARCH (DCC-GARCH) model respectively. The DCC-GARCH model was developed by Engle and Sheppard (2001) and Engle (2002) to estimate large, time-varying covariance matrices.

It combines dynamic correlation with the GARCH model, allowing it to handle heteroscedasticity as well as large, dynamic covariance matrices. Recall, that the GARCH(1,1) takes the following view:

$$\sigma_t^2 = \omega + a\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \quad (12)$$

Where σ_t^2 is the conditional variance at time t; ω is the constant term; a is the coefficient of the autoregressive term; ε_{t-1}^2 is the squared residual at time t-1; β is the coefficient of the moving average of squared shocks term; σ_{t-1}^2 is the conditional variance at time t-1. Regarding the DCC-GARCH formula, although it is quite complicated, the current study still aims to briefly explain it. There is the following set of formulas:

$$\begin{aligned} H_t &= D_t R_t D_t D_t = \text{diag}(\sqrt{h_{11t}}, \dots, \sqrt{h_{NNt}}) \\ Q_t &= (1 - a - \beta)Q + a\varepsilon_{t-1}\varepsilon'_{t-1} + \beta Q_{t-1} \end{aligned} \quad (13)$$

$$R_t = \text{diag}(Q_t)^{-1} Q_t \text{diag}(Q_t)^{-1}$$

Where H_t is the conditional covariance matrix; D_t is a diagonal matrix of time-varying standard deviations from univariate GARCH models; h_{NNt} is the conditional variance of the asset, which was calculated via GARCH before, R_t is the time-varying correlation matrix; Q_t is an intermediate correlation matrix; Q_{t-1} is the long-run unconditional correlation matrix of standardized residuals; a and β are parameters controlling the dynamics of correlation. The multivariate distribution is specified as Gaussian and estimation is conducted in R-studio using the `rmgarch` and `rugarch` packages, through which conditional covariance and variance are extracted from the estimated DCC model

3.2 Research Design

For this study, a U.S. AI-focused portfolio was constructed, consisting of 10 large-cap companies actively involved in artificial intelligence. Daily returns for each stock were collected from 10 December 2020 to 1 January 2025. The Nasdaq-100 index was used as the market benchmark and representative of the broader market. The dataset was divided into an in-sample (training) period from 10 December 2020 to 1 January 2024, used for model estimation, and an out-of-sample (testing) period from 1 January 2024 to 1 January 2025, used to evaluate model performance.

Table 3.1 summarizes the key characteristics of the stocks included in the AI portfolio. Data were obtained in mid-May 2025 via TradingView and Tiingo (free access). Notably, daily returns are calculated from raw closing prices and are not adjusted for dividends or stock splits. While this may affect absolute return levels, it does not influence the comparative analysis across the portfolio optimization models.

Table 3.1 The structure of the US AI Index

Company	Capitalization	Main AI Involvement
MSFT	3.42T USD	Investments in OpenAI, Azure AI
NVDA	3.3T USD	GPUs and architecture for AI training
AMZN	2.19T USD	AWS AI/ML services, Alexa
GOOGL	2.1T USD	Leaders in machine learning (DeepMind, Gemini, Bard)
META	1.61T USD	
ORCL	454.03B USD	AI integration into cloud products
PLTR	291.19B USD	Big data analytics and military AI
IBM	244.65B USD	Watson, enterprise AI solutions
AMD	185.75B USD	NVIDIA alternative: chips for AI
AI	3.09B USD	Pure-play AI company: enterprise AI solutions

Source: TradingView

As the primary objective of this study is to compare alternative Bayesian portfolio optimization approaches applied to an AI portfolio, five Bayesian model specifications (B1–B5) are developed alongside a classical Markowitz mean–variance optimization (MVO) benchmark. Table 3.2 provides a summary of their key characteristics. Below, there is a formal specification of each Bayesian model.

Table 3.2 All models’ description

Generation	Description
Bayesian 1	The initial model with a mean equal sample mean, sigma is 0.01, and weights follow the Dirichlet distribution. All weights almost equally distributed.
Bayesian 2	The developed Bayesian 1 model with increased sigma to 0.05.
Bayesian 3	A model with sigma equals 0.02, the single asset limitation to 0.2 and implementation a penalty multiplied by 1000.
Bayesian 4	A developed Bayesian 3 model with the same sigma, but with asset limitation 0.25 and a penalty multiplied by 10000.
Bayesian 5	A grid search model, with weight limitation = 0.25; sigma = 0.01, 0.02, 0.05; penalty multiplied by 1000, 10000, 100000.
Markowitz	The Markowitz Mean-Variance Optimization model with Sharpe ratio maximization.

Source: Calculated by the Author

Bayesian 1 (B1) represents a baseline Bayesian portfolio optimization framework that incorporates parameter uncertainty in expected returns while enforcing fully invested, long-only portfolio weights. Expected returns are assigned independent normal priors centered at their empirical sample means with a sigma equal to 0.01. Portfolio weights follow the Dirichlet distribution. Rather than specifying a likelihood for returns, B1 defines a utility-based objective proportional to the Sharpe ratio. Posterior inference is conducted using the No-U-Turn Sampler (NUTS), an adaptive variant of Hamiltonian Monte Carlo. Sampling is performed with 2000 posterior draws following

1000 tuning iterations. Final portfolio weights are obtained as posterior means of the sampled weight distributions.

Bayesian 2 (B2) extends the baseline specification by increasing prior uncertainty over expected returns and allowing for greater dispersion in portfolio weights. Expected asset returns are assigned independent normal priors centered at their empirical sample means, with a larger prior sigma of 0.05. Portfolio weights follow a Dirichlet distribution with concentration parameters below one, which permits more extreme long-only allocations while maintaining fully invested portfolios without short selling. Portfolio return, volatility, the Sharpe-ratio-based utility function, and inference are defined identically to Bayesian Model 1.

Bayesian Model 3 (B3) extends the previous specifications by introducing soft portfolio concentration constraints and a more agnostic prior over expected returns, where the mean is 0.001, and the sigma is 0.02. The model assumes that the maximum desired weight for the single asset in the portfolio is 0.2, while the penalty term is scaled by a coefficient of 1000, controlling the strength of the constraint without imposing hard bounds. Portfolio weights are parameterized via a softmax transformation of unconstrained latent variables, ensuring long-only and fully invested portfolios without short selling. Portfolio performance is evaluated using a Sharpe-ratio-based utility function computed from posterior draws of expected returns and an empirical covariance matrix. Inference is conducted using the NUTS, employing four chains with 5000 posterior draws following 2000 tuning iterations. Final portfolio weights are computed as averages over the top 5% of posterior draws ranked by the Sharpe ratio, emphasizing high-performing portfolios.

Bayesian 4 (B4) builds upon the penalized Sharpe-ratio framework of Bayesian Model 3 by adjusting the portfolio concentration parameters. Expected returns and portfolio weights are modeled identically to B3. The soft concentration threshold is increased to 0.25. At the same time, the strength of the penalty applied to constraint violations is increased to 10000.

Bayesian 5 (B5) extends the penalized Sharpe-ratio framework by conducting a systematic grid search over key hyperparameters governing prior uncertainty and constraint enforcement. The objective is to assess the robustness of portfolio outcomes to alternative Bayesian specifications and penalty magnitudes. Expected asset returns are assigned independent normal priors with a constant mean of 0.001 and prior standard deviations of 0.01, 0.02, and 0.05. Portfolio weights are parameterized via a softmax transformation to ensure long-only and fully invested portfolios. A soft concentration constraint is imposed by penalizing weights exceeding 0.25, with penalty scaling factors of 1000, 10000, and 100000. Portfolio performance is evaluated using a Sharpe-ratio-based utility function computed

with an empirical covariance matrix For each combination of prior variance and penalty strength, posterior inference is conducted using the NUTS with identical sampling settings. Across all model configurations, the specification achieving the highest Sharpe ratio is selected, and the corresponding portfolio weights are reported as the B5 outcome.

Given the use of daily return data and a short investment horizon, the risk-free rate is set to zero across all portfolio optimization models. This choice is equivalent to working with daily excess returns under the assumption that the one-day risk-free rate is negligible relative to asset return variability. Moreover, because the risk-free rate enters the Sharpe ratio as a constant shift, its omission does not affect portfolio rankings and has no material impact on the comparative performance of the Bayesian models. As a robustness check, the Sharpe ratio is additionally computed using the 3-month U.S. Treasury bill yield as a proxy for the risk-free rate. To ensure consistency with the log-transformed daily index returns, the Treasury yield is converted to a daily rate and expressed in logarithmic form before calculating excess returns. This approach allows the Sharpe ratio to fully reflect movements in short-term interest rates while preserving comparability with the baseline specification.

All Bayesian models are implemented in Python using the PyMC library. Posterior inference is conducted via Hamiltonian Monte Carlo using the NUTS. Convergence is assessed through multiple chains, tuning phases, and inspection of posterior summaries. Portfolio weights are constrained to be long-only and fully invested through either Dirichlet priors or softmax transformations. Final portfolio allocations are computed as posterior averages or performance-weighted averages of high-Sharpe posterior draws.

To provide clearer empirical structure, the study formulates testable hypotheses regarding portfolio performance and risk characteristics. First, it is hypothesized that Bayesian models incorporating concentration penalties will outperform unconstrained Bayesian specifications in terms of out-of-sample risk-adjusted performance, while simultaneously reducing tail risk and conditional market beta. Second, it is expected that the classical Markowitz mean–variance optimization will achieve the highest Sharpe ratio but at the cost of substantially higher portfolio concentration and lower diversification. These hypotheses reflect the theoretical trade-off between pure Sharpe maximization and robustness to estimation error and concentration risk, and they guide the comparative evaluation of the proposed models.

3.3 Descriptive Statistics

As the main objective of the study is to compare different Bayesian portfolio optimization models, it is essential to calculate the optimal weighting for securities in the AI portfolio based on the training period. Table 3.3 shows the share of each stock in the portfolio according to each generation decision.

Interestingly, while the first generation used an equally weighted portfolio, subsequent generations preferred to increase the shares of certain companies due to their high profitability. However, the greatest concentration can be seen in the Markowitz (MVO) model, which allocates only three out of the ten companies. Regarding Bayesian optimization models, some generation reduce concentration (B3 and B4), while others (B5) can also become highly concentrated depending on grid settings and objective. While this may be mathematically sound, the lack of diversity is still a risky decision.

Table 3.3 Assets' allocation in the portfolio

Generation	AI	ORCL	AMZN	MSFT	AMD	NVDA	IBM	GOOGL	META	PLTR
Bayesian 1	9.89%	9.92%	9.95%	10.13%	9.95%	10.01%	10.14%	10.04%	9.93%	10.05%
Bayesian 2	8.69%	11.50%	7.68%	11.47%	9.37%	8.63%	16.18%	7.64%	9.70%	9.12%
Bayesian 3	2.84%	22.12%	2.25%	21.32%	5.75%	2.91%	23.41%	2.10%	13.41%	3.90%
Bayesian 4	2.27%	24.51%	1.80%	24.09%	4.61%	2.47%	25.08%	1.72%	10.21%	3.24%
Bayesian 5	0.15%	0.32%	0.20%	33.46%	0.17%	0.19%	64.96%	0.15%	0.22%	0.19%
Markowitz	0.00%	32.04%	0.00%	47.38%	0.00%	0.00%	20.58%	0.00%	0.00%	0.00%

Source: Calculated by the Author

Table 3.4 provides a summary of the descriptive statistics for six custom-built AI indexes (B1 to B5 and M), each created using different Bayesian portfolio optimization models, compared to the Nasdaq-100 (NDX). The data spans from 2021 to 2024.

Table 3.4 Descriptive statistics of models' performance

2021-2024	Mean	Median	Sd	Min	Max	Sharpe	Sharpe*	Skew.	Kurt.
Index B1	-0.07%	0.09%	2.57%	-30.11%	9.04%	-0.026	-0.030	-4.15	48.80
Index B2	-0.04%	0.09%	2.24%	-23.03%	8.38%	-0.019	-0.024	-2.86	30.43
Index B3	0.03%	0.06%	1.52%	-6.69%	6.38%	0.017	0.011	-0.30	4.78
Index B4	0.03%	0.05%	1.44%	-5.70%	5.96%	0.022	0.016	-0.22	4.42
Index B5	0.05%	0.06%	1.18%	-6.59%	4.58%	0.038	0.031	-0.44	6.01
Index M	0.07%	0.10%	1.33%	-5.81%	6.06%	0.049	0.043	-0.03	4.58
NDX	0.04%	0.09%	1.50%	-5.70%	7.22%	0.027	0.021	-0.18	4.28

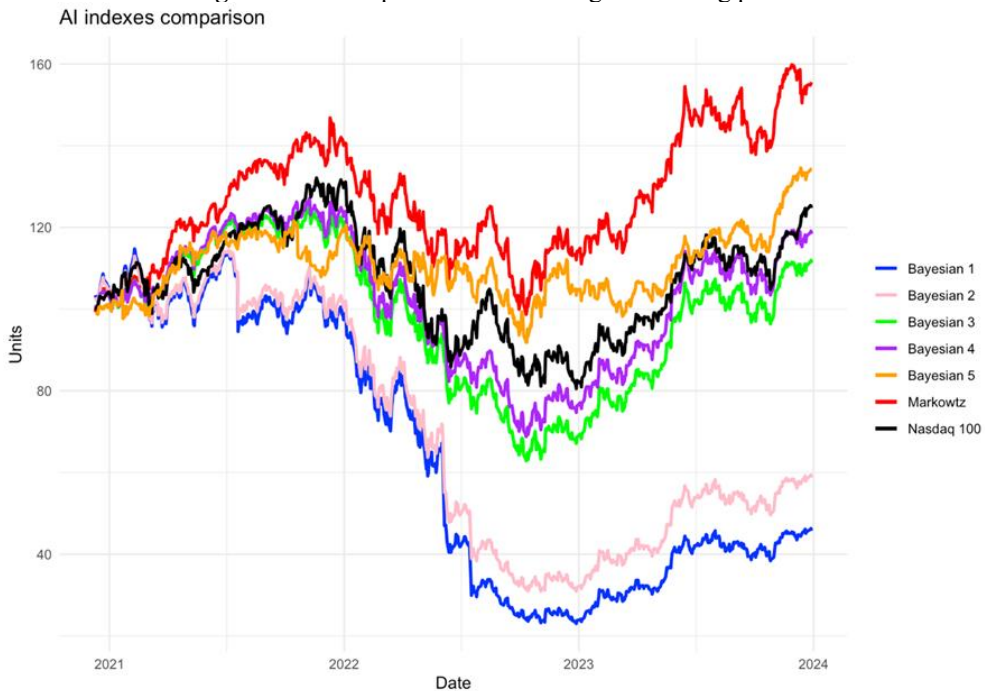
Sharpe* - risk-free adjusted ratio
 Source: Calculated by the Author

Indexes B1 and B2 have negative mean returns (-0.07% and -0.04%, respectively) and pronounced negative skewness (-4.15 and -2.86) indicates exposure to asymmetric downside events, while the high kurtosis values (48.80 and 30.43) reflect heavy-tailed return realizations typical of equity markets during turbulent periods, while the B1 and B2 made almost equal allocation in weights among assets. Indexes B3 through B5 demonstrate improved performance, with increasing average returns (up to 0.05%), decreasing standard deviations, and lower skewness and kurtosis values, indicating more stable and symmetric return behavior. The index M, which was created using the traditional Markowitz optimization approach, exhibits the highest average return (0.07%) and the best Sharpe ratio (0.049) among all

custom indices. Notably, since the study uses the daily returns, so the Sharpe ratio is also presented on daily scale. The index M also demonstrates relatively low-risk characteristics, with a standard deviation of 1.33% and a minimal skewness of -0.03. In contrast, the Nasdaq-100 (NDX) achieved a mean return of 0.04%, with a Sharpe ratio of 0.027 - higher than most Bayesian models, except for B5 and M. This makes B5 and M the most promising models during the training period, with M standing out in terms of overall risk-adjusted performance.

Figure 3.1 illustrates the dynamics of all Bayesian model indices, based on the USA AI companies' portfolio during the training period.

Figure 3.1 Index performances during the training period



Source: Calculated by the Author

Table 3.5 assesses the out-of-sample performance of the AI-powered indices over the timeframe of 2024 to 2025, using fixed portfolio weights that were determined during the preceding training period. This stage serves to test the models' practicality and their ability to generalize beyond the data they were trained on.

Table 3.5 Descriptive statistics of models' performance

2024-2025	Mean	Median	Sd	Min	Max	Sharpe	Sharpe*	Skew.	Kurt.
Index B1	0.10%	0.16%	2.11%	-22.70%	4.65%	0.046	0.039	-5.03	56.22
Index B2	0.10%	0.13%	1.92%	-19.59%	4.43%	0.053	0.046	-4.28	45.77
Index B3	0.12%	0.18%	1.35%	-6.54%	4.45%	0.091	0.082	-0.49	5.66
Index B4	0.12%	0.16%	1.30%	-5.57%	4.69%	0.093	0.084	-0.32	5.05
Index B5	0.10%	0.16%	1.17%	-6.45%	6.08%	0.084	0.074	-0.52	9.42
Index M	0.11%	0.16%	1.23%	-4.03%	5.44%	0.089	0.080	0.13	6.11
NDX	0.10%	0.15%	1.15%	-3.72%	3.01%	0.083	0.072	-0.45	3.95

Sharpe* - risk-free adjusted ratio

Source: Calculated by the Author

Remarkably, all six indices (B1 through B5 and M) achieved positive average returns ranging from 0.10% to 0.12%, outperforming their performance during the training period. Notably, Indexes B3, B4, and M continued to exhibit strong Sharpe ratios (0.091, 0.093, and 0.089, respectively), indicating attractive returns adjusted for risk. These findings reinforce the earlier conclusion that Bayesian models with lower variance (such as B3 and B4) and the Markowitz-based Index M remain resilient when applied to new data. Despite the positive mean returns, indexes B1 and B2 continue to exhibit extreme skewness (-5.03 and -4.28) and high kurtosis (56.22 and 45.77), indicating persistent left-tail risk and non-normal distributions. Their Sharpe ratios (0.046 and 0.053) remain the lowest, suggesting that these models may not be suitable for real-world application, despite their improved returns. The Nasdaq-100 (NDX) achieved a mean return of 0.10% and a Sharpe ratio of 0.083, performing similarly to indexes B5 and slightly below M, B3, and B4. This suggests that some of the custom Bayesian and Markowitz-weighted indexes may outperform the benchmark, particularly in terms of risk-adjusted returns.

Figure 3.2 represents the dynamics of all indexes on the AI company's portfolio during the out-of-sample period, with respect to different optimal weight allocations.

Figure 3.2 Index performances during the out-of-sample period



3.4 Time-varying beta

This part aims to analyze the market risk exposure for the out-of-sample period. While all generations already made their allocation decision, it is essential to examine how risky their strategies are on another data sample. The following Table 3.6 presents the results of conditional volatility and market beta estimates for each AI index, calculated using the DCC-GARCH model under the conditional CAPM theory. This approach allows us to analyze the time-varying exposure to market risk (beta) and dynamically estimate portfolio risk (volatility), providing a more accurate picture of portfolio behavior in changing market conditions.

Table 3.6 Descriptive statistics of models' volatility

	Mean	Median	Sd	Min	Max	Skewness	Kurtosis
Vol_B1	2.02%	2.02%	0.0461%	1.9422%	2.1011%	0.06	1.80
Vol_B2	1.85%	1.84%	0.0389%	1.7806%	1.9147%	0.06	1.80
Vol_B3	1.31%	1.31%	0.0169%	1.2849%	1.3429%	0.07	1.81
Vol_B4	1.28%	1.28%	0.0137%	1.2462%	1.2999%	0.08	1.81
Vol_B5	1.13%	1.13%	0.0231%	1.0884%	1.1678%	0.06	1.80
Vol_M	1.22%	1.22%	0.0002%	1.2238%	1.2243%	-0.09	1.81
Vol_NDX	1.14%	1.10%	0.1419%	0.9624%	1.6743%	1.41	4.84
Beta_B1	1.31	1.35	0.35	-0.85	1.85	-2.10	11.24
Beta_B2	1.22	1.27	0.32	-0.77	1.70	-2.13	11.33
Beta_B3	0.94	0.96	0.13	0.08	1.16	-1.81	10.62

Beta_B4	0.91	0.93	0.12	0.21	1.10	-1.50	7.87
Beta_B5	0.58	0.59	0.07	0.38	0.68	-0.82	3.02
Beta_M	0.82	0.84	0.09	0.58	0.95	-0.90	3.12

Source: Calculated by the Author

The levels of conditional volatility reveal a clear trend: indexes B3, B4, and B5 consistently exhibit the lowest risk levels (1.31%, 1.28%, and 1.13%, respectively), while indexes B1 and B2 display higher volatility (2.02% and 1.85%). The Markowitz-optimized portfolio (Index M) achieves both low volatility (1.22%) and extremely low dispersion ($SD \approx 0.00\%$), indicating exceptional stability. Interestingly, while the Nasdaq-100 has a relatively low mean volatility (1.14%), it also has the highest variability ($SD = 0.14\%$) and skewness (1.41), suggesting occasional spikes in risk exposure. Examining the conditional betas, the study notices that B1 and B2 have the highest average market exposure (1.31 and 1.22), accompanied by strong negative skewness and extreme kurtosis, indicating their susceptibility to asymmetric market shocks. In contrast, B5 and M have the lowest average betas (0.58 and 0.82), suggesting limited market dependence and greater potential for diversification benefits. Moreover, the low volatility–low beta profiles of B3, B4, B5, and M support the notion that these indexes can provide more stable performance with reduced exposure to systemic risk.

Overall, the DCC-GARCH results reinforce the findings from previous observations: indexes derived from Bayesian models with lower variance (B3–B5) and the Markowitz-optimized index (M) not only offer favorable return-risk ratios but also exhibit desirable conditional characteristics, such as low volatility and reduced sensitivity to market-wide fluctuations.

Table 3.7 reports the diagnostics of the DCC-GARCH models, including parameter estimates for both the univariate GARCH components of the Index and Market series, as well as the DCC correlation dynamics. The “Sum” column represents volatility persistence for univariate GARCH (Index/Market) or correlation persistence for DCC. All parameters are positive and satisfy the stationarity condition ($\alpha + \beta < 1$), and convergence was achieved without numerical issues. These diagnostics confirm that the estimated models are well-behaved, and the results are robust.

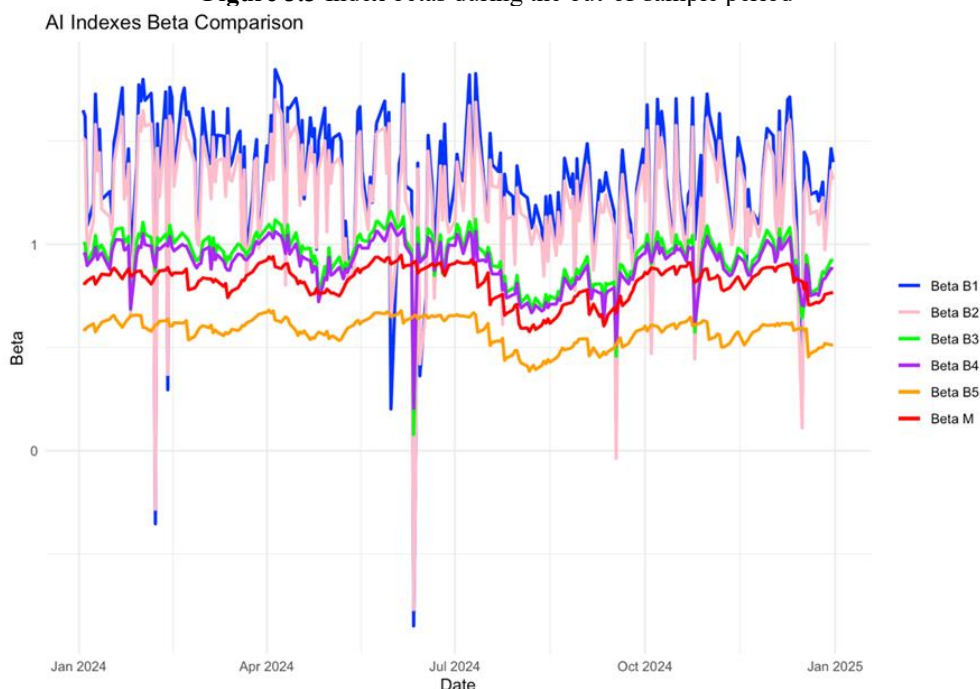
Table 3.7 Descriptive statistics of models’ volatility

Ind.	Conv.	Index			Market			DCC		
		alpha	beta	sum	alpha	beta	sum	alpha	beta	sum
B1	0	3,93E-11	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,73	0,08	0,806
B2	0	2,56E-10	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,73	0,08	0,808
B3	0	2,80E-09	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,29	0,12	0,416
B4	0	9,53E-11	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,23	0,18	0,405
B5	0	5,33E-10	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,00	0,90	0,900
M	0	2,24E-08	9,99E-01	0,999	5,82E-02	8,65E-01	0,923	0,04	0,67	0,708

Source: Calculated by the Author

Figure 3.3 illustrates the dynamics of the conditional betas (market risk exposure) of all indexes during the out-of-sample period.

Figure 3.3 Index betas during the out-of-sample period



Source: Calculated by the Author

Conclusion

This study examined the performance of alternative Bayesian portfolio optimization models using a constructed AI index of the United States composed of ten large-cap companies over the period from December 2020 to January 2025. The empirical analysis was conducted within a three-year training period and a one-year out-of-sample evaluation, with portfolio weights held constant during the testing phase. Five Bayesian model specifications were compared against a classical Markowitz mean-variance optimization benchmark, with particular attention paid to risk-adjusted performance, concentration, and time-varying market risk exposure.

The results indicate that within this narrow AI-focused investment universe, the Markowitz MVO model achieved the highest Sharpe ratio both in-sample and out-of-sample. This “win” is likely influenced by the small number of assets, overlapping factor exposures, and the use of Sharpe ratio maximization with a zero risk-free rate, which can magnify the apparent efficiency of unconstrained allocations. However, this performance came at the cost of substantial portfolio concentration, increasing exposure to idiosyncratic risk.

Bayesian models incorporating soft concentration penalties (B3–B4) demonstrated a more balanced profile, while others (B5) can also become highly concentrated depending on grid settings and objective. These models achieved competitive Sharpe ratios while maintaining lower conditional volatility and reduced market beta, as evidenced by DCC-GARCH and conditional CAPM results. The trade-off between marginally lower Sharpe ratios and greater diversification suggests that such Bayesian specifications may be preferable for investors prioritizing risk management, robustness to estimation error, or adherence to diversification constraints.

It is important to note potential overfitting risks, particularly for the B5 model, which was selected through a grid search on Sharpe ratios. Without a nested validation set or rolling-window evaluation, performance estimates may be upward-biased. Future studies could adopt a three-way split or rolling-window frameworks to mitigate this risk.

Finally, the analysis is subject to several limitations. The small, sector-specific universe of ten AI stocks restricts generalizability to broader equity markets or other asset classes. Portfolio weights were held constant out-of-sample, with no consideration of transaction costs or dynamic rebalancing. Results also reflect a specific market environment characterized by rapid technological growth and unique volatility patterns, which may influence model performance.

Overall, the evidence suggests that Bayesian portfolio optimization provides a flexible framework for addressing parameter uncertainty and concentration risk in narrowly defined, high-growth sectors. For investors willing to accept a slight reduction in Sharpe ratio, models with explicit regularization (B3–B5) offer a practical balance between performance, diversification, and time-varying market risk exposure.

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Public–Private Partnerships in Healthcare: A Literature Review

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Abstract

As fiscal pressures intensify and healthcare needs continue to rise, public-private partnerships have evolved into a central policy response to close enduring gaps in infrastructure, financing, and service efficiency. This paper presents an integrative literature review of PPPs in healthcare sector, exploring their theoretical foundations and examining their conceptual underpinnings and the empirical results. Based on evidence from scholarly publications, institutional analyses, and international policy sources, the review highlights findings across diverse contexts from both advanced and developing economies. The review draws on peer-reviewed publications and institutional reports identified through major databases (Scopus, Web of Science, PubMed, ESJ, Google Scholar) covering the period 2000–2024.

Findings reveal that PPPs can markedly advance healthcare access, efficiency, and quality when backed by strong institutional capacities, clear governance mechanisms, and fair risk sharing. While case studies from Morocco, Iran, and Lesotho demonstrate the positive impact of PPPs on hospital functioning and patient care, other studies underscore persistent challenges such as budgetary exposure, governance deficits, and the growing financialisation of the healthcare sector.

According to the study, PPPs should not be viewed as a universal solution but rather as a governance approach whose success relies on robust

state capacity, sound regulatory frameworks, and consistent policy alignment. When thoughtfully designed and efficiently implemented, PPPs can enhance the pursuit of equitable, efficient, and durable healthcare systems, notably within settings facing fiscal and infrastructural constraints.

Keywords: Public-private partnerships, Healthcare governance, Institutional capacity, Health service performance

Introduction

Global health systems are increasingly challenged to sustain equitable, efficient, and resilient service delivery in light of demographic transitions, epidemiological shifts, and fiscal austerity. The combined effects of expanding healthcare demand, technological progress, and limited public budgets have driven health spending to unprecedented levels. According to the World Health Organization (1993) low- and middle-income nations face an annual shortfall exceeding USD 371 billion to reach the Sustainable Development Goals (SDGs) related to health. These systemic challenges have encouraged policymakers to adopt innovative funding and governance models that can leverage additional investment without undermining the principle of universal healthcare access.

In this context, PPPs have gained prominence as a strategic approach to modernizing healthcare systems, expanding access to care, and improving institutional efficiency. By integrating public oversight with private financing and managerial capabilities, PPPs seek to address funding shortfalls and stimulate innovation in health service delivery. Over the last three decades, many countries including the United Kingdom, Australia, Morocco, Iran and South Africa have embraced PPP arrangements to fund hospitals, diagnostic platforms, and specialized treatment centres. Their rationale rests on principles of shared risk, improved accountability, and value-for-money outcomes. Nevertheless, empirical evidence remains ambivalent: while many evaluations reveal significant improvements in infrastructure and service quality, others expose challenges linked to fiscal exposure, lack of transparency, and the increasing commodification of healthcare.

The diversity of PPP outcomes has revitalised theoretical discussions on the determinants of their capacity to create public value. Various theoretical frameworks have been widely used to explain performance variations; however, comparative research across institutional environments remains underdeveloped, particularly in developing and emerging economies, where institutional and legal settings diverge markedly from those of industrialised economies. Moreover, critical perspectives warn that when regulatory oversight is weak, PPPs may alter the nature of healthcare provision,

prioritising profit generation over social welfare and thus jeopardising both equity and accountability.

Within this framework, the study undertakes an integrative review that unifies theoretical debates and empirical evidence on PPPs within the health sector. It investigates how governance structures, institutional strength, and contractual configurations affect the ability of PPPs to deliver health services, emphasising experiences in emerging economies. By combining global evidence with locally grounded analysis, the paper contributes to a more balanced understanding of PPPs as context-dependent governance mechanisms whose effectiveness relies on strong state oversight, financial resilience, and alignment with national health policy priorities.

This article contributes to the existing literature in several ways. First, it provides an integrative synthesis that combines conventional theoretical approaches to public–private partnerships, such as agency theory, transaction cost economics, and incomplete contract theory, with critical perspectives rooted in financialisation and political economy. Second, the review places particular emphasis on emerging and developing economies, with specific attention to the MENA region, which remains underrepresented in the empirical literature on healthcare PPPs. Third, by conceptualizing PPPs not merely as financing instruments but as hybrid governance mechanisms, the paper offers a nuanced framework for understanding how institutional capacity, regulatory quality, and contractual design jointly shape healthcare outcomes. This approach allows for a more balanced assessment of PPPs beyond ideological polarization, highlighting the conditions under which they can contribute to sustainable and equitable health systems.

Before outlining the methodological approach, it is necessary to clarify the scope of PPP models examined in this study. Given the conceptual breadth of Public–Private Partnerships in the healthcare sector, it is important to clarify the scope of this review. The analysis focuses primarily on three categories of PPP arrangements that directly affect healthcare service provision and system governance. First, the review includes hospital infrastructure PPPs, particularly long-term contractual arrangements similar to Private Finance Initiative (PFI)-type models, in which private partners are responsible for financing, constructing, and maintaining public hospital facilities under performance-based contracts. Second, the review examines service-delivery PPPs, including partnerships for dialysis services, diagnostic platforms, and specialized clinical services, where private actors participate in the provision of specific healthcare services within publicly regulated systems. Third, the analysis considers management and governance partnerships, in which private entities are involved in hospital management, operational support, or capacity-building arrangements within public health institutions.

By contrast, the review does not aim to cover purely financial investment vehicles or private healthcare provision operating independently of public partnership frameworks. Similarly, PPP models in non-health infrastructure sectors—such as transport or energy—are excluded. This delimitation ensures analytical coherence and maintains a clear focus on PPP arrangements that directly shape healthcare governance, fiscal sustainability, and service delivery outcomes.

Theoretical background

The participation of private actors in healthcare through the management of hospitals and clinics, reliance on user charges, and the outsourcing of auxiliary services including patient transport, infrastructure maintenance, and equipment management (Birn et al., 2016), has long formed an integral part of national health systems, rather than a contemporary novelty. Calls to expand private participation began in the 1980s and accelerated throughout the 1990s, notably following the release of the World Development Report: *Investing in Health* (World Bank, 1993), which framed private engagement as a pathway to greater efficiency, innovation, and fiscal sustainability in health financing.

Since the early 2000s, private-sector engagement in healthcare has undergone a profound structural transformation. Whereas the sector was previously dominated by non-financial actors—such as corporate hospital networks, clinical service providers, it has increasingly attracted financial investors, including private equity firms, pension funds, investment funds, and specialised financial vehicles (Dentico, 2019; PSI, 2021; Cordilha, 2022a; Sriram et al., 2024). This shift reflects a transition from traditional service provision toward financial intermediation, whereby healthcare assets are increasingly treated as investment products capable of generating stable long-term returns. As healthcare becomes progressively financialised, the boundaries between public obligation and private profit grow blurred, giving rise to renewed debates over equity, accountability, and the governance of health services. Fueled by the global “private turn” in development finance, this reorientation embeds health systems within a policy agenda that emphasises mobilising private capital for the provision of public goods (Hunter & Murray, 2019).

Health public–private partnerships are generally described as long-term agreements between public authorities, including central governments, local administrations, and ministries such as ministry of health, and private partners for the development, funding, and management of essential healthcare facilities and services. These agreements generally focus on large-scale public assets, including hospital construction, facility management, and the provision of non-clinical services essential to maintaining continuity of

care in public institutions. The private partner, either a single company or a consortium formed into a special purpose vehicle (SPV), is assigned specific responsibilities that may include design, construction, financing, operation, or maintenance. In return, it receives compensation through a predetermined revenue mechanism, funded by user charges, government payments, or a mix of both. Even though PPPs are justified by claims of shifting risks and managerial expertise to the private actor, the state retains ultimate accountability for healthcare provision (Stafford et al., 2022). This reflects the hybrid architecture of PPPs, where private actors operate within a framework of public oversight to meet social and policy-oriented goals.

PPPs in the health sector are often categorised according to how responsibilities and risks are divided between the public and private partners (Montagu & Harding, 2012; PwC, 2018). These arrangements vary in the extent of private-sector engagement, from design–build–finance models to comprehensive contracts covering operation and maintenance, each supported by specific mechanisms of remuneration and risk allocation. Yet, as underscored by Romero and Van Waeyenberge (2020), an overly typological emphasis can mask the deeper structural reconfiguration that PPPs entail. Beyond their contractual configuration, PPPs contribute to the redefinition of public health infrastructure as privately monetised assets. National and international institutions play a pivotal role in enabling this shift through regulatory frameworks, financial support instruments, and policy measures that incentivise private capital participation. Payment modalities are defined contractually and may take the form of availability payments, performance-linked fees based on service quality metrics, or user charges collected from patients. The configuration adopted reflects the negotiated balance between public control and private initiative that shapes PPP governance in the healthcare sector (World Bank, 2017; Yescombe, 2018).

Theoretically, PPPs have been analysed through multiple complementary frameworks that illuminate their rationale, governance dynamics, and performance outcomes. Agency theory interprets PPPs as institutional mechanisms that reduce incentive misalignment between public principals and private agents through structured risk allocation. Transaction cost economics posits that PPPs are chosen when contracting and supervision costs are comparatively lower than those associated with direct state provision. Incomplete contract theory (Hart, 2003) underscores the impossibility of specifying every contingency in advance, implying that long-term PPPs depend on flexibility, renegotiation, and trust-based relationships. The New Public Management (NPM) framework views PPPs as vehicles for importing private-sector efficiency, performance metrics, and accountability mechanisms into public service delivery. Meanwhile, financialisation scholarship interprets PPPs as part of a global shift that recasts public

infrastructure as financial assets, embedding public goods within market-based valuation and risk frameworks (Romero & Van Waeyenberge, 2020; Cordilha, 2022). Collectively, these theoretical lenses highlight the hybrid, evolving character of PPPs as both governance mechanisms and financial instruments within contemporary health systems.

Methodology

Literature reviews constitute structured academic inquiries aimed at mapping, synthesizing, and critically interpreting existing knowledge within a given field. Ensuring rigor in such work requires methodological transparency and a clearly articulated analytical framework. This requirement is particularly salient in the field of healthcare Public–Private Partnerships (PPPs), where research on hospital infrastructure, governance, financing, and service delivery has expanded rapidly and diversified across multiple disciplines. As noted by Rodrigues (2023), literature reviews in organizational and management research must contend with fragmentation and multidisciplinary, necessitating a structured yet flexible methodological approach.

In response to these challenges, this study adopts an integrative literature review methodology, enabling the synthesis of both theoretical and empirical contributions across economics, public administration, governance studies, and political economy. The objective is not to conduct a quantitative meta-analysis but to provide a structured and comparative interpretation of diverse strands of scholarship related to PPP implementation in healthcare systems.

The literature was identified through a structured search of major academic databases, including Scopus, Web of Science, PubMed, and Google Scholar, covering publications between 2000 and 2024. This timeframe reflects the period during which health-sector PPPs gained significant prominence globally. The search strategy relied on combinations of key terms such as “Public–Private Partnerships,” “Healthcare PPPs,” “Hospital PPPs,” “Health system governance,” and “Private sector participation in healthcare.” These terms were used individually and jointly to capture relevant contributions addressing both governance mechanisms and performance outcomes.

In addition to peer-reviewed journal articles and academic books, the review incorporated institutional reports published by recognized international organizations, including the World Bank, the OECD, the World Health Organization (WHO), and the European Investment Bank, particularly where these sources provided analytical insight into regulatory frameworks, financing models, and fiscal sustainability.

The search process generated a broad corpus of references, which were screened to ensure direct relevance to PPP implementation within the healthcare sector. Studies focusing exclusively on non-health infrastructure domains (such as transport, energy, or water), non-scientific publications, duplicated records, and contributions lacking analytical substance were excluded. Full-text assessment further ensured that selected studies provided either empirical evaluation (quantitative analyses, qualitative case studies, or comparative research) or theoretically grounded assessments directly linked to healthcare governance, institutional performance, fiscal sustainability, or equity considerations.

The selected literature was analyzed using a thematic and comparative approach structured around performance outcomes, governance determinants, and political economy perspectives. This framework allowed for the identification of converging findings, contradictions, and contextual factors shaping PPP effectiveness across diverse institutional environments.

As no primary fieldwork or quantitative modeling was undertaken, the study remains conceptual and synthetic in nature. Its purpose is to integrate theoretical insights with documented empirical experiences in order to provide a balanced and context-sensitive understanding of PPP deployment in healthcare systems facing fiscal constraints and structural pressures.

Empirical Literature Review

The empirical literature on public–private partnerships in the health sector has grown substantially over the past thirty years, mirroring both the rising policy importance of PPPs and the increasing diversification of their use across different health system settings. Initial studies tended to focus on issues of efficiency and cost-effectiveness, particularly in relation to hospital infrastructure and management (Montagu & Harding, 2012; Hodge & Greve, 2017). More recent scholarship has broadened this scope to investigate governance effectiveness, service quality, healthcare access, and fiscal sustainability (Hellowell, 2019; Romero & Van Waeyenberge, 2020; Casady & Mikic, 2022). Overall, the findings remain mixed and highly sensitive to context, reflecting differences in institutional strength, regulatory design, and the developmental stage of national health systems.

Research on health PPPs encompasses both high-income and developing countries, with a substantial body of empirical work stemming from early adopters like the United Kingdom, Australia, and Canada under the Private Finance Initiative (PFI). In developing regions—including Asia, Latin America, and Sub-Saharan Africa—empirical research has emerged more recently, frequently examining PPPs as vehicles for expanding health infrastructure and improving service delivery in settings marked by resource constraints (Kumar & Gupta, 2022; Moyo et al., 2020). In contrast, the MENA

region remains relatively underexamined, with only a handful of studies addressing PPPs in healthcare, including Zine El Abidine, Hajji, and Bouhmala's (2021) analysis of PPP implementation in Moroccan dialysis services.

These studies reveal significant methodological variety, with quantitative analyses of costs and health outcomes complemented by qualitative examinations of governance dynamics, stakeholder engagement, and policy effectiveness. This heterogeneity reflects both the richness and the fragmentation of empirical research on PPPs, echoing Romero and Van Waeyenberge's (2020) observation regarding the inherently multidisciplinary character of PPP scholarship.

To provide greater analytical clarity and structure to this heterogeneous body of evidence, the reviewed studies are synthesized in tables 1 and 2 according to their dominant empirical orientation.

Tables 1 and 2 provide a structured analytical synthesis of the empirical literature examined in this review. The studies included in these tables were drawn from the final curated corpus following the structured screening process described in the methodology section. Inclusion was guided by four principal criteria. First, selected studies explicitly addressed the implementation, governance, or performance of Public–Private Partnerships within the healthcare sector, thereby excluding PPP research focused exclusively on non-health infrastructure domains such as transport, energy, or water. Second, studies were required to provide either empirical evaluation—quantitative analyses, qualitative case studies, comparative cross-country assessments—or analytically grounded theoretical contributions directly linked to observable healthcare outcomes or institutional performance. Third, each study had to clearly identify measurable or analytically assessable dimensions of PPP performance, including service quality, access to care, operational efficiency, fiscal sustainability, risk allocation, governance arrangements, or equity implications. Fourth, methodological transparency was considered essential; studies were retained only when they clearly specified their research design, analytical approach, data sources, or conceptual framework. The distinction between Table 1 and Table 2 reflects the dominant orientation of findings reported in the selected studies rather than a normative or binary judgment of PPPs as inherently successful or problematic. Table 1 synthesizes studies whose primary conclusions emphasize performance-enhancing effects—such as improvements in infrastructure, service delivery, institutional coordination, or patient outcomes—within specific governance conditions. Table 2, by contrast, compiles studies that report mixed, context-dependent, or predominantly critical findings, particularly in relation to fiscal exposure, contractual rigidity, governance asymmetries, long-term liabilities, and financialisation dynamics.

This classification is therefore analytical rather than evaluative, aiming to organize the literature according to prevailing empirical patterns while acknowledging that PPP outcomes remain highly contingent on institutional capacity, regulatory quality, and contextual factors.

The positive effect of PPPs in health

Across an increasingly diverse set of empirical studies, Public–Private Partnerships have been identified as important levers for expanding access to health services, improving quality of care, and strengthening organisational performance. Despite varying contexts, much of the literature converges on the idea that PPPs—when embedded within strong governance structures and supported by effective coordination can serve as complementary instruments to improve the efficiency and equity of healthcare delivery.

Joudyan et al. (2021) indicate that, despite the significant challenges inherent in their implementation, PPPs constitute a promising means of improving access to healthcare services, particularly in remote or underserved areas. The authors underline that the success and sustainability of these partnerships depend on several essential conditions: ase transparency, trust, and cooperative relationships between public authorities and private partners, as well as flexible contractual arrangements capable of evolving with changing needs and circumstances. They also highlight the importance of securing stable and sustainable financing, fostering genuine mutual commitment, and reinforcing the public sector’s capacity to oversee and ensure the quality of services provided by private actors. Governments are encouraged to establish long-term strategic plans and coherent policy frameworks that facilitate the development and ongoing viability of health PPPs. Drawing on international experiences and adjusting them to local realities can strengthen institutional learning and improve the design and performance of future partnerships.

Expanding on these insights, Ghasemi et al. (2022) provide further evidence showing that cooperative arrangements between public authorities and private actors in healthcare systems have generated favourable results across multiple dimensions. heir analysis indicates that such partnerships strengthen service provision, broaden coverage, and enhance overall system performance, as well as enhanced provider responsiveness—particularly through stronger referral mechanisms and more efficient patient flows. Moreover, the authors show that the extent and effectiveness of participatory service delivery vary with countries’ economic and institutional development. In contexts where collaboration between government and private stakeholders is more developed, the evidence points to broader service coverage and a reduction in access inequalities. Collectively, these findings underscore the significant contribution that sustained public–private cooperation can make to advancing efficiency and equity in national health systems.

Reinforcing this multidimensional understanding, Basabih et al. (2022) argue that PPPs offer an appropriate and effective strategy for filling persistent gaps in health infrastructure, access to care, and service quality, particularly in settings characterised by fiscal limitations. Their review analysed the performance of PPPs through hospital financing and service delivery indicators, identifying both notable achievements and the challenges that arise during implementation. This reinforces the conclusion advanced by Ghasemi et al., namely that the performance of PPPs is highly sensitive to contextual factors, particularly institutional maturity and the coherence of policy frameworks.

Placed within this wider international landscape, the study of Zine El Abidine, Hajji, and Bouhmala (2023) offers Moroccan empirical evidence the beneficial impact of PPPs on healthcare quality and performance, with a particular focus on renal dialysis services. Their findings reveals significant improvements in patient outcomes, continuity of care, and operational efficiency after the implementation of PPP arrangements. These results illustrate the capacity of PPPs to fill structural gaps in the public health sector, especially in specialised areas that require advanced technologies and professional expertise. Nonetheless, the authors emphasise that achieving sustainable outcomes requires sufficient stakeholder training and preparedness, highlighting the importance of developing managerial and technical capacities. The Moroccan case adds to the broader evidence base by illustrating how national adaptation and institutional learning can enhance the benefits of PPP schemes.

Likewise, Gharaee et al. (2021), examining the case of East Azerbaijan Province in Iran, confirm the positive contribution of PPPs on healthcare system development. Their study demonstrates that PPP initiatives improved service delivery, strengthened hospital management, and expanded patient access, while also mobilising resources and enhancing the overall responsiveness of the health system. Nevertheless, consistent with the findings of Zine El Abidine et al., the authors note that weaknesses in infrastructure and coordination can limit the extent of achievable improvements. This convergence across national contexts underscores that institutional preparedness and governance capacity are critical determinants of PPP success across different socioeconomic environments.

Extending the perspective to a broader international scale, Sadeghi et al. (2022) conducted a cross-country comparison involving the United Kingdom, Canada, Turkey, Australia, and Iran, demonstrating that PPPs can deliver tangible improvements in hospital performance across both clinical and non-clinical areas. Their analysis underscore that long-term contracts, ranging between 12 and 40 years, promote continuity, stronger accountability, and greater operational efficiency when built upon robust performance

indicators and balanced risk-sharing arrangements. This focus on contractual design and performance monitoring aligns with earlier findings by Gharaee et al. and Basabih et al., reinforcing the idea that PPP effectiveness depends critically on the coherence between institutional frameworks, regulatory capacity, and the competencies of participating partners.

Evidence from lower-income environments, such as the study by McIntosh et al. (2015) on the Lesotho hospital network, reinforces these broader findings. By comparing a PPP-operated referral hospital with a publicly managed system, the authors observed superior clinical quality, higher levels of patient satisfaction, and improved efficiency under the PPP arrangement. These improvements were linked to modern infrastructure, efficient resource allocation, and more responsive managerial systems. Echoing the conclusions of Sadeghi et al. and Ghasemi et al., McIntosh and colleagues emphasise that robust contractual structures and strong regulatory oversight are essential for unlocking the full benefits of PPPs in resource-limited settings.

Lastly, the study by Krivenko et al. (2021) expand the debate by assessing PPP initiatives at local and regional levels in Russia and abroad. Their findings indicate that PPPs have improved not only healthcare access and service quality but also contributed to wider socio-economic development through infrastructure improvements, job generation, and technological innovation. The authors argue that localized, bottom-up PPP configurations—in which municipalities engage directly with private investors—enable more context-specific, adaptive, and accountable healthcare solutions. This perspective is consistent with the conclusions of McIntosh et al. (2015) and Gharaee et al. (2021), confirming that PPPs are most effective when embedded within governance structures that promote coordination, responsiveness, and shared accountability.

Taken together, these empirical contributions provide a coherent picture of the positive impacts of PPPs across diverse geographical and institutional contexts. They indicate that PPPs can enhance access to healthcare, improve service quality, and strengthen resource mobilisation within health systems. However, a critical insight emerges: the scale and durability of these benefits depend less on the PPP model itself than on the institutional, regulatory, and managerial capacities that underpin its implementation.

Table 1: Empirical Studies Reporting Positive Impacts of PPPs in the Health Sector

Authors and Year	Country	PPP model	Focus of Study	Main Positive Findings	Key Success Factors Identified
Joudyan et al. (2021)	Multi-country / Conceptual	Health service PPPs	Access to healthcare, especially in remote areas	PPPs improve access and service provision in underserved regions	Transparency, flexibility, sustainable financing, strong monitoring by public sector
Ghasemi et al. (2022)	Multi-country (comparative)	Public-private cooperation in service delivery	Public-private cooperation and coverage of health services	Improved service provision, responsiveness, and reduced inequalities	Strong government-private interaction, institutional development
Basabih et al. (2022)	Global (hospital-focused review)	Hospital infrastructure & service PPPs	Hospital financing and service delivery	PPPs bridge infrastructure and service gaps under budget constraints	Institutional maturity, financial sustainability, effective policy frameworks
Zine El Abidine, Hajji & Bouhmala (2023)	Morocco	Dialysis service PPP	PPPs in renal dialysis services	Enhanced quality, continuity of care, and efficiency	Capacity building, training, institutional governance
Gharacee et al. (2021)	Iran (East Azerbaijan Province)	Hospital PPP	Hospital PPP implementation	Improved hospital operations, patient access, and resource mobilization	Institutional readiness, coordination mechanisms, infrastructure capacity
Sadeghi et al. (2022)	UK, Canada, Turkey, Australia, Iran	Hospital infrastructure PPP (PFI-type)	Comparative hospital PPP performance	Improved clinical and non-clinical performance, facility management, and maintenance	Long-term contracts, performance indicators, balanced risk-sharing
McIntosh et al. (2015)	Lesotho (Africa)	Hospital PPP	PPP-managed vs. public hospital network	Higher clinical quality, patient satisfaction, and management efficiency	Robust regulation, clear contracts, leadership and accountability
Krivenko et al. (2021)	Russia / International	Local health PPPs	Local and regional PPP initiatives	Improved infrastructure, service quality, and local socio-economic development	Local coordination, managerial flexibility, stakeholder accountability

Source : Author's own elaboration

The negative and mixed effect of PPPs in health

While the majority of empirical evidence underscores the potential benefits of Public–Private Partnerships (PPPs) in healthcare, a significant number of studies also report mixed or negative outcomes, especially concerning fiscal sustainability, governance practices, and equity in access to care. These studies stress a fundamental point: PPP outcomes are not inherently beneficial. Their success depends critically on contextual factors such as institutional strength, contract design, and the alignment of incentives and responsibilities between public authorities and private partners.

A key study by Hellowell (2019) on the Lesotho hospital PPP illustrates the inherently contradictory nature of PPP outcomes in low-income settings. Although the project achieved measurable improvements in clinical quality and facility management, it also created severe fiscal pressures, diverting a disproportionate portion of the national health budget. Hellowell warns that weak procurement capacity, limited competition, and poor budgeting practices can turn PPPs into enduring financial burdens rather than efficiency-enhancing mechanisms. These results show that without strong institutional safeguards, improvements in service quality may come at the expense of affordability and public accountability.

Extending this line of critique, Romero and Van Waeyenberge (2020) adopt a political-economy approach to show that PPPs often contribute to the financialisation of public health infrastructure, converting hospitals and services into revenue-generating assets for private investors. From this standpoint, PPPs represent more than contractual arrangements; they function as mechanisms of structural change that redirect public value creation toward private accumulation. The authors caution that such tendencies can weaken the redistributive mission of health systems and amplify social inequalities, especially where regulatory capacity is insufficient to safeguard equity and public accountability.

A complementary line of critique is provided by Hunter and Murray (2019), who situate the growth of health PPPs within the broader “private turn” in development finance. They contend that growing dependence on private capital to finance public goods—most notably healthcare—may lead to the dominance of market imperatives over social objectives. Their analysis shows that donor agencies and international financial institutions often encourage PPPs as a substitute for public investment, thereby embedding commercial logics within essential health services. Similarly, Dentico (2021) highlights the expanding role of private-equity firms and investment funds in health PPPs, framing this trend as part of a financialised development paradigm in which investor returns are prioritised over equitable health outcomes.

These financial and governance concerns are echoed by Hodge and Greve (2017), who argue that PPPs frequently face transparency and accountability

challenges arising from complex long-term contracts. Their review reveals that governments routinely face difficulties in supervising performance, handling renegotiations, and maintaining control, which can lead to escalating costs and rigidity in service delivery. Similarly, Casady and Mikic (2022) argue that PPP failures are commonly linked to poorly designed risk-sharing mechanisms and insufficient regulatory oversight, conditions that can leave the public sector exposed to unexpected fiscal liabilities and undermine long-term value for money.

Collectively, these contributions offer a critical counterweight to prevailing enthusiasm about PPPs. While demonstrating that PPPs can indeed improve service delivery when supported by strong institutional arrangements, these studies also show that PPPs carry significant risks of inefficiency and inequity when introduced in environments marked by weak administrative capacity or limited transparency. The evidence thus supports a balanced interpretation: PPPs are not inherently good or bad, but their outcomes depend on the balance between performance incentives and public accountability, as well as on the strength of the institutional environment in which they operate.

Table 2: Empirical Studies Reporting Negative or Mixed Impacts of PPPs in the Health Sector

Authors and Year	Country	PPP model	Focus of Study	Main Negative or Mixed Findings	Key Success Factors Identified
Hellowell (2019)	Lesotho	Hospital PPP	Fiscal sustainability and hospital PPPs	Improved service quality but excessive fiscal burden on the health budget	Weak procurement capacity, poor contract design, limited competition
Romero & Van Waeyenberge (2020)	Global / Theoretical	Infrastructure PPP	Political economy of PPPs in health	PPPs contribute to the financialisation of health infrastructure	Inequality, private asset conversion, weak regulation
Hunter & Murray (2019)	Global (development finance)	Health PPP financing	Private capital in health PPPs	PPPs embed commercial logics into public services	Overreliance on private finance, loss of public control
Dentico (2021)	Global (development critique)	Financialised PPP structures	Financialisation and private equity in health PPPs	PPPs prioritize investor returns over equity in access	Dominance of private capital, weak social orientation
Hodge & Greve (2017)	OECD countries	Infrastructure PPP	Comparative PPP performance	Contract complexity leads to cost overruns, inflexibility, and low transparency	Poor monitoring, accountability deficits, rigid long-term contracts
Casady & Mikic (2022)	OECD / Global	PPP risk allocation models	Risk allocation and fiscal sustainability	PPP failures often stem from unbalanced risk-sharing and poor regulation	Inadequate oversight, weak risk transfer, public fiscal exposure

Source : Author’s own elaboration

Determinants of success and failure of PPPs in healthcare sector

The contrasting outcomes reported across empirical studies highlight that the performance of Public–Private Partnerships (PPPs) in the health sector is fundamentally determined by the institutional, contractual, and relational conditions under which they are implemented. Rather than intrinsic features of the PPP model, it is these enabling or constraining factors that explain why some projects achieve efficiency and quality gains while others generate fiscal risks or governance failures.

A first determinant concerns the institutional and legal framework within which PPPs are developed. Empirical evidence consistently shows that clear regulations, transparent procurement procedures, and standardized contract templates enhance predictability and reduce transaction costs (Yescombe, 2018; OECD, 2012). Countries with dedicated PPP units or specialized agencies tend to perform better in project preparation, evaluation, and monitoring, ensuring that partnerships deliver value for money and remain fiscally sustainable. By contrast, weak institutional oversight often results in poorly drafted contracts, limited competition, and unbalanced risk allocation—issues that have been recurrent in several developing contexts examined by Hellowell (2019) and Gharaee et al. (2021).

Second, the capacity of public authorities to manage complex long-term contracts is central to PPP success. Studies such as those by Roehrich, Lewis & George (2014) and Zine El Abidine et al. (2023) demonstrate that governments must possess strong technical, managerial, and financial expertise to negotiate, implement, and supervise PPP agreements effectively. Without this capacity, asymmetries of information and dependence on private operators can emerge, undermining accountability and performance monitoring.

A third determinant relates to the design and quality of contractual arrangements. As emphasized by Hodge & Greve (2017) and Sadeghi et al. (2022), well-calibrated risk-sharing mechanisms, performance-based payment systems, and clear dispute-resolution procedures are essential to align incentives between public and private actors. Inadequate risk allocation—where the public sector retains most financial exposure or where private partners face unrealistic performance targets—has often been at the root of PPP underperformance or failure.

Equally important is the relational dimension of governance. Successful PPPs are characterized by cooperative relationships built on mutual trust, transparent communication, and joint problem-solving. Montagu & Harding (2012) and Roehrich et al. (2014) show that relational governance mechanisms—such as steering committees, shared monitoring platforms, and adaptive management—facilitate flexibility and learning over time,

particularly in dynamic sectors like healthcare where demand and technology evolve rapidly.

Financial structure also plays a decisive role. As noted by Casady & Mikic (2022) and Basabih et al. (2022), blended-finance models that combine public and private capital can expand fiscal space for health investment, but only when supported by transparent accounting standards and sustainable revenue flows. Projects reliant on volatile or uncertain funding streams risk generating hidden liabilities and long-term fiscal stress.

Finally, political commitment and policy continuity are indispensable for maintaining investor confidence and ensuring project longevity. Frequent policy reversals, administrative turnover, or shifts in political priorities can disrupt project implementation and weaken stakeholder trust. Conversely, stable political support, as seen in successful cases documented by McIntosh et al. (2015) and Krivenko et al. (2021), helps consolidate institutional learning and attract further private participation.

In sum, the empirical literature demonstrates that PPP outcomes depend on a multidimensional ecosystem of institutional quality, contractual rigor, financial stability, and relational governance. When these conditions coexist, PPPs can enhance efficiency, innovation, and accessibility in healthcare delivery. When they are absent, however, the same arrangements may generate inefficiencies, inequities, or fiscal burdens. These determinants thus provide the analytical bridge between the optimistic and critical strands of the literature, underscoring that PPPs' effectiveness lies not in their form but in the governance context that sustains them.

Discussion

The empirical evidence reviewed reveals that Public–Private Partnerships in the health sector constitute neither a universally successful policy instrument nor an inherently problematic one. Their performance depends fundamentally on the governance architecture, institutional capacity, and contractual arrangements underpinning their implementation. This conclusion aligns with the theoretical frameworks discussed earlier, which explain PPP dynamics through the interaction of agency relationships, contract incompleteness, and the broader paradigms of New Public Management (NPM) and financialisation.

At a broader analytical level, the divergence of PPP outcomes between developed and developing countries reflects structural differences in institutional capacity, regulatory enforcement, and fiscal resilience. While high-income countries may absorb contractual rigidity and long-term financial commitments, developing economies face higher vulnerability to fiscal stress, renegotiation risks, and governance asymmetries. This structural gap explains

why similar PPP models can generate efficiency gains in some contexts and fiscal fragility in others.

From the perspective of agency theory, PPPs are conceived as mechanisms designed to align the incentives of public principals and private agents through performance-based contracts. The positive outcomes identified in the reviewed studies—such as efficiency gains, enhanced quality of care, and improved infrastructure in contexts like Morocco (Zine El Abidine et al., 2023), Iran (Gharaee et al., 2021), and Lesotho (McIntosh et al., 2015)—illustrate situations in which risk-sharing arrangements and performance monitoring effectively mitigated opportunistic behaviour. When the principal (the government) possesses sufficient contractual and technical capacity to specify measurable outputs and monitor performance, agency problems diminish, resulting in superior outcomes. Conversely, the failures documented by Hellowell (2019) or Romero and Van Waeyenberge (2020) highlight how information asymmetry and weak oversight allow private actors to capture rents, leading to fiscal burdens and loss of public accountability. Thus, PPP performance depends on the balance between incentive alignment and the state's ability to control and evaluate the agent's behaviour.

The theory of incomplete contracts further clarifies why PPP results diverge across contexts. Health-sector partnerships are intrinsically complex and long-term, encompassing multiple tasks and uncertain contingencies that cannot be fully anticipated *ex ante*. Incomplete contractual clauses therefore create “grey zones” of interpretation that require renegotiation or discretionary adjustments. When these arrangements are supported by institutional trust and adaptive governance—as noted by Joudyan et al. (2021) and Sadeghi et al. (2022)—they promote flexibility and innovation. However, in institutional environments where administrative capacity and transparency are weak, contractual incompleteness becomes a source of risk exploitation, opportunism, and escalating costs. This theoretical lens explains why PPPs in developing contexts may initially deliver visible results but later encounter sustainability problems once unforeseen events arise or financial commitments accumulate.

From the standpoint of New Public Management (NPM), PPPs embody the managerial reform agenda that seeks to introduce private-sector efficiency, accountability, and customer orientation into public services. The reviewed evidence confirms that NPM-inspired principles have indeed fostered improvements in hospital performance, patient satisfaction, and service responsiveness (Ghasemi et al., 2022; Sadeghi et al., 2022). Nonetheless, the translation of private-sector logics into the public domain also produces tensions between efficiency and equity. Studies such as those of Hunter and Murray (2019) and Hodge and Greve (2017) demonstrate that managerialism and performance contracting can shift attention away from

universality and affordability, especially when cost recovery through user fees or long-term payment commitments undermines fiscal equity. Consequently, while NPM provides a useful efficiency framework, its application in health PPPs requires strong public stewardship to preserve the social objectives of healthcare provision.

The concept of financialisation provides a complementary macro-level interpretation of these dynamics. As Romero and Van Waeyenberge (2020) and Denticò (2021) argue, the expansion of PPPs in health systems reflects a structural transformation in development finance: public infrastructure and services are increasingly treated as financial assets generating predictable cash flows for investors. This evolution explains the growing involvement of investment funds and private equity actors, as noted in the empirical cases of Sadeghi et al. (2022) and Krivenko et al. (2021). Financialisation thus redefines the nature of PPPs—from collaborative service arrangements to investment vehicles—raising normative questions about accountability and the public value of private profit. The challenge for policymakers is therefore to design PPP frameworks that attract private capital without surrendering public control or compromising equity outcomes.

Integrating these theoretical perspectives, the empirical literature suggests that successful PPPs are those that reconcile contractual efficiency with public accountability. They rely on robust institutional capacity to manage risk, on transparent governance to ensure fiscal discipline, and on continuous stakeholder coordination to sustain trust over the project lifecycle. The Moroccan and Iranian experiences exemplify how capacity-building and adaptive learning can transform PPPs into catalysts for system-wide improvement. Conversely, the Lesotho and international cases remind that when political oversight, technical expertise, or regulatory safeguards are weak, PPPs can generate fiscal fragility and social exclusion rather than efficiency.

Ultimately, PPPs in healthcare should not be understood merely as funding instruments but as complex governance mechanisms that redistribute roles, risks, and rewards between the state and the market. Their success depends less on contractual formality than on the institutional and ethical capacity of governments to steward partnerships in the public interest. Ensuring that private participation serves collective welfare rather than private accumulation requires transparent frameworks, measurable performance standards, and the political will to enforce them. In this regard, the synthesis of theoretical and empirical evidence underscores a critical insight: PPPs are neither a panacea nor a peril—they are tools whose outcomes are shaped by the quality of governance, not by the partnership itself.

Conclusions

This article has examined the role of Public–Private Partnerships in the health sector through an integrative review combining theoretical analysis and empirical evidence drawn from diverse national contexts. The findings demonstrate that PPPs have become a central instrument in contemporary health governance, providing governments with alternative mechanisms to mobilize capital, expand infrastructure, and enhance service delivery. Yet, their outcomes remain highly contingent upon the institutional, contractual, and political environments in which they are implemented.

The synthesis of empirical studies reveals a dual narrative. On one hand, PPPs have produced tangible improvements in healthcare quality, infrastructure, and efficiency, particularly in countries where institutional capacity, clear regulation, and mutual accountability mechanisms exist. Cases from Morocco, Iran, Lesotho, and Russia illustrate how PPPs can generate innovation, attract investment, and strengthen public health systems when embedded within transparent governance structures and supported by adequate technical expertise. On the other hand, several experiences highlight the risks and limitations of PPP implementation—ranging from fiscal dependency and inflexible contracts to weakened public oversight and growing financialisation of health services. These mixed results confirm that PPPs are not a universal solution but context-sensitive arrangements requiring strong state capacity and coherent long-term planning.

The theoretical integration of agency theory, incomplete contracts, New Public Management (NPM), and financialisation perspectives provides a coherent explanation for this diversity of outcomes. PPPs succeed when incentives are aligned, risks are properly distributed, and the public sector retains the ability to monitor performance and enforce accountability. They fail when contractual asymmetries, information imbalances, or profit-driven logics dominate, eroding the public value that health systems are meant to protect. The intersection of these theories underscores a broader insight: PPPs are not merely financial instruments but hybrid governance mechanisms that redefine the boundaries between state and market in the provision of essential services.

From a policy standpoint, the review suggests that the effective use of PPPs in healthcare requires robust legal frameworks, institutionalised capacity building, and transparent evaluation systems to ensure fiscal sustainability and social equity. Governments should adopt context-adapted models that emphasize accountability, community engagement, and flexibility rather than replicating generic PPP templates promoted internationally. Furthermore, developing countries, such as Morocco, can leverage PPPs as complementary tools for achieving universal health coverage, provided that they are

accompanied by solid regulatory supervision, long-term policy coherence, and mechanisms for skill transfer between sectors.

In conclusion, PPPs in the health sector embody both opportunity and risk. They hold the potential to accelerate health system development, foster innovation, and improve service delivery, but only under conditions of good governance, institutional maturity, and sustained public stewardship. The debate surrounding PPPs should thus move beyond ideological polarization toward a balanced understanding of partnership governance—one that recognises private participation as a means to achieve public health objectives, not as an end in itself. Future research could expand on this analysis by exploring country-specific models, quantitative assessments of fiscal impact, and the long-term effects of financialisation on health equity, thereby contributing to the design of more inclusive and resilient partnership frameworks.

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Global Financial Tightening Conditions and Foreign Exchange Volatility in Kenya

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Abstract

Emerging market economies, such as Kenya, are experiencing heightened foreign exchange (FX) volatility because of ongoing global financial-tightening measures that integrate them into a dysfunctional global economic system. In contrast, theoretical models, such as the Conventional Mundell–Fleming model and post-Keynesian–structuralist theory, diverge on the transmission mechanisms. Therefore, this study tests these competing frameworks to examine the impact of U.S. Federal Reserve (FED) rates, global liquidity (GLI), and global risk factors on Kenya shilling volatility. This study employed a two-stage multivariate volatility dynamic conditional correlation exponential GARCH (DCC-EGARCH) model to measure the impact of financial tightening on Kenya's Forex volatility from January 2004 to June 2025. The results confirm strong persistence in FX volatility driven by Fed tightening and global risk, with significant DCC correlations rejecting transitory absorption. Domestic monetary policy, proxied by the central bank rate (CBR), exhibits a weak shock response despite high persistence, whereas Fed/CBR and GLI/CBR interactions show procyclical leverage effects, validating Köhler's Minskyan cycles over symmetric Mundell-Fleming adjustments. These findings advance emerging market theoretisation by demonstrating how global financial tightening triggers contractionary balance-sheet channels in debt-dependent economies, thereby limiting domestic monetary policy autonomy. Kenya should prioritize macroprudential

buffers alongside reserves accumulation over sole rate reliance to mitigate future US-led volatility spillovers. The originality of this paper lies in the testing of the Conventional Mundell-Fleming model, which views flexible rates as shock absorbers, versus the post-Keynesian-structuralist theory, which warns of endogenous amplification via balance-sheet fragilities.

Keywords: Foreign exchange volatility, global financial tightening, EGARCH, stochastic volatility, Kenya Shilling, monetary policy, Federal Reserve, exchange rate management

Introduction

1.1. Background of study

Emerging-market economies are experiencing heightened foreign-exchange (FX) volatility due to ongoing global financial-tightening measures that integrate them into a dysfunctional global economic system characterized by deep-rooted structural vulnerabilities, such as excessive foreign currency-denominated debt and shallow financial markets. Kenya's economy is at a critical crossroads as the ripple effects of global financial tightening intensify, causing unprecedented volatility in the foreign exchange market. With the Kenyan shilling experiencing sharp fluctuations against major currencies, understanding how global monetary shifts impact Kenya's exchange rate stability has never been more urgent. Exchange rate instability endangers macroeconomic stability and makes policy options to stimulate growth and decrease poverty in this emerging economy difficult (World Bank, 2023; Wanzala et al., 2024; Mosbei et al., 2021). This study examines Kenya's exchange rate volatility during global financial tightening through empirical evidence, providing empirical insights into the transmission mechanisms of global influence on Kenya's economic outlook and discussing the challenges they pose. In addition, this study contributes novel theoretical perspectives via post-Keynesian and structuralist approaches to emerging-market economies and challenges the traditional notion that flexible exchange rates are simply shock absorbers for foreign-exchange-rate volatility (Köhler, 2023).

Post-Keynesian theories demonstrate that currency depreciation causes contractionary effects through various channels, including balance-sheet effects, in emerging market economies with high levels of public and private sector external debt. In contrast, institutional weaknesses amplify the effects of external shocks by creating endogenous boom-bust cycles based on structuralist views of the world (Köhler, 2023; Stockhammer & Köhler, 2021). Traditional Mundell-Fleming models assume a symmetric adjustment process in terms of the emergence of foreign-exchange-rate volatility, whereas an emerging-market theoretical framework reveals numerous asymmetries (Fleming, 1962; Mundell, 1960). As a result of global tightening, interest-rate

differentials narrow, causing capital outflows that result in greater levels of volatility than predicted by advanced economies, where flexible exchange rates typically create self-fulfilling expensive eight-to-ten-year boom-bust cycles, rather than simply absorbing shocks (Krugman, 1998; Köhler, 2023; Bruno & Shin, 2015). In the Kenyan economy, these dynamic processes are particularly evident, as evidenced by the depreciation of the Kenyan shilling as a consequence of U.S. policy changes associated with the commodity dependency of the Kenyan economy.

Most existing studies on exchange rate volatility in Kenya have primarily focused on domestic factors, such as inflation, interest rates, and remittances, overlooking how global financial dynamics shape currency behavior. Scholars have yet to thoroughly examine the direct and indirect impacts of global financial tightening—especially through U.S. federal fund rate changes and worldwide financial stress—on the Kenyan shilling (Abdi et al., 2020; Kiptui, 2019). Given Kenya's openness to international market movements, this external dimension remains critical but underexplored. Recent work has sought to address this by investigating how global financial tightening episodes affect exchange rate volatility, offering fresh empirical insights into external shock transmission (Eguren-Martin & Sokol, 2022). Furthermore, limited attention has been given to global commodity price fluctuations, even though Kenya's trade structure makes it vulnerable to such shocks; integrating commodity prices as key variables can thus enhance the understanding of external forces influencing exchange rate movements (Miriti, 2024).

1.2. Impact of Global Financial Tightening on Kenya's Exchange Rate

Global monetary tightening by advanced economies has triggered financial market challenges that have severely affected Kenya's economic stability. The Kenyan shilling has lost more than 20% of its value against the US dollar during 2022–2024, reaching a low of KES 160.80 per dollar in January 2024 amid rising international interest rates, reflecting intensified capital outflow pressure. The exchange rate decline resulted from international interest rate hikes, domestic supply chain disruptions, and shifting commodity market values (Mbugua & Maseno, 2024). The Kenyan shilling depreciation pattern mirrored the global monetary policy-tightening phases and investors' increasing skepticism about emerging market economies.

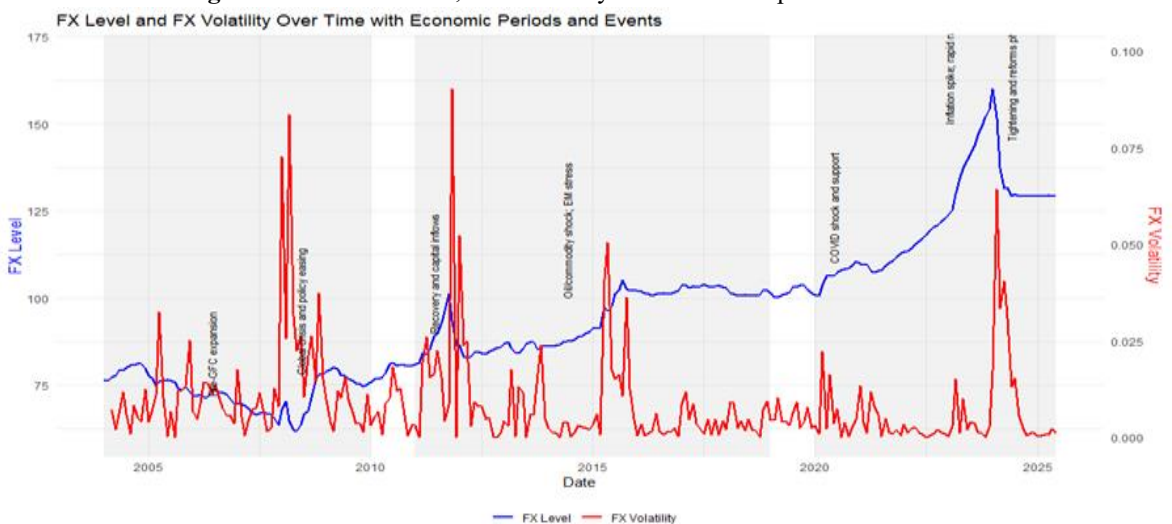
As global interest rates increase, emerging markets are increasingly challenged to finance their external needs, which causes a sharp decline in foreign exchange inflows. Similar to other emerging markets, these capital outflows in Kenya have not only led to considerable depreciation of the shilling but have also heightened Forex volatility against the US dollar. This volatility increases uncertainty for both businesses and policymakers

attempting to manage the economy. Along with these bouts of global monetary tightening (such as the U.S. Federal Reserve's series of interest rate hikes), Kenya has weathered sustained depreciation pressures and a vacillating foreign exchange market (Abdi et.al., 2020). In April 2022, the Central Bank of Kenya (CBK) took steps to address market instability through foreign exchange scarcity relief measures, including commercial bank dollar purchase restrictions. The scale of external shocks and the ongoing global financial market volatility restrict the effectiveness of these interventions. Monetary policy constraints worsened because Kenya faced reduced foreign exchange reserves and a deteriorating external position when dealing with unfavorable global liquidity conditions (Barasa, 2022; Sumba et al., 2024).

1.3. Stylized Facts

Figure 1 shows the foreign exchange rate of the movement of the Kenyan Shilling (KES) against the US dollar (USD) from 2004 to mid-2025, with shaded sections indicating major political and economic events that influenced this exchange rate. Kenyan Shilling to US Dollar exchange rate (KES/USD) (blue) and FX volatility (red) from 2004 to 2025. Kenyan Shilling maintained stable exchange rates with slight appreciation from 2004 to 2007 because of economic expansion, market reforms, and political stability, which attracted foreign investors. The FED rate increase led to a stronger US dollar value until the 2008 global financial crisis triggered a rapid dollar value decline due to US monetary policy relaxation, as shown in Figure 2. However, the 2008–2009 global financial crisis and Kenya’s post-election violence led to sharp depreciation and heightened volatility as capital flights and domestic unrest undermined the currency.

Figure 1: FX movement, FX Volatility and Economic periods and Events:



Source: Author construction from the data

Following this crisis, the Fed rate remained near zero for several years during the recovery and capital-inflow phases. However, in Kenya, between 2010 and 2012, economic recovery efforts, renewed foreign investment, and the adoption of a new constitution helped temporarily appreciate shilling. This was followed by depreciation from 2014 to 2016, driven by global commodity shocks, fiscal challenges, regional security concerns, and political instability. However, as depicted in Figure 2, during the same period, the Fed rate gradually increased as the economy faced oil and commodity shocks, along with emerging market stress.

From 2017 to 2019, while the Fed rate continued to tighten steadily, the Kenyan shilling saw relative stabilization backed by monetary tightening, reforms such as the interest rate cap, and managed political transitions. During the COVID-19 pandemic period (2020–2021), global monetary policy easing was observed, with the Fed rate plunging rapidly to nearly zero as the Fed responded to the COVID-19 shock through emergency support measures. However, in Kenya, the COVID-19 pandemic has caused economic disruptions and shilling volatility, although policy interventions have provided some support.

As shown in Figure 1, the Kenyan shilling has experienced a rapid decline from 2022 to 2023, fueled by inflation spikes, supply chain disruptions, drought, and rapid interest rate hikes, compounded by fiscal pressures and sociopolitical unrest. Similarly, the Federal Reserve (FED) rate has sharply increased from 2022 to 2023, owing to an inflation spike and rapid rate hikes, as indicated in Figure 2. The tapering of the FED rate in 2024 and 2025 signifies a period of tightening and reforms, whereas the shilling has begun to lose value. In general, the course of the shilling represents the influence of these different global megatrends on Kenya's political and economic policies, along with the country's underlying issues. The shilling tends to depreciate during periods of external shocks and inflationary pressure and offers greater stability during reforms and policy tightening. Political shifts, external shocks, fiscal deficits, and inflationary pressure have been the main drivers of exchange rate movements over the past 20 years.

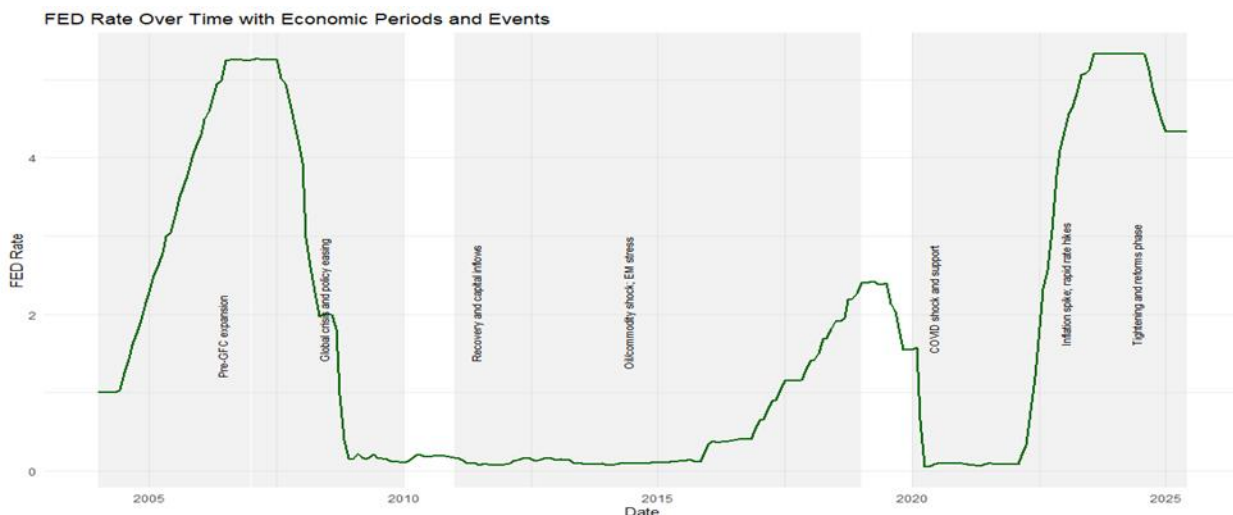


Figure 2: US Fed rate Movement over time with Economic periods and events

The relationship between KES/USD exchange rate volatility and global monetary policy is evident, as peaks in the Fed rate accompany upward trends in the FX rate. The KES/USD exchange rate becomes highly volatile when the Fed rate increases because markets experience high uncertainty, whereas capital flows and risk perceptions lead to fast market adjustments. The KES exchange rate stabilizes or strengthens when the Fed rate decreases because the dollar value decreases, resulting in decreased FX volatility.

1.4. Statement of the Problem

The Kenyan economy has experienced significant exchange rate volatility over the last 20 years due to global financial tightening. Global money tightening occurred because global interest rates increased and global liquidity decreased in countries such as the United States. After the Global Financial Crisis, the Federal Reserve (FED) gradually initiated an interest rate increase, starting from near zero up to 2018. The Federal Reserve (FED) cut rates and later increased them from 2024 to 2025. The tightening phases led to currency depreciation, capital outflows, and inflationary pressures that hurt monetary stability and undermined economic growth in emerging markets, such as Kenya. According to empirical data, the KES/USD exchange rate became more volatile during these periods, with episodes of sharp depreciation around 2015–2017 and again from 2022 onwards, aligning with periods of FED rate hikes (Abdi et al., 2020; Harikrishnan et al., 2023). (Abdi et al., 2020; Harikrishnan et al., 2023).

Global financial tightening conditions have resulted in capital outflows from emerging economies in search of safer assets with higher returns, leading to depreciation pressures on the Kenyan shilling, which in turn raises imports

and pushes inflation to upper limits. Despite the interventions by the CBK, such as adjusting the Central Bank Rate (CBR), continued global spillovers, and domestic fiscal vulnerabilities, external shocks, such as volatile oil prices, continue to inhibit the Kenyan shilling exchange rate from stabilizing (Maana et al., 2010). Such volatility poses significant pressure and challenges to economic stability across many Sub-Saharan African countries by increasing inflation expectations, debt service burdens, and discouraging both foreign direct and domestic investments. As such, the overall economic resilience of Kenya could be adversely impacted by affecting foreign exchange reserves and growth prospects (Matschke et al., 2023; World Bank, 2024).

Despite the importance of understanding these linkages, empirical research on the transmission of global financial tightening through exchange rate volatility patterns in Kenya remains poorly documented. The literature fails to identify the mechanisms by which commodity price changes create external financial shocks that affect exchange rates and economic stability in Kenya. The lack of research on this topic prevents policymakers from creating prompt and effective solutions to stabilize foreign exchange markets while preserving economic stability during ongoing global financial instability (Mwangi, 2015; Abdi et al., 2020).

1.5. Objectives of the Study

The overarching objective of this study examines the influence of global financial tightening on exchange rate volatility in Kenya.

1.5.1 Specific Objectives

The specific objectives of the study are to:

- (i) Analyze the Impact of global monetary policy changes on Exchange Rate Volatility
- (ii) Examine the Impact of global liquidity indicator on Exchange Rate Volatility
- (iii) Assess the Influence of Global Commodity Prices on Exchange Rate Volatility
- (iv) To investigate the Role of Domestic Monetary Policy (CBR) in stabilizing exchange rate volatility amid global financial tightening.

2. Literature Review

2.1. Theoretical Literature Review

This study is anchored in post-Keynesian theory, particularly Köhler's Minskyan framework and the Mundell-Fleming model. The Mundell-Fleming model assumes that international financial tightening (such as U.S. interest rate hikes) is an external shock that raises global interest rates and triggers

capital flight from emerging markets. They view currency depreciation as being absorbed through increased net exports due to the J-curve effect, which produces short-term currency fluctuations and stabilizes output. This perspective brings the policy trilemma (impossible trinity) into focus. The trilemma states that a country may simultaneously choose any two of the following three policy goals: monetary independence, exchange rate stability, and financial integration (Aizenman, 2013; Sengupta, 2016; Iqbal, 2022; Obstfeld & Taylor, 2004).

In contrast, post-Keynesian theory, specifically using Köhler's Minskyan frame of reference, considers international financial tightening as an endogenous risk-off shock. They do not view currency depreciation as being absorbed by J-curve effects; instead, they view tightening as a catalyst for increasing the amplitude of the endogenous boom-bust cycle. In their view, international financial tightening leads to capital inflows during monetary easing, which increases the value of a country's currency via its foreign exchange liabilities and improves the country's overall balance sheet. This, in turn, supports increased investment and deficit spending. However, when the U.S. raises interest rates, this action creates capital outflows from emerging markets, resulting in stronger currency devaluation and added contractionary balance sheet effects that ultimately force the country to deleverage capital and drive the country deeper into an economic recession (Köhler, 2023; Köhler, 2019).

Mundell-Fleming assumes that all trade-led adjustments are symmetrical and that countries have policy autonomy within the constraints of the trilemma; in contrast, post-Keynesian models (such as Köhler's) focus on the asymmetries created by currency mismatches and financial fragility, making them more applicable to debt-burdened emerging markets (e.g., Kenya) and their currency volatility and the associated impacts of international financial tightening. This research challenges the traditional Mundell-Fleming assumption that flexible exchange rates provide complete monetary policy independence, suggesting instead that global financial conditions create a powerful channel through which advanced economic policies affect emerging markets.

2.2. Empirical Literature Review

2.2.1. Global Monetary Policy and Foreign Exchange Volatility

The effects of global monetary policy on foreign exchange (forex) volatility in emerging and developing economies (EMDEs) have garnered significant scholarly attention, particularly in light of recent global economic disruptions. A comprehensive analysis of the literature reveals a complex interplay between global monetary policy, capital flows, and forex volatility. Multiple studies have demonstrated that Federal Reserve tightening creates

major adverse effects on emerging markets and developing economies (EMDEs). According to Iacoviello and Navarro (2019), U.S. interest rate increases of 100 basis points led to a 0.8 percent decrease in GDP growth in emerging economies during the following three years. External sensitivity to U.S. monetary policy shocks remains high for countries that maintain dollar-denominated debt or weak policy frameworks.

Benigno et al. (2012) use a two-country open-economy model to show that higher monetary policy shock volatility leads to major real exchange rate adjustments, in which the real exchange rate appreciates after inflation-target shock volatility increases; however, currency risk premiums show less systematic responses. Using a vector autoregressive (VAR) model, this study demonstrates that increased U.S. monetary policy volatility causes real economic activity to shrink while affecting international prices, resulting in enhanced exchange rate fluctuations in both emerging and developed economies (Benigno et al., 2012).

Akinci and Queralto (2019) used a two-country new Keynesian model to study how U.S. monetary policy affects foreign economies through financial frictions and dollar debt in balance sheets. The structural vector autoregression (SVAR) model demonstrated that uncovered interest parity (UIP) deviations from U.S. policy create substantial effects that impact exchange rate volatility. The mechanism shows how U.S. monetary policy actions create global financial system connections that produce international market effects on exchange rates (Akinci and Queralto 2019).

Alba et al. (2024) extend this discussion by studying how U.S. monetary policy announcements affect Mexican financial and macroeconomic indicators using a VAR model. The research shows that positive information shocks from the U.S. central bank improve Mexican financial conditions, resulting in peso appreciation and reduced forex volatility. Conversely, restrictive monetary policy shocks tighten financial conditions, adversely affecting real activity and increasing forex volatility, thereby emphasizing the direct link between U.S. monetary policy and forex dynamics in EMDEs.

A recent European Central Bank (ECB) working paper documented how global financial tightening, such as rising interest rates and financial stress, affects the distribution of exchange rate returns. By employing a quantile regression model, the study finds that the currencies of countries with high interest rates, large current account deficits, and low reserves are particularly vulnerable to sharp depreciation during tightening periods. This study quantified the increased risk of extreme exchange rate movements under adverse global conditions (Eguren-Martin & Sokol, 2022). Another study constructed a financial stress index to examine its predictive value for exchange rate volatility in SSA countries. The results showed increased

financial stress, often linked to global tightening, significantly increased exchange rate volatility in the region. The findings highlight SSA economies' vulnerability to external shocks and emphasize the need for stronger financial system stability (Rufai et al., 2023).

In addition, Engler et al. (2023) highlight that changes in US interest rates strengthen the dollar against major currency appreciation by approximately 3–4% per significant Fed tightening, leading to increased FX volatility worldwide. Moreover, World Bank research focusing on EMDEs notes that inflation-driven shocks from rising US interest rates cause capital outflows, which widen sovereign bond spreads and depress equity valuations, while directly contributing to local currency depreciation under pressure from tighter global liquidity conditions (Arteta et al., 2022).

2.2.2. Global Liquidity and Foreign Exchange Volatility

Research has focused on how global liquidity affects foreign exchange volatility in both emerging and developing economies (EMDEs). Dua and Verma (2024) examine the relationship between gross capital inflows and outflows to show that the global financial cycle (GFCy) affects capital flows in EMDEs. Research shows that the sensitivity of EMDEs' capital flows to global trends depends heavily on both liquidity conditions and macroeconomic indicators in advanced economies. The sensitivity of capital flows affects forex volatility because exchange rates experience increased pressure when capital flows fluctuate.

Choi, Kang, Kim, and Lee (2017) analyze how global liquidity spread to EMEs and their policy actions from 2000 to 2015. They gather extensive data on liquidity indicators and capital flow information from emerging markets. The authors employ panel regression models together with interactive fixed effects to measure liquidity spillovers and policy impacts. The research shows that liquidity increases from developed economies, triggering changes in the exchange rates and financial markets of EMEs, which leads to policy interventions through interest rate changes and capital control implementation to stabilize markets. This study demonstrates how global liquidity conditions and forex volatility are connected, which helps to explain the mechanisms by which global financial tightening affects EMEs (Cevik et al., 2016).

The literature on the effects of global liquidity indicators on foreign exchange (FX) volatilities in emerging and developed nations reveals nuanced and significant relationships shaped by market structure, economic fundamentals, and investor behavior. Banti, Phylaktis, and Sarno (2011) provide a foundational study by constructing a global liquidity risk measure for the FX market using extensive order flow data across 20 US dollar exchange rates over 14 years. Their findings establish that liquidity risk is an

important priced factor in currency returns, with a significant commonality across currencies, indicating that global liquidity shocks affect FX volatilities consistently across markets, but with varying intensity depending on local factors (Banti et al., 2011). This underscores the critical role of microstructural elements, such as dealer behavior and order flows, in explaining FX volatility.

Empirical studies focusing on the relationship between global liquidity and forex volatility in Africa have yielded mixed results, reflecting the diverse economic landscapes and policy regimes across the continent. For instance, Daggash and Abraham (2017) establish evidence that increases in global liquidity tend to be associated with higher forex volatility in African countries, particularly those with more open capital accounts. Conversely, other studies show that increased financial openness also leads to increased income volatility for the de jure measure of financial openness, whereas for the de facto measure, increased financial openness reduces income volatility (Tolulope & Charles, 2019).

2.2.3. Global Commodity prices and foreign exchange volatility

The relationship between commodity prices, particularly crude oil prices, and foreign exchange volatilities has garnered significant attention in recent years, particularly in oil-dependent economies. World Bank studies have examined how trade and financial openness, as well as commodity price fluctuations, influence real exchange rate volatility. These findings suggest that financial openness can amplify volatility, and commodity price shocks are a significant source of exchange rate fluctuations in developing countries (Hanusch et al., 2018).

The relationship between crude oil futures prices and exchange rates was studied using a time-varying parameter VAR (Alam et al., 2023). This study established that major events, including the COVID-19 pandemic and geopolitical crises, increased the link between oil prices and foreign exchange rates (Alam et al., 2023). The research demonstrated that the oil and foreign exchange markets transmit shocks to each other in both directions. This dynamic interplay suggests that fluctuations in oil prices can lead to substantial volatility in foreign exchange rates, particularly in economies that are heavily reliant on oil exports.

The literature has shown growing interest in the relationship between commodity prices, especially crude oil, and foreign exchange volatilities in sub-Saharan Africa (SSA). Baek and Kim (2020) conducted an extensive examination of how oil price fluctuations affect exchange rates in SSA countries. The NARDL model shows that real exchange rates in these countries exhibit stronger responses to rising oil prices than to falling oil prices over the long term. Exchange rate dynamics are heavily influenced by oil price volatility because these economies primarily depend on a single product.

In contrast, Yeboah et al. (2025), using quantile regression (QQR) and wavelet coherence techniques, demonstrated that SSA exchange rates respond to generalized price-range (GPR) under different market scenarios, with Angola being more vulnerable to GPR during positive market conditions and Mauritius and Tanzania showing resistance. The differences in exchange rate volatility and crude oil price relationships indicate that external shock mitigation policies require customization based on geopolitical conditions.

Academic research on the effects of crude oil prices on Kenyan foreign exchange volatility has increased because Kenya depends on oil imports and operates as an open economy. Gachara (2015) demonstrated how crude oil price fluctuations cause Kenyan Shilling depreciation, while slowing economic growth. The research employed a structural vector autoregressive model with quarterly data spanning 1991 to 2014 to demonstrate that these shocks produced significant exchange rate volatility by altering monetary aggregates and inflation levels (Gachara, 2015).

2.2.4. Domestic Monetary Policy and Foreign Exchange volatility amidst global tightening

Literature on the moderating effect of monetary policy on foreign exchange volatility due to global financial tightening is complex and mixed, with some studies suggesting a negligible or small effect and others highlighting the significant influence of volatility on productivity growth (Aghion et al., 2009). The debate over the effectiveness of foreign exchange interventions has persisted in international finance for decades (Filardo et al., 2022). Research has shown that foreign exchange interventions function as effective policy tools that achieve success when specific conditions are met (Fratzscher et al., 2019). Research has shown that interventions produce short-term or minimal effects when macroeconomic policies lack consistency. Several studies have investigated how monetary policy affects exchange rate volatility in Africa by employing different econometric methods and data sources to evaluate multiple policy tools.

Kamau and Ngugi (2020) employed an event study methodology to analyze how the Kenyan shilling reacts to central bank interventions and policy announcements against major currencies (USD, GBP, and EUR). Using criteria such as event significance, directional movement, reversal, and smoothing, and applying the sign test to daily exchange rate data, their research found that central banks' foreign exchange market participation often triggers immediate and directionally consistent exchange rate changes, especially against the US dollar. It also reveals that central bank purchases tend to be associated with shilling depreciation, while combined purchases and sales during tight monetary policies often correlate with appreciation. Their

study identified mixed, lagged, and persistent responses, indicating that market reactions extend beyond announcement days and vary by currency and event clusters, reflecting the complexity of the policy impact on exchange rate volatility. These findings underscore the challenges policymakers face in managing exchange rate expectations and suggest the importance of clear communication alongside market interventions for effective exchange rate stabilization.

Similarly, Kearns and Manners (2018) investigated the impact of monetary policy on exchange rates using event studies to show how policy announcements can significantly influence exchange rate movements. This study is based on four small open economies (Australia, Canada, New Zealand, and the United Kingdom), using high-frequency intraday data and a rigorous event study methodology. Their findings show that an unanticipated monetary tightening of 25 basis points leads to a rapid and significant exchange rate appreciation of approximately 0.35%, and this effect is even larger if the change shifts expectations about the future path of policy rather than merely altering timing. By focusing purely on unexpected policy moves and isolating the announcement window, this study avoids endogeneity and provides compelling evidence that exchange rates react swiftly and strongly to monetary shocks, consistent with the theory of uncovered interest parity (UIP). This suggests that central banks in open economies can exert potent, immediate influence over currency values via well-communicated, unanticipated policy moves that can then support the strategic use of surprise and signaling in monetary policy to control exchange rate volatility and maintain macroeconomic stability.

Sumba et al. (2024) provide empirical evidence that the pass-through effect from exchange rate depreciation to inflation in Kenya is significant only when monthly depreciation exceeds a 0.51% threshold, using a nonlinear threshold autoregressive (TAR) model on data from 2005 to 2023. Sumba et al. (2024) significantly advance the literature on the monetary policy control of forex volatility by empirically confirming the existence and significance of a threshold for the exchange rate pass-through (ERPT) in Kenya. Their demonstration of nonlinearity means that central banks must not only react to inflation but also proactively manage exchange rate risks by adjusting policy tools in proportion to the scale of currency movements. Similar economies may benefit from incorporating similar frameworks to more effectively safeguard macroeconomic stability amid global volatility.

3. Methodology

3.1. Model Specification

This study uses dynamic conditional correlation exponential GARCH (DCC-EGARCH) to investigate exchange rate volatility against global

financial tightening. The DCC-EGARCH model is the most appropriate choice for studying global financial tightening conditions and foreign exchange volatility in Kenya because it uniquely combines two critical capabilities in a single parsimonious framework. The EGARCH component captures the asymmetric leverage effect, whereby negative shocks, such as sudden global tightening, generate disproportionately larger volatility than positive shocks, while also operating in log-variance space, eliminating the need for non-negativity parameter constraints common in standard GARCH models. The DCC component addresses the unrealistic assumption of constant correlations made by simpler models, such as CCC-GARCH, allowing the relationship between global financial conditions and the Kenyan shilling to evolve dynamically across different monetary policy episodes. Compared with BEKK-GARCH, it is far more computationally tractable in a multivariate setting, and unlike symmetric DCC-GARCH, it does not underestimate volatility following adverse shocks. This is particularly important, given Kenya's thin FX market, periodic central bank interventions, and asymmetric exposure to global capital flow reversals. Engle (2002) and Tse and Tsui (2002) proposed a dynamic conditional correlation (DCC) model to address the limitations of the constant correlation assumption in earlier models. The software tools used in this study were R and/or Python, to facilitate data processing and analysis.

3.1.1. Dynamic Conditional Correlation (DCC-EGARCH)

The underlying equation will be

$$Y_{it} = \alpha + \beta_1 X_{i,t} + \beta_2 Z_{it} + \epsilon_{it}$$

Where:

- Y_{it} is the Dependent (FX Volatility) variable for individual i at time t
- X_{it} represents a vector of explanatory variables (US FED rate, Global Liquidity, crude oil prices)
- $Z_{i,t}$ is the set of control variables (CBR Rate, inflation, diaspora remittances, foreign exchange reserves, and global risk aversion measures)
- ϵ_{it} is the idiosyncratic error term

This specification aligns with the study's objective of quantifying the influence of global financial tightening on Kenya's exchange rate volatility, while controlling for domestic macroeconomic variables and capturing asymmetric volatility effects.

Considering an N-dimensional time series, the return equation can be expressed by the mean equation given in Equation 2:

$$r_t = \mu + \epsilon_t$$

where r_t is the $N \times 1$ vector of returns, and μ is a $N \times 1$ vector of mean returns. ϵ_t is the $N \times 1$ vector of shock terms with mean zero and conditional covariance matrix H_t which can be modelled as:

$$\epsilon_t = H_t^{\frac{1}{2}} z_t$$

where H_t is a $N \times N$ conditional covariance matrix, $H_t^{\frac{1}{2}}$ is a $N \times N$ positive definite matrix, and z_t is $N \times 1$ vector of independent and identically distributed (i. i. d.) standard normal innovations.

$$z_t \sim N(0, I_N)$$

From the above H_t can be modeled as equation 5 below

$$H_t = D_t R_t D_t$$

Where

- $D_t = \text{diag}(\sqrt{h_{11,t}}, \sqrt{h_{22,t}}, \dots, \sqrt{h_{kk,t}})$ is a diagonal matrix containing the conditional standard deviations.
- R_t is the time-varying correlation matrix.

The EGARCH model for conditional variances follows each diagonal element of D_t^2 specified as equation 4

$$\begin{aligned} \log \log (h_{ii,t}) &= \omega_i + \sum_{k=1}^p \beta_{ik} \log (h_{ii,t-k}) + \sum_{k=1}^q \alpha_{ik} \left| \frac{\epsilon_{i,t-k}}{\sqrt{h_{ii,t-k}}} \right| \\ &+ \sum_{k=1}^q \gamma_{ik} \frac{\epsilon_{i,t-k}}{\sqrt{h_{ii,t-k}}} \end{aligned}$$

For $i=1, \dots, 8$ (1 dependent + 7 exogeneous variables),

Where:

- $h_{ii,t}$ is the conditional variance for variables i and time t
- $\epsilon_{i,t}$ are the standardized residuals,
- $\omega_i, \alpha_{ik}, \beta_{ik}, \gamma_{ik}$ are parameters to estimate.

The Dynamic Conditional Correlation (DCC) for R_t evolves according to Equation 5 as follows:

$$Q_t = (1 - a - b) \underline{Q} + aZ_{t-1} Z'_{t-1} + bQ_{t-1}$$

Where:

- Q_t is an intermediate 8×8 positive definite matrix
- \underline{Q} is the unconditional covariance matrix of the standardized residuals $Z_t = D_t^{-1} \epsilon_t$
- a and b are scalar parameters with $a, b \geq 0, a + b < 1$
- R_t is then obtained by standardizing Q_t

$$R_t = \text{diag}(Q_t)^{-1/2} Q_t \text{diag}(Q_t)^{-1/2} Q_t$$

This ensures R_t is a proper correlation matrix at every time t

3.2. Data Collection Methods

Data were collected from reputable and publicly available secondary sources such as the Federal Reserve (The Fed), Bank for International Settlement (BIS), Central Bank of Kenya (CBK) and <https://www.nancyxu.net/risk-aversion-index>. This study compiled monthly time-series data from January 2004 to June 2025. The data included exchange rate volatility (measured monthly as the standard deviation or variance of KES/USD returns), US Federal Reserve interest rates, global liquidity data from the Bank for International Settlements, crude oil prices (WTI), the Central Bank of Kenya's Central Bank Rate (CBR), inflation (CPI), diaspora remittances, foreign exchange reserves, and global risk aversion measures.

Foreign exchange volatility was used as the dependent variable, calculated using the standard deviation of monthly returns. Global monetary policy was operationalized using changes in the U.S. Federal Reserve (FR) rate. The FR rate functions as the primary benchmark, which determines worldwide interest rates and capital movements. The Bank for International Settlements (BIS) global liquidity indicators represent the global availability of funding and credit, which can be measured through an advanced economy, broad money supply, cross-border bank lending, and shadow banking flows. Global Commodity Prices are operationalized using crude oil prices (WTI prices), deeply integrated with global financing, trade balances, and inflation, act as de facto financial "barometers." The market shows financial tightening when oil prices rise, but financial conditions ease when prices decrease. Domestic monetary policy was operationalized using the central bank rate (CBR).

4. Research Findings and Discussion

4.1. Descriptive Statistics

The foreign exchange rate (KES/USD), for which the average during this period was 95.23 (with considerable volatility (standard deviation of 20.52) and a range of 61.9 to 160.08). This is a large range that captures periods of currency depreciation, currency appreciation, and external shocks at varying scales (2008 financial crisis, commodity price shocks), as well as domestic factors such as monetary policy changes and capital mobility. A positive skew of 0.73 indicates that, in some instances, accompanied by market stress or speculative pressure against the shilling, the exchange rate spikes above the normal range. The Central Bank of Kenya was active during this period in attempting to mitigate currency depreciation, with concerns about inflationary expectations and external vulnerability to external shocks.

At times, monetary adjustments are made, and foreign exchange market interventions are used at other times.

Table 1: Descriptive Statistics Results

Var	Obs	Mean	SD	Min	Max	Skew	Kurtosis	Jarque-bera Prob	Normality?
FX	258	95.23	20.52	61.9	160.08	0.73	0.08	23.076	9.75E-06 Reject normality
FED	258	1.73	1.92	0.05	5.33	0.81	-0.91	37.423	7.48E-09 Reject normality
GLI	258	34.28	6.06	18.39	46.76	-0.4	0.32	8.1601	0.01691 Reject normality
Oil	258	70.35	21.64	16.98	133.96	0.28	-0.45	5.4886	0.06429 Do not reject normality
CBR	258	9.1	2.76	5.75	18	1.62	3.13	222.7	2.20E-16 Reject normality
Risk	258	3.03	0.78	2.48	8.03	3.8	17.24	3881.5	2.20E-16 Reject normality
RM	258	161.05	122.99	25.15	445.39	0.74	-0.76	29.518	3.89E-07 Reject normality
CPI	258	80.87	33.4	31.34	145.58	0.28	-1.1	16.147	0.000312 Reject normality
RES	258	5993.2	2725.47	1313.59	11089	-0.27	-1.33	21.905	1.75E-05 Reject normality

Source: Author computations based on study data for the period 2005(1)-2025(6).

The U.S. Federal Reserve rate averaged 1.73% against the backdrop of significant global monetary policy cycles. With an extremely low minimum near zero, reflecting the post-2008 crisis policy environment of near-zero interest rates, and a maximum of 5.33%, the Fed rates fluctuate in response to global economic conditions. The positive skewness (0.81) highlights episodic increases during the tightening phases, particularly from 2015 onwards. Kenya is particularly vulnerable to these changes in global financial conditions through investor sentiment, capital flows, and trade finance, and changes in the FED rate have indirect effects on Kenya's economy and monetary policy calibrations.

Crude oil prices (WTI) averaged \$70.35, with modest volatility, given the relatively symmetrical distributions. Oil prices have a significant effect on Kenya's economy as they are wholly dependent on imported fuel for transport and industry. The BIS Global Liquidity Index (GLI), which measures global credit availability, averaged 34.28 and exhibited a mild negative skew. As a proxy for global financial liquidity, GLI fluctuations influence Kenya's access to foreign financing and investment inflows. This period saw phases of ample liquidity, especially pre-2008 and post-pandemic, facilitating capital inflows and remittances, along with sporadic contractions during global downturns. The Central Bank Rate (CBR) in Kenya averages 9.1%, but with high volatility (SD 2.76), a strong positive skew (1.62), and high kurtosis (3.13), indicative of monetary policy shifts in response to inflationary conditions, currency fluctuations, and economic shocks such as droughts or food price volatility.

Remittance inflows (RM) averaged \$161 million monthly but demonstrated large variability (The positive skewness of 0.74) driven by diaspora earnings, migrant labor conditions, and global economic cycles. The Consumer Price Index (CPI) averaged 80.87, moderate symmetry (skewness) and negative kurtosis which details the implied path of inflation in Kenya. Foreign exchange rates (RES: 61.9-160.08) exhibited similar volatility,

primarily from domestic factors amplified by global commodity prices and monetary policy changes. Foreign exchange reserves have a large average size (approximately \$6 billion) but also exhibit volatility (standard deviation [SD] 2725). The volatility of reserves is likely reflected by the central bank's active management of reserves to contain pressure on the shilling and meet external obligations against possible confined capital outflows, rising commodity prices, and debt servicing costs.

Overall, the descriptive results indicate an economy that exhibits extreme volatility and ongoing structural transformation from both global macroeconomic (fed rates, global liquidity, and oil prices) and domestic (monetary policy, domestic inflation, and remittances) conditions. The summary also fits well with Kenya's macroeconomic history, spanning decades of adapting monetary policy, an average economic growth of roughly 4–5% per year, inflation targeting, external vulnerability via remittances and reserves, and perceived efforts to stabilize and grow the economy amid regional and global uncertainties.

4.2. Stationarity Test

This study employed the augmented Dickey-Fuller (ADF) test for the presence of a unit root in a time series; the results are presented in Table 2. Non-stationary time-series data can have persistent shocks with effects that do not dissipate over time. Non-stationarity is crucial for time-series econometric analyses (Yang et al., 2023). The null hypothesis of the ADF test is that the series has a unit root (is non-stationary), whereas the alternative hypothesis is that the series is stationary.

Table 2: Augmented Dickey-Fuller Test Unit Root Test

ADF test at Level and 1st Difference				Critical Values			Decision
		Test Statistic	p-value	1%	5%	10%	
FXR	Level	-10.5836	< 2.2e-16	-3.98	-3.42	-3.13	Stationary
FED	Level	-9.8162	< 2.2e-16	-3.98	-3.42	-3.13	Stationary
	1st Diff	-9.8162	< 2.2e-16	-3.98	-3.42	-3.13	Stationary
lnGLI	Level	-10.6424	< 2.2e-16	-3.98	-3.42	-3.13	Stationary
lnOil	Level	-3.8189	1.26E-09	-3.98	-3.42	-3.13	Stationary
CBR	Level	-3.7543	2.18E-02	-3.98	-3.42	-3.13	Stationary
Risk	Level	-3.7127	0.02385	-3.98	-3.42	-3.13	Stationary
lnRM	Level	-2.7121	0.276	-3.98	-3.42	-3.13	Non-Stationary
	1st Diff	-7.1050	0.0100	-3.98	-3.42	-3.13	Stationary
lnCPI	Level	-1.0316	0.932	-3.98	-3.42	-3.13	Non-Stationary
	1st Diff	-6.3956	0.0100	-3.98	-3.42	-3.13	Stationary
lnRES	Level	-1.8238	0.1573	-3.98	-3.42	-3.13	Non-Stationary
	1st Diff	-6.4367	0.0100	-3.98	-3.42	-3.13	Stationary

The Augmented Dickey-Fuller (ADF) test results indicate which variables are stationary at level and require differencing based on the 5% critical value of -3.42. Variables such as FX, FED, lnGLI, lnOil, CBR, and Risk have test statistics that are more negative than this level. Therefore, their

null hypothesis of a unit root is rejected, meaning that these series are stationary without any difference. On the other hand, the test statistics of the FED, lnRM, lnCPI, and lnRES variables at level are above the threshold of -3.42, suggesting that these series are non-stationary at level. Nevertheless, their first differences have strongly negative test statistics with significant p-values, and we conclude that these variables are stationary after differencing. This information informs modeling choices, especially for the GARCH-family models. In general, since p-values of .05 are common, using the 5 percent cutoff provides a reasonable guideline for identifying stationarity in the data.

4.3. ARCH Effects Tests

Autoregressive Conditional Heteroskedasticity (ARCH) effects are a prerequisite for GARCH modeling. The ARCH effects indicate that the variance of the errors is not constant over time but depends on past errors. A GARCH model, including a multivariate model such as the DCC-GARCH model, is built on the premise that the conditional variance of a time series changes over time. The ARCH LM test and the Box-Ljung test on the squared residuals are presented in table 3.

Table 3: ARCH LM test and Box-Ljung test Results

	LMTest	Box-Ljung Test	Remarks
FX	48.657(2.401e-06)	74.268 (5.051e-11)	highly significant
FED	17.752 (0.1234)	22.852(0.02901)	significant at 5%
GLI	41.383 (4.228e-05)	27.021 (0.007674)	highly significant
Oil	33.17 (0.0009)	39.66 (8.187e-05)	highly significant
CBR	2.3359 (0.9987)	2.4989 (0.9982)	highly insignificant
Risk	18.375 (0.1048)	25.953 (0.0109)	significant at 5%
RM	75.775 (2.622e-11)	239.27 (2.2e-16)	highly significant
CPI	245.95 (2.2e-16)	2736.5 (2.2e-16)	highly significant
RES	2.02(0.9994)	1.9336(0.9995)	highly insignificant

For foreign exchange (FX), the global liquidity indicator (GLI), crude oil price (oil), diaspora remittances (RM), and consumer price index (CPI), both tests provide strong statistical evidence for the presence of **ARCH effects**. This means that the conditional variance of these series is significantly time-varying and can be modeled using ARCH or GARCH-type models. For both tests, two variables, namely, the central bank rate (CBR) and foreign exchange reserves (RES), suggest that there are no statistically significant ARCH effects at the conventional significance level (e.g., 5%). This implies that the variance in the residuals appears to be constant over time for these series. However, for the U.S. Fed Rate (FED) and risk aversion (Risk), while the ARCH LM test does not reject the null hypothesis of no ARCH effects at the 5% level, the significant Box-Ljung test on squared residuals suggests that

there might be some autocorrelation in the squared residuals, which is indicative of ARCH effects. The benefit of the DCC model is that it can model and analyze the time-varying volatility and correlations of the entire system, even if some individual components have constant volatility (Ampountolas, 2023).

4.4. Regression Results

This study employs dynamic conditional correlation–exponential generalized autoregressive conditional heteroscedasticity (DCC-EGARCH) to investigate the dynamic correlations among variables. The DCC-EGARCH results in Table 4 provide parameter estimates that describe the dynamic volatility of each variable, including foreign exchange volatility (FX) as the dependent variable and eight other independent variables that influence FX volatility.

Table 4: Results from multivariate EGARCH (DCC) model

	mu	omega	alpha1	beta 1	gamma
FX	0.000539	-2.199951	0.12769	0.734689	0.756541
	(0.001096;0.623)	(0.476462;0)	(0.09062;0.159)	(0.058322;0)	(0.1687;0.0001)
FED	0.839675	-0.37832	-0.065537	0.892581	2.251151
	(0.012197;0)	(0.053209;0)	(0.09917;0.509)	(0.049932;0)	(0.246691;0)
GLI	3.500334	-1.095542	0.073498	0.861225	2.144205
	(0.023649;0)	(0.177873;000)	(0.04205;0.081)	(0.03249;0)	(0.169581;0)
Oil	4.312856	-1.096456	-0.067324	0.698241	1.617419
	(0.062585;0)	(0.71358;0.124)	(0.14530;0.643)	(0.2724;0.0104)	(0.25811;0)
CBR	8.890787	-0.168265	0.064357	0.875876	1.791936
	(0.012364;0)	(0.07605;0.027)	(0.14328;0.653)	(0.08112;0)	(0.43957;0.000)
Risk	2.608649	-0.309485	0.129342	0.846486	1.945845
	(0.023464;0)	(0.51115;0.545)	(0.45008;0.774)	(0.130668;0)	(0.7686;0.0113)
RM	4.88221	-0.199028	0.053749	0.972401	0.985377
	(0.051736;0)	(0.08552;0.020)	(0.01626;0.001)	(0.021658;0)	(0.4552;0.0304)
CPI	4.590644	-0.420402	0.059682	0.976878	1.917797
	(0.076691;0)	(0.10504;0.000)	(0.0488;0.2212)	(0.069374;0)	(0.6453;0.0030)
RES	8.990709	-0.671611	-0.224407	0.824935	1.205491
	(0.080381;0)	(0.2230;0.0026)	(0.14416;0.120)	(0.055326;0)	(0.157542;0)
FED_CBR	6.350086	0.330203	-0.9534	0.839008	2.141308
	(0.038892;0)	(0.2209;0.135)	(0.1457; 0.5123)	(0.039418;0)	(0.203;0)
GLI_CBR	31.655878	0.066229	0.275914	0.877628	2.536691
	(0.001714; 0)	(0.0575; 0.2494)	(0.2391; 0.2485)	(0.022725; 0)	(0.40017; 0)
dcca1			0.29696		
			0.000		
dcdb1				0.624847	
				0.000	

Note: GARCH models were estimated with the student’s t distribution. Asymptotic standard errors and P-values are given in parentheses.

4.4.1 Foreign Exchange Volatility (FX)

FX volatility is highly responsive ($\alpha = 0.128$, $p < 0.001$) and strongly persistent ($\beta = 0.734$, $p < 0.001$) to shocks. The strong positive asymmetric effect ($\gamma = 0.76$, $p < 0.001$) indicates that adverse/negative shocks (e.g., depreciation or unexpected stress) increase volatility more than favorable/positive shocks, consistent with the financial theory of higher uncertainty during currency depreciation. This aligns with the financial market theory, where FX volatility in Kenya exhibits persistent temporal clustering and reacts more intensively to adverse shocks, reflecting market risk aversion and external financial shocks.

4.4.2 US Federal Funds Rate (FED):

Fed rate volatility as the core tightening channel has very high persistence ($\beta = 0.89$, $p < 0.001$) with positive asymmetry ($\gamma = 2.25$, $p = 0.0077$), reflecting stronger impacts from global monetary tightening shocks than cuts, especially U.S. Tightening spikes U.S. rate volatility, dynamically spilling FX volatility via DCC correlations. Fed rate hikes, which have strong, lasting, and disproportionately large effects on financial markets. Tightening spikes U.S. rate volatility, dynamically spilling FX volatility via DCC correlations. This result is in agreement with those of Alba et al. (2024), Eguren-Martin and Sokol (2022), and Engler et al. (2023). Fed rate movement is not only directional but also inherently destabilizing relative to easing cycles, with important spillover implications for Kenya. This result is in agreement with those of Alba et al. (2024), Eguren-Martin and Sokol (2022), and Engler et al. (2023). Rate hikes tend to tighten capital, leading to a reduction in global liquidity and an increase in risk premiums, giving rise to capital outflows from emerging economies and causing FX markets, including KES/USD, to increase volatility (Habib & Venditti, 2018; Uz Akdogan, 2023). Positive asymmetry means that increases in U.S. rates have a greater effect on volatility than decreases in rates, as markets are more sensitive to the tightening cycle with increased borrowing costs and lower global demand.

4.4.3 Global Liquidity Indicator (lnGLI):

Volatility in global liquidity is persistent ($\beta = 0.86$, $p < 0.001$), indicating stable volatility shocks related to global liquidity conditions, whereas a strong positive asymmetry ($\gamma = 2.14$, $p < 0.001$) implies that positive liquidity shocks notably increase volatility. This result contradicts the results of Olds et al. (2021), who found that higher FX liquidity is associated with lower FX volatility. However, this study agrees with the findings of Daggash and Abraham (2017) and Le et al (2024). (2024). This aligns with the theory that improved global liquidity increases market activity and volatility, whereas tightening it reduces liquidity and causes a sharp rise in volatility. Changes in

global liquidity directly impact FX volatility through funding and capital flow in Kenya. This is a critical transmission channel through which global tightening reaches Kenya via reduced capital inflows and external financing pressures. This is a critical transmission channel through which global tightening reaches Kenya via reduced capital inflows and external financing pressures. In general, rising global liquidity lowers funding costs and facilitates capital flow into emerging markets, leading to increased trading volume and market activity and resulting in higher FX volatility by increasing price discovery and speculative trading. However, decreased liquidity raises risk premia, and as a result, there may be an increase in volatility due to elevated uncertainty (Cevik et al., 2016).

4.4.4 Crude Oil Price (InOil):

Oil price volatility is moderately persistent ($\beta = 0.70$, $p < 0.001$), with positive asymmetry ($\gamma = 1.62$, $p < 0.0001$), meaning that price surges or negative oil price shocks increase volatility more than they decrease it. As an oil-importing economy, rising oil prices drive inflation and trade-deficit pressures, increasing FX market uncertainty and volatility and import costs and inflationary pressures. These findings are consistent with those of Alam et al. (2023), Monday and Abdulkadir (2020), and Mukherjee and Bardhan (2024). From an economic standpoint, higher oil prices increase import costs and inflationary pressure, aggravate the trade balance of payments, and create further uncertainty in the foreign exchange market. Inflationary pressures and trade deficits increase exchange rate volatility through trade deterioration, monetary policy uncertainty, and changes in capital flows. Empirical and theoretical research indicates that oil-price shocks in oil-importing countries result in cost-push inflation and external imbalances that further increase financial market volatility and adversely affect macroeconomic performance.

4.4.5 Kenya's Central Bank Rate (CBR):

CBR volatility is highly persistent ($\beta = 0.88$, $p < 0.001$) with significant positive asymmetry ($\gamma = 1.79$, $p < 0.001$), showing high persistence and asymmetric effects, meaning that monetary policy shifts exert influential and uneven effects on FX volatility. This is consistent with the CBK's reactive monetary policy — when forced to raise rates in response to global tightening and currency pressure, it generates more domestic financial uncertainty than equivalent rate cuts would. This sets the stage for the interaction effects examined below. As the key monetary policy instrument, increased uncertainty or tightening in the CBR tends to raise FX volatility by affecting interest rate differentials and capital flows, heightening exchange rate uncertainty as market participants adjust their expectations of currency value and capital flows. This finding highlights the role of domestic policies in

stabilizing or amplifying currency risk. These findings are in line with those of Huertas (2022) but contradict those of Ndagara et al. (2020), who opined that central bank interventions do not reduce foreign exchange volatility. Evidence from Kenya shows that CBR's monetary policy decisions shape FX markets, but intervention is typically a reaction to volatility and not an effort to fully control it. Accordingly, this reinforces the need for the Central Bank to effectively gauge its policy communication to anchor market expectations of its policy actions, leading to less excessive fluctuations in the FX market.

4.4.6 Risk Aversion (Risk)

Volatility also showed high persistence ($\beta = 0.85$, $p < 0.001$) and positive asymmetry ($\gamma = 1.95$, $p = 0.017$). Increasing risk aversion increases market uncertainty and flight-to-safety behavior, thus increasing FX volatility. The results imply that risk-off shocks (increases in risk perception) generate notably more market volatility than risk-on episodes, consistent with the asymmetric nature of investor panic versus gradual confidence recovery. This means that increases in risk aversion drive larger increases in volatility than decreases. This pronounced asymmetric effect indicates that increments in risk aversion and capital flight risk amplify FX market instability more than decreases in it mitigate it.

4.4.7 Remittances (lnRM)

Remittances exhibit extremely persistent volatility ($\beta = 0.97$, $p < 0.001$), and γ (~0.99 significant) implies near-unit persistence, reflecting the stabilizing nature of inflows but with pronounced asymmetric volatility responses. Fluctuations in remittance flows create uncertainty in foreign currency supply, directly influencing FX volatility by changing the pressure on the exchange rate demand and supply. Fluctuations in remittance flows affect the foreign exchange supply-demand balance, where unexpected reductions tighten FX availability, increase volatility, and surges temporarily stabilize the market. The high persistence reinforces the critical buffering role of remittances, but also implies that shocks reverberate over extended periods, complicating FX market forecasting and policy responses.

4.4.8 Consumer Price Index (lnCPI)

CPI volatility shows strong persistence ($\beta = 0.97$, $p < 0.001$) and positive asymmetry ($\gamma = 1.92$, $p = 0.003$). Strong persistence implies that inflation shocks strongly and persistently affect FX volatility, with asymmetric impacts, whereas positive asymmetry indicates that inflation shocks increase volatility more than deflationary shocks. This aligns with purchasing power parity (PPP) theory and monetary policy reaction frameworks, in which inflation shocks increase the uncertainty surrounding real economic conditions

and monetary policy, thus feeding into FX volatility through heightened unpredictability in purchasing power and exchange rate expectations. This implies that inflation uncertainty influences exchange rate expectations, destabilizes currency markets, and monetary policy anchors inflation but does not fully eliminate volatility.

4.4.9 Foreign Exchange Reserves (dRES)

Reserves present strong volatility persistence ($\beta = 0.82$, $p < 0.001$) and asymmetry ($\gamma = 1.21$, $p < 0.001$), indicating that changes in reserves reflect intervention capacity and market confidence, impacting volatility persistence and asymmetry. An insignificant shock effect ($\alpha = -0.22$, $p = 0.120$) coupled with positive asymmetry suggests that shocks may initially reduce volatility without causing adverse effects (possibly signaling no loss and no intervention capacity needed) that can undermine market confidence. Positive asymmetry (**$\gamma = 1.20$, $p < 0.001$**) implies that some shocks, likely negative ones, significantly increase volatility. This complex pattern suggests that reserves affect market confidence and volatility, and sharp decreases or concerns about reserve adequacy may trigger FX volatility spikes. This reflects the theoretical role of adequate reserves as both a buffer and a confidence signal: adequate reserves reduce market uncertainty by assuring intervention capability under the central bank's stabilization hypothesis, whereas drops, declines, or perceived inadequacy trigger market fears and spike volatility.

4.4.10 The interaction effects of CBR with FED and GLI

The interaction terms FED_CBR and GLI_CBR exhibit high volatility persistence ($\beta=0.84$ and 0.88 , respectively) and strong leverage effects ($\gamma=2.41$ and 2.54 , both $p<0.001$), indicating that Kenya's CBR stance dynamically moderates but does not fully offset global tightening and liquidity shifts in their impact on FX volatility, with time-varying correlations strengthening during shocks (DCC $\alpha=0.30$) (Adrian et al., 2024; Ahmed et al., 2024). **The interaction between the FED rate and CBR shows persistent volatility ($\beta=0.84$), indicating that** combined US hikes and CBR adjustments sustain FX volatility clustering, suggesting that procyclical policy responses amplify spillovers rather than dampen them. This aligns with IMF evidence that EM rate hikes (avg. +780bps post-pandemic) create buffers only if credible and timely (Adrian et al., 2024). In addition, **strong leverage ($\gamma=2.41$) depicts negative shocks** (e.g., hawkish Fed and tight CBR) disproportionately raising volatility, implying that CBR hikes amid US tightening exacerbate outflows via widened differentials under the Mundell-Fleming autonomy in practice (Ahmed et al., 2024; Yoldas, E. (2024). These results imply that the Central Bank of Kenya's monetary policy tightening partially counters FED effects (via stance), but shallow transmission due to an

insignificant α_1 means net amplification as per post-Keynesian financial fragility.

Similarly, the interaction between global liquidity and CBR interaction shows high persistence ($\beta=0.88$). This illustrates that global liquidity contractions paired with CBR changes prolong FX volatility while easing reversals (low GLI) interact with domestic stances to cluster shocks. Asymmetric amplification occurs during liquidity squeezes with policy tightening, highlighting vulnerability when global funding dries up despite CBR defense, as indicated by the leverage effect ($\gamma=2.54$). When global liquidity contracts simultaneously with the CBK tightening domestically, the resulting volatility is not only highly persistent but also disproportionately amplified relative to loosening scenarios. The exceptionally high mean ($\mu = 31.66$) also signals that this combined tightening dynamic operates at a structurally elevated level. This is arguably the **most important finding** of the model: that the convergence of global liquidity withdrawal and domestic monetary tightening creates a compound, nonlinear shock to Kenya's financial environment. These results support emerging market resilience via proactive hikes (wider differentials buffer outflows); however, the interactions confirm domestic monetary policy as a conditional moderator that is only effective against liquidity easing and not purely tightening, as per the Bruno-Shin leverage (Checo et al., 2024; Adrian et al., 2024; Bruno & Shin, 2015; Bruno & Shin, 2013).

4.4.11 DCC Parameters ($dcca1 = 0.0296$, $dccb1 = 0.625$)

These significant positive values confirm the dynamic or time-varying interdependence and evolving correlations among volatilities, showing that shocks to these macro variables co-move and jointly affect FX volatility over time. Both DCC parameters are highly significant, confirming that the correlations between global financial tightening variables and Kenya's FX volatility are genuinely **time-varying** rather than constant. The moderately high $dcca1$ (≈ 0.30) indicates that correlations respond meaningfully to recent shocks, meaning that during acute tightening episodes (such as rapid Fed rate hikes), the co-movement between global variables and KES volatility intensifies quickly. The high $dccb1$ (≈ 0.62) confirms that these elevated correlations are **persistent**, not transitory — once tightening conditions raise the interdependence between global markets and Kenya's FX, the effect lingers well beyond the initial shock. Crucially, the sum ($0.92 < 1$) ensures that the model is stationary and that correlations ultimately revert to long-run equilibrium levels, validating the overall model stability.

4.4.12 Dynamic Conditional Correlation

Pairwise conditional correlations are typically used to assess the change in behavior between two variables over time in response to market shocks and past volatility. High values of the estimated parameter tend to indicate a persistent correlation over time when assessing volatility clustering. Figure 3 shows the pairwise conditional correlation coefficients between foreign exchange, the key global tightening variables, and domestic monetary policy.

The top-left panel shows the dynamic conditional correlation between FX and the Federal Reserve policy rate). This plot illustrates how their correlation fluctuates over time, with periods of positive and negative correlation, suggesting shifts in the co-movement regimes between monetary policy and FX. Periods of negative correlation likely suggest increased FX volatility when the Fed tightens monetary policy, potentially reflecting shifts in capital flows and pressures to appreciate the dollar (Acharya et al., 2025). In turn, this can increase volatility in the KES/USD exchange rate as the market adjusts to interest rate differentials and financial tightening in global markets. Positive correlation episodes suggest co-movement, potentially when the Fed is in an easing cycle or when the market moves in tandem across asset classes. The magnitude of fluctuations suggests complicated macro-financial linkages related to changes in the Fed rate, market expectations in FX, and risk sentiment.

The graph in the top-right panel shows the dynamic conditional correlation between FX and GLI (which could be a global liquidity index or a similar index). Dynamic switching between positive and negative values reflects how global liquidity conditions influence FX volatility in different ways over time. The periods of negative correlation suggest a tightening global liquidity environment, causing increased FX volatility in KES/USD. Positive correlations may reflect abundant liquidity phases and dampen exchange rate volatility by stabilizing capital flows (Pham, 2018). The graph captures the sensitivity of emerging market currencies to shifts in global financial cycle conditions, as measured by GLI.

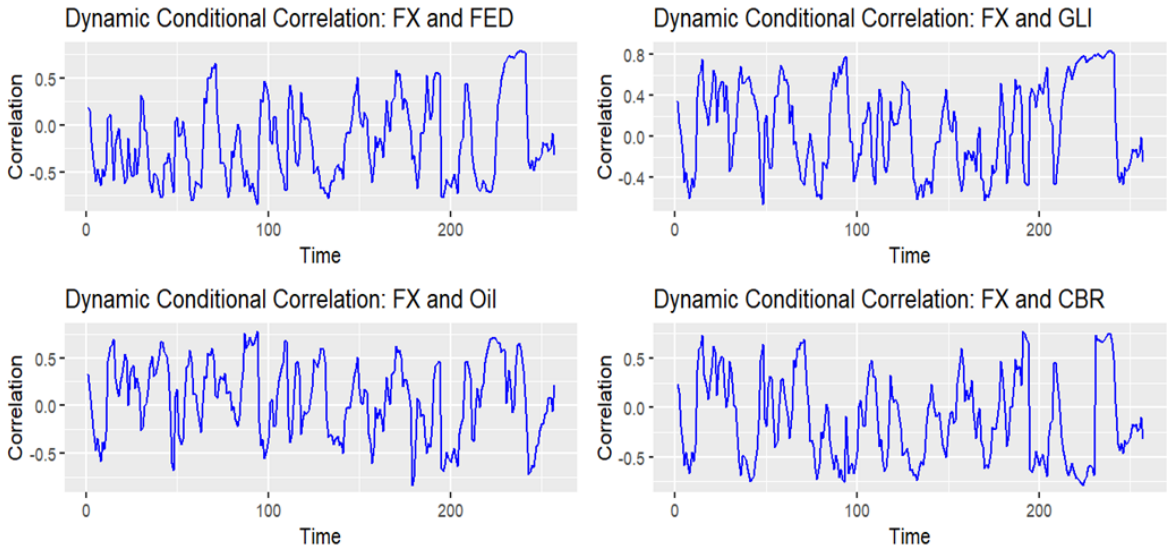


Figure 3: Dynamic Conditional Correlations between the FX and Key Variables

The bottom-left plot captures the dynamic conditional correlation between FX and oil prices. The co-movement of oil and foreign exchange rates (KES/USD) is often due to trade, commodity price channels, and inflation expectations, which are reflected in the time-varying correlations. Negative correlations could indicate that oil price spikes lead to a weakening of KES and an increase in FX volatility. Positive correlation spells may arise when global commodity price trends coincide with synchronized capital markets or when inflation expectation movements influence FX (Saidu et al., 2021). The dynamic nature of the model reflects the interaction between commodity shocks and exchange rate volatility. Kenya, an oil-importing nation, is susceptible to exchange rate shocks from oil prices.

The bottom-right plot indicates the dynamic conditional correlation between FX and CBR (possibly the central bank rate or a related financial variable). This plot shows how FX and central bank rate relationships evolve dynamically. Negative correlation periods reflect scenarios in which domestic monetary tightening leads to FX depreciation volatility through interest rate differentials and capital flow adjustments (Ulm & Hambuckers, 2022). Positive correlation episodes indicate coordinated domestic policy easing and exchange rate stabilization. This evolving correlation mirrors the influence of monetary policy on forex market volatility, inflation expectations, and investor confidence in Kenya. The CBR shapes domestic interest rate differentials and liquidity through investment inflows and currency demand. A proactive monetary policy that adjusts the CBR can moderate volatility by anchoring inflation expectations and increasing market confidence.

4.4.13 DCC-GARCH Summary

The model indicates that volatility in global monetary policy rates, global liquidity, risk sentiment, remittances, inflation, reserves, oil prices, and local monetary policy significantly influences FX volatility in Kenya. Most variables exhibit strong persistence and asymmetric impacts, meaning that volatility shocks tend to endure, and that positive and negative shocks affect volatility differently. These dynamics confirm that domestic fundamentals and global financial conditions shape FX market volatility in an important and interconnected manner. Specifically, the findings reveal that FX volatility responds asymmetrically, with negative shocks increasing market uncertainty. Variables representing domestic monetary conditions (CBR, CPI, and RES) strongly shape FX volatility by influencing inflation expectations, policy uncertainty, and reserve adequacy. Specifically, domestic monetary policy through the Kenya's central bank rate plays a dual role as both a signaling mechanism and an active market stabilizer or amplifier. Inflation and reserves reflect the macroeconomic fundamentals that shape FX dynamics.

4.4.14 Limitations of the study

This study operates at the macroeconomic level and does not account for FX market microstructure factors that significantly influence exchange rate volatility in Kenya, including the role of foreign exchange bureaus, informal currency markets, bid-ask spreads, order flow dynamics, and the timing and magnitude of CBK intervention operations. These microstructure elements can amplify or dampen the transmission of global shocks in ways that aggregate macroeconomic models cannot fully capture, representing a limitation in the granularity of the analysis.

Although the DCC-EGARCH framework is well suited to this study's objectives, it has inherent limitations. The two-step estimation procedure, although parsimonious, introduces a generated regressor bias. For example, errors in the first-stage univariate EGARCH estimates propagate into the second-stage DCC correlation estimates, potentially understating standard errors and overstating statistical significance. Furthermore, while the study generates actionable policy recommendations, the DCC-EGARCH framework is fundamentally backward-looking, estimating relationships based on historical data. It cannot fully account for structural changes in Kenya's economy, such as ongoing financial deepening, expanding domestic debt markets, or evolving CBK policy frameworks that may alter how the economy responds to global tightening in the future. Therefore, the policy recommendations should be interpreted as grounded in historical dynamics while remaining open to revision as Kenya's economic structure continues to evolve.

Summary

The DCC-EGARCH model and the U.S. Federal Reserve rate (FED), as a proxy for global monetary policy, exhibit high volatility persistence and asymmetry, indicating that global financial tightening shocks not only have lasting effects on volatility but also increase interest rates, provoking stronger volatility responses relative to decreases. This observation concurs with global financial cycle theory, whereby U.S. monetary policy significantly influences capital flows, risk premia, and emerging market exchange rate volatility, including that of Kenya. From the SV model, a significant positive beta indicates that increases in the U.S. Federal Reserve rate (global financial tightening) tend to increase the volatility of Kenya's shilling against the USD due to global uncertainty and pressures in emerging market currencies, making FX volatility persistent.

The BIS Global Liquidity Indicator (GLI) is a proxy for global liquidity conditions and shows a particularly persistent volatility component with high asymmetry. The results from the DCC model underscore the critical role played by global liquidity in shaping exchange rate volatility in emerging markets through liquidity shocks and sudden tightening, which is consistent with liquidity preference theory and international portfolio balance models. Similarly, in the SV model, a positive and significant beta implies that tighter global liquidity conditions (i.e., lower GLI values) are associated with higher FX volatility. Reduced global liquidity can limit capital flows and increase exchange rate fluctuations due to risk aversion and liquidity constraints.

The third objective is to use crude oil prices (oil) as a proxy for major global commodity prices that have a notable influence on volatility dynamics. Although their mean returns and short-term volatility responses are moderate, oil price shocks have asymmetric effects, reflecting Kenya's exposure to oil price fluctuations through import costs and inflation. This reflects commodity price channel theory, which states that trade balance and inflation expectations mediate the effect of oil price volatility on currency risk. The same findings are portrayed in the stochastic volatility model, which shows a significantly positive beta, indicating that fluctuations in crude oil prices increase FX volatility. Importer: oil importer. Thus, oil price shocks directly affect import costs and inflation expectations, thereby influencing currency stability and volatility.

The final objective was motivated by domestic monetary policy as a control measure for Kenya's financial market. The DCC-EGARCH model results indicate that the Kenya Central Bank Rate (CBR) captures the transmission of the domestic monetary policy stance to foreign exchange rate volatility. The results for CBR volatility exhibit strong persistence with asymmetric responses, suggesting that changes in the policy rate send significant signals to markets, affecting foreign exchange volatility in a lasting

and uneven manner. This is consistent with standard monetary transmission theories, in which policy decisions influence investor expectations, liquidity conditions, and exchange rate volatility. Similarly, the SV model, with a significantly positive beta, indicates that changes in Kenya's monetary policy rate increase FX volatility. Tightening by raising the CBR can signal economic stress or an attempt to manage inflation, which impacts currency uncertainties.

The significant DCC-EGARCH statistics (alpha 1 and beta 1) show a moderate and persistent time-varying correlation over time between these variables, demonstrating interdependence among global financial conditions, domestic policies, macroeconomic fundamentals, and forex market volatility. Similar time-varying interdependence is an important feature in the literature on international financial integration and spillovers. Furthermore, the parameters in the latent SV model—the persistence parameter ϕ (~ 0.87) and the volatility parameter σ (~ 0.86)—also exhibit moderate to strong persistence in latent volatility shocks and latent volatility variability, which is consistent with the stylized facts of financial time series. The negative μ parameter represents the logarithm of the variance, and the exponential transformation of μ serves as the estimated baseline level of volatility.

Collectively, these results illustrate how the dynamics of FX volatility in Kenya are influenced by a web of global monetary policies, liquidity conditions, commodity prices, and domestic macroeconomic fundamentals, demonstrating the importance of both international economic theory and domestic economic management in understanding FX market behavior.

Conclusions

This study investigates the dynamic relationship between global financial tightening conditions and foreign exchange volatility in Kenya by employing a dynamic conditional correlation – exponential GARCH (DCC-EGARCH) framework to capture both the asymmetric nature of volatility transmission and the time-varying interdependence among key macroeconomic and financial variables. The empirical evidence generated from this analysis yields several important conclusions that advance both theoretical understanding and practical knowledge of how small open economies at the frontier of global capital markets respond to external monetary shocks.

The findings unambiguously confirm that global financial tightening conditions (proxied through the U.S. Federal Funds Rate, the Global Liquidity Indicator, and West Texas Intermediate crude oil prices) exert significant, persistent, and asymmetric effects on Kenya's foreign exchange volatility. Consistent with the leverage effect postulated in asymmetric GARCH literature, every variable in the model exhibited a statistically significant positive gamma coefficient, establishing that tightening shocks uniformly

generate disproportionately larger volatility than equivalent easing episodes. This asymmetry is not merely a statistical artifact; it reflects the structural reality that capital outflows triggered by global monetary tightening are rapid and disorderly, whereas the recovery of investor confidence and capital re-entry into frontier markets is gradual and conditional. For a country like Kenya, whose external financing requirements are substantial and whose foreign exchange market is characterized by thin liquidity and periodic central bank intervention, this asymmetry has profound macroeconomic consequences.

The persistence parameters across all estimated series were uniformly high, with beta coefficients ranging between 0.70 and 0.977, indicating that shocks to global financial conditions leave long-lasting imprints on Kenya's FX volatility rather than dissipating rapidly. Particularly concerning are the near-unit-root persistence estimates for diaspora remittances and the consumer price index, suggesting that disruptions to these stabilizing flows and price stability (both of which are vulnerable to deteriorating global conditions) have effects that embed themselves deeply into Kenya's macroeconomic fabric and are difficult to reverse in the short to medium term. This finding has significant implications for macroeconomic management, as it implies that CBK cannot rely on volatility self-correction within standard policy response horizons.

Perhaps the most theoretically significant finding of this study lies in the interaction terms. The simultaneous tightening of the US Federal Funds Rate and Kenya's Central Bank Rate (FED_CBR), and the convergence of global liquidity contraction with domestic monetary tightening (GLI_CBR), produced the strongest asymmetric volatility effects in the entire model. The GLI_CBR interaction term yielded the highest gamma coefficient ($\gamma = 2.54$) and the highest mean level ($\mu = 31.66$) among all variables, establishing that compound tightening (where domestic monetary policy tightens in tandem with deteriorating global liquidity) creates a nonlinear amplification of FX volatility that far exceeds the effect of either force acting independently. This finding challenges the conventional wisdom that CBK rate hikes serve straightforwardly as a stabilizing response to currency depreciation pressure during global tightening cycles and raises difficult questions about the limits of conventional monetary policy in externally exposed economies.

The DCC estimates reinforce these conclusions by confirming that correlations between global financial conditions and Kenya's FX volatility are not static but respond dynamically to shocks and remain elevated for extended periods thereafter. With $dcca1$ and $dccb1$ summing to 0.92, the model confirms covariance stationarity while simultaneously establishing that once global tightening raises the co-movement between external variables and the Kenyan shilling, this elevated interdependence persists long beyond the immediate shock window. This time-varying correlation structure implies that

Kenya's vulnerability to global financial conditions is not constant but intensifies precisely during periods when global financial stress is highest, creating a procyclical exposure pattern that amplifies economic instability.

The role of oil prices as a transmission channel deserves particular emphasis. Kenya's status as a net oil importer means that oil price spikes, which are partly driven by global financial tightening and geopolitical dynamics, simultaneously pressure the current account, widen the trade deficit, and amplify domestic inflation. The significant asymmetric oil price volatility estimated here, combined with the near-unit-root CPI persistence, maps a clear and consequential transmission pathway: global tightening → dollar strengthening → oil price volatility → import cost inflation → KES depreciation → entrenched CPI volatility → forced CBK rate hikes → compound domestic-external tightening shock. This chain of causation, fully supported by the empirical results, represents the central vulnerability of Kenya's macroeconomic architecture in periods of global monetary stress.

In summary, the findings of this study establish that Kenya's foreign exchange market is deeply and asymmetrically integrated into the global financial system in ways that render standard reactive monetary policies insufficient as stabilization tools. The country faces structural exposure to global tightening cycles that are mediated through multiple simultaneous channels, such as capital flows, liquidity conditions, commodity prices, inflation, and remittances, which intensify when global conditions are most adverse. Addressing this vulnerability requires not only reactive policy responses but also a fundamental rethinking of Kenya's macroeconomic policy architecture and external buffers.

Policy Recommendations

Based on the study findings and the prevailing economic context of Kenya's foreign exchange market, the following policy recommendations are proposed to stabilize Kenyan Shilling amidst global financial tightening: (i) Strengthen coordination with global monetary conditions, given the dominant influence of the U.S. Federal Reserve rate changes and global liquidity; (ii) enhances domestic monetary policy credibility and flexibility by prioritizing short-term monetary actions to reduce FX volatility by tightening monetary policy promptly but gradually; (iii) builds and maintains adequate forex reserves; the central bank can enhance its ability to control currency fluctuations through reserve strengthening by diversifying foreign exchange inflows between diaspora remittances and export revenues; and (iv) mitigates commodity price vulnerabilities by implementing energy diversification strategies, hedging mechanisms, and petroleum reserve development, which will help decrease the currency's exposure to price shocks. Other recommendations include managing macroeconomic uncertainty and risk

aversion, leveraging remittances as a stabilizing force, and enhancing data monitoring and market development to help policymakers make quick and effective decisions by better monitoring capital movements, FX market activities, and global financial data.

Areas of Further Research

Although this study makes a significant contribution to the understanding of external financial shock transmission in Kenya, several avenues for future research remain open. First, future studies could explore the role of financial market microstructure factors and capital flow composition in shaping FX volatility, providing finer insights into liquidity impacts and speculative behavior beyond aggregate macroeconomic variables. Second, expanding the modeling framework to incorporate nonlinear dynamics and regime-switching effects could better capture structural breaks, prolonged shocks, or crisis periods that affect volatility and correlations. Third, research on the effectiveness and timing of various policy intervention tools, including macroprudential measures, along with monetary and fiscal policies, would enhance the understanding of optimal stabilization strategies in the face of global tightening. Finally, future studies could extend the analysis to a panel of Sub-Saharan African economies to assess whether Kenya's vulnerabilities are idiosyncratic or regionally systemic.

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Industry vs. Services: Long- and Short-Run Growth Effects of FDI in Türkiye

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Abstract

This paper investigates how the sectoral composition of foreign direct investment (FDI) shapes economic growth in Türkiye. Using quarterly data and an autoregressive distributed lag (ARDL) framework, two separate models are estimated: one relating output to FDI in industry and the other to FDI in services. Bounds test results indicate the presence of a long-run cointegrating relationship in both specifications, allowing for a joint assessment of long- and short-run effects. The industry model shows that domestic capital has a positive long-run impact on output, while labour contributes negatively and industry-related FDI exerts a negative and significant effect, suggesting limited or adverse growth spillovers from manufacturing FDI. By contrast, in the services model, both capital and services-sector FDI have positive and significant long-run coefficients, and services FDI emerges as a key driver of growth. Short-run dynamics reveal hump-shaped responses of output to sectoral FDI, with initial gains or disruptions followed by partial reversals, whereas the error-correction terms are negative and highly significant, indicating reasonably fast convergence back to the long-run equilibrium in both models. The findings highlight that the growth payoff from FDI in Türkiye depends critically on its sectoral allocation.

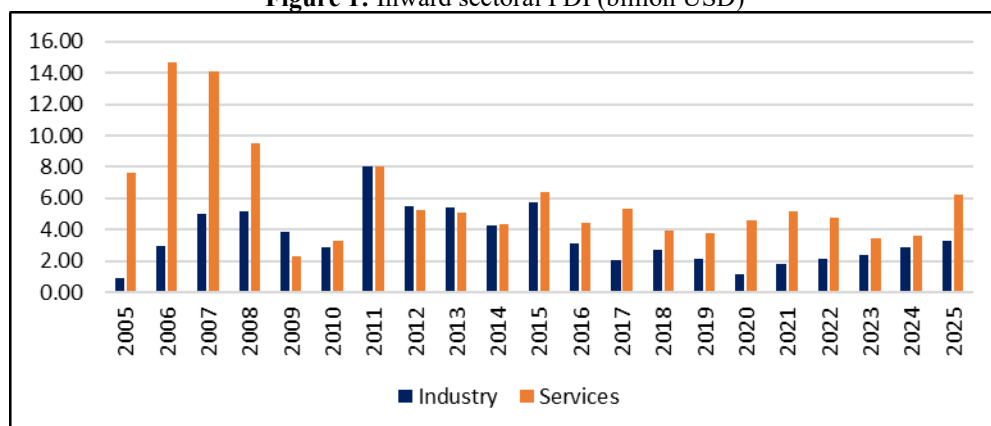
Keywords: ARDL bounds testing; economic growth; foreign direct investment (FDI); Sectoral FDI; Türkiye

Introduction

Foreign direct investment (FDI) has long been regarded as a potential engine of growth for emerging economies (Harrison, 2003; Hyun, 2006), not only because it provides additional external finance but also because it can transfer technology, managerial know-how and access to international markets (De Mello, 1997; Simionescu and Naros, 2019). Yet the empirical literature offers mixed evidence on whether and under which conditions FDI actually raises host-country growth. A central insight is that the impact of FDI is highly heterogeneous: it depends on the sectoral allocation of inflows, on the strength of vertical and horizontal linkages with domestic firms, and on the host economy's absorptive capacity in terms of human capital, institutions, and infrastructure (Imsiraroj and Ulubaşoğlu, 2015). In particular, a growing body of work disaggregates FDI by sector and estimates its growth effects separately for manufacturing, services, and other industries, often reaching divergent conclusions rather than a uniform pattern (Akinlo, 2004; Vu and Noy, 2009; Wang, 2009; Aykut and Sayek, 2007; Ullah et al., 2023; Marasco et al., 2024). Many studies report that the sign and magnitude of FDI spillovers vary across sectors and country contexts, highlighting that no single sector—whether manufacturing or services—can be regarded as universally superior in terms of its growth impact.

Türkiye provides a compelling setting in which to revisit these issues. Since the early 2000s, the country has pursued an active FDI-promotion strategy as part of its broader integration into global value chains and convergence towards high-income status. Over this period, Türkiye has experienced large swings in FDI inflows and profound changes in its sectoral composition. Figure 1, which plots inward FDI to industry and services, highlights three salient features: a sharp surge in inflows during the pre-crisis boom years, a marked decline and subsequent volatility in the aftermath of the 2009 global financial crisis, and a persistent dominance of services-sector FDI over its industrial counterpart for most of the sample. These patterns raise important questions for growth policy. If the bulk of FDI has increasingly been directed towards services rather than manufacturing, what does this imply for Türkiye's long-run growth prospects, and does the sectoral shift enhance or weaken the overall contribution of FDI to output? Are the benefits of sectoral FDI confined to short-run fluctuations, or do they underpin stable long-run relationships with output and domestic factor accumulation?

Figure 1: Inward sectoral FDI (billion USD)



Source: Central Bank of the Republic of Türkiye (CBRT)

Motivated by these considerations, this paper investigates the long- and short-run growth effects of sectoral FDI in Türkiye by estimating separate Autoregressive Distributed Lag (ARDL) models for industry- and services-related inflows. The analysis is based on quarterly data and relates real output to sectoral FDI, domestic gross fixed capital formation and employment, while also incorporating dummy variables to capture the structural breaks associated with the 2009 crisis and 2020 pandemic. The ARDL bounds-testing framework is particularly well suited to this context because it allows for regressors that are integrated of different orders, performs reliably in small samples and provides a convenient error-correction representation that distinguishes between long-run equilibrium relationships and short-run adjustment dynamics. By comparing the estimated long-run coefficients and short-run responses across the industry and services models, the paper addresses two core research questions: (i) do FDI inflows into industry and services affect Türkiye’s output growth differently; (ii) are these effects primarily short-lived or do they manifest in stable long-run relationships?

In answering these questions, the study seeks to contribute to the broader debate on FDI-led development in two ways. First, it moves beyond aggregate FDI measures by explicitly distinguishing between industrial and services inflows, thereby shedding light on whether the composition of FDI matters for growth in a large emerging economy. Second, it uses a time-series approach that jointly models long-run cointegration and short-run dynamics, allowing for a richer characterisation of how sectoral FDI, domestic factors and output interact over the business cycle and in response to major shocks.

Building on this introduction, the rest of the paper is organised as follows. In Section 2, the existing literature on FDI, sectoral composition and economic growth is reviewed, with particular attention to evidence from

emerging economies and to studies that distinguish between manufacturing and services FDI. Section 3 presents the empirical model and methodology, outlining the ARDL specification, the unit root and bounds testing procedures, the data sources and variable definitions. Section 4 reports the estimation results for the two sectoral ARDL models, detailing both the long-run coefficients and the short-run error-correction dynamics, together with the associated diagnostic and stability tests. Section 5 discusses the main findings in light of the theoretical and empirical literature, interpreting the different roles of industry and services FDI. Section 6 concludes by summarising the key results, drawing out their policy implications for Türkiye's FDI and growth strategy, and suggesting directions for future research.

Literature review

The literature on the FDI–growth nexus is vast and heterogeneous, and it does not yield a clear consensus on whether foreign direct investment systematically promotes or hinders economic performance in host economies. Early contributions, framed within neoclassical and endogenous growth theories, typically view FDI as a key engine of growth because it augments the domestic capital stock and facilitates the diffusion of advanced technologies, managerial practices and organizational know-how (De Mello, 1997). In these models, foreign investors can help relax the savings constraint in capital-scarce economies and, more importantly, generate knowledge spillovers that raise total factor productivity and shift the economy to a higher long-run growth path (Akinlo, 2004; Yimer, 2023). This mechanism is particularly emphasized in endogenous growth frameworks, where human capital and innovation are central and returns to knowledge are not necessarily diminishing.

Empirical studies that follow this optimistic view often employ cross-country or panel data and find a positive and statistically significant relationship between FDI and growth. Pioneering works by De Gregorio (1992) Blömström et al. (1994) and Balasubramanyam et al. (1996), show that countries receiving larger FDI inflows tend to experience faster output growth, especially when foreign investment is oriented towards export-oriented manufacturing industries. These studies argue that foreign affiliates introduce more sophisticated technologies, improve managerial efficiency (Jovarcik, 2004), and stimulate competition, thereby forcing domestic firms to upgrade their production processes. The positive effect is frequently found to be stronger in economies that are more open to trade, suggesting that FDI and export-led strategies can be mutually reinforcing (Balasubramanyam et al., 1996; Akinlo, 2004).

However, a substantial strand of the literature has challenged the view that FDI is unconditionally growth-enhancing. Meta-analytical work

reviewing a large number of empirical studies concludes that the evidence is highly mixed: while a non-negligible share of papers report a positive impact, many others find a negative or statistically insignificant relationship (Iamsiraroj and Ulubaşoğlu, 2015). This has shifted attention towards the role of “absorptive capacity” and structural conditions in shaping the FDI–growth link. A number of studies point out that the benefits of FDI crucially depend on the quality of human capital (Balasubramanyam et al., 1996; Basu et al., 2003) the depth of financial markets (Hermes and Lensink, 2003; Azman-Saini and Law, 2010; Alfaro et al., 2010) the degree of trade openness and the strength of institutions in the host country (Melynk, et al., 2014; Çiftçi and Durusu-Çiftçi, 2022). When domestic firms have adequate skills and access to finance, and when the regulatory environment is stable and transparent, they are better able to learn from foreign partners, form backward and forward linkages, and internalise technology spillovers. In contrast, if these conditions are weak, foreign firms may remain enclaves with limited integration into the local economy, and the expected productivity gains may fail to materialise.

Other contributions go further and document cases where FDI is associated with adverse growth outcomes. Studies such as those by Carkovic and Levine (2005), Akinlo (2004), and Shittu et al. (2022) report that in many developing and fragile economies, the long-run effect of FDI on output is zero or even negative. Several mechanisms are proposed to explain these findings. First, foreign firms may crowd out domestic producers when they enjoy generous tax incentives (Herzer and Klasen, 2008), preferential access to credit or regulatory advantages that local firms do not receive (Iwasaki and Tokunaga, 2014). Under such circumstances, FDI can displace rather than complement domestic investment, leading to a net reduction in local entrepreneurial activity. Second, large and persistent profit remittances, interest payments and other income outflows can weaken the balance of payments over time, offsetting the initial positive impact of capital inflows (Akinlo, 2004). Third, substantial FDI inflows can contribute to real exchange-rate appreciation and Dutch-disease-type effects, whereby resources shift away from tradable sectors such as manufacturing and agriculture towards non-tradable services, undermining long-term competitiveness (Findlay, 1978). Fourth, when multinational enterprises acquire significant market power, they may engage in rent-seeking behaviour and limit technology transfer, further reducing the potential growth benefits for the host economy (Akinlo, 2004).

The sectoral composition of FDI has emerged as a particularly important dimension in explaining divergent results. Empirical research that differentiates between primary, manufacturing and services FDI generally finds that not all types of foreign investment are equally conducive to growth. Aykut and Sayek (2007), Vu and Noy (2009), Ullah et al. (2023) and Marasco

et al. (2024) show that FDI in manufacturing tends to generate stronger positive spillovers because it is more closely linked to export activities, has deeper backward and forward linkages with domestic suppliers, and often embodies more advanced technologies. In contrast, FDI concentrated in natural resources or non-tradable services such as real estate, retail trade or some segments of finance can have weak or even negative growth effects. In resource-based sectors, high rents and enclave-type production structures often limit local linkages and may reinforce volatility (Akinlo, 2004; Yimer, 2023). In non-tradable services, foreign investment may be oriented towards capturing domestic market share rather than building export capacity, and productivity spillovers to local firms may remain limited.

Table 1 displays the empirical literature regarding Türkiye. Empirical studies on Türkiye analyse the FDI–growth nexus at an aggregate level, without distinguishing between different sectors. For example, Bildirici et al. (2010) and Ilgın et al. (2010) use time-series techniques such as cointegration and VAR models and generally find that total FDI has a positive effect on industrial production or real GDP growth. Subsequent work employing cointegration analysis or VAR frameworks over longer samples similarly reports that aggregate FDI is positively associated with real GDP or GDP per capita in Türkiye, although a few recent contributions document statistically insignificant links once additional macroeconomic controls are introduced. Overall, this country-specific literature mirrors the international evidence by delivering mixed results, but it treats FDI as a single, economy-wide variable and focuses on total rather than sector-specific inflows.

Table 1: Empirical literature related to Türkiye

	Data Coverage	Dependent Variable	Methodology	Result
Bildirici et al. (2010)	1992-2008	Industrial Production	Threshold cointegration	Positive
İlgün et al. (2010)	1980-2004	Real GDP growth	VAR and causality tests	Positive
Ekinci (2011)	1980-2010	Real GDP	Cointegration analysis	Positive
Arisoy (2012)	1960-2005	Real GDP growth	Cointegration analysis	Positive
Aga (2014)	1980-2012	GDP per capita (USD)	Cointegration analysis	Positive
Cambazoğlu and Karaalp (2014)	1980-2010	Real GDP growth	VAR analysis	Positive
Demirsel et al. (2014)	2002-2014	Real GDP	Cointegration analysis	No significant relationship
Gökmen (2021)	1970-2019	Real GDP	Cointegration analysis	No significant relationship
Kurul (2021)	1984-2018	Real GDP growth	Non-linear ARDL	Positive
Usanmaz et al. (2025)	1970-2021	Real GDP	Johansen Cointegration	Positive
Özbek and Turgut (2025)	1990-2023	Real GDP	Fourier Shin Cointegration	Positive

A common limitation of these studies is that they do not disaggregate FDI into industry, services and other sectors, even when the dependent variable is industrial production. As a result, they cannot address whether the growth impact of FDI depends on the sector in which foreign capital is deployed, nor can they compare the roles of manufacturing versus services FDI in shaping Türkiye's growth performance. The present paper fills this gap by constructing separate series for industry and services FDI and estimating distinct ARDL models for each, thereby providing a systematic assessment of how the sectoral composition of FDI influences both the long-run equilibrium relationship between FDI and output and the short-run adjustment dynamics. In this way, the study extends the Turkish literature from an aggregate to a sectorally disaggregated perspective.

Empirical model and methodology

The empirical analysis relies on a standard FDI-augmented growth framework in which aggregate output depends on physical capital, labour input and foreign direct investment. The long-run relationship is derived from a Cobb–Douglas type production function and specified in logarithmic form as,

$$LY_t = \alpha_0 + \alpha_1 LK_t + \alpha_2 LLAB_t + \alpha_3 LFDI_t + u_t \quad (1)$$

where LY_t denotes the log of real GDP, LK_t is the log of real gross fixed capital formation. $LLAB_t$ represents the log of employment, $LFDI_t$ is a generic FDI term, and u_t is an error term. In order to capture the potentially different roles of sectoral foreign investment, two separate versions of this equation are estimated: in the first, $LFDI_t$ refers to FDI inflows into the industrial sector, while in the second, it denotes FDI inflows into the services sector. In both cases, FDI inflows are converted to Turkish lira using the average quarterly exchange rate and deflated by the domestic GDP deflator, so that the resulting series measure real sectoral FDI. FDI data is obtained from the Central Bank of the Republic of Türkiye (CBRT), the others are obtained from the Turkish Statistical Institute (TurkStat).

In line with the theoretical and empirical literature, the baseline expectation is that higher real investment in physical capital and a larger labour input should be associated with higher real output in the long run, implying positive coefficients on gross fixed capital formation (α_1 and employment α_2 in the growth equation). For FDI, however, the anticipated effects are more nuanced and depend on the sector considered. Industrial FDI is expected to foster output by expanding productive capacity, facilitating technology transfer and strengthening backward and forward linkages with

domestic firms, so a positive long-run coefficient would be consistent with the conventional view that manufacturing-oriented foreign investment is growth-enhancing (Bergoui and Murshed, 2023). By contrast, the impact of services-sector FDI is a priori ambiguous: while foreign entry in finance, telecommunications and other services can improve efficiency and support overall economic activity, FDI concentrated in non-tradable, low-productivity services may generate limited spillovers and could even crowd out domestic firms (Morasco et al., 2024). Consequently, the empirical analysis is designed to test whether the Turkish experience aligns with the optimistic scenario in which both types of FDI support growth, or instead reveals asymmetric effects across sectors.

The empirical analysis is conducted using quarterly macroeconomic data for Türkiye covering the period from 2005Q1 to 2025Q4. The choice of quarterly frequency allows the model to capture short-run dynamics in output, investment, labour and FDI that would be obscured in an annual setting, while the 2005Q1 starting point is dictated by data availability for the sectoral FDI and labour market series. Using quarterly data makes it possible to track the timing of shocks and to model short-run fluctuations in output and FDI more precisely than in an annual setting. Real GDP and gross fixed capital formation have been seasonally adjusted using the X-13 ARIMA-SEATS procedure to remove regular intra-year fluctuations and obtain series that are more suitable for quarterly time-series analysis.

This study employs the ARDL approach for several reasons. First, the time-series are relatively short and display a mixture of integration orders, with some variables being stationary in levels while others become stationary only after first differencing. In such settings, conventional cointegration techniques that require all variables to be integrated of the same order are not appropriate, whereas the ARDL–bounds testing framework of Pesaran et al. (2001) allows for a flexible treatment of $I(0)$ and $I(1)$ regressors within a single model. Second, the ARDL specification is well suited to quarterly data, as it captures rich short-run dynamics through distributed lags while simultaneously identifying the long-run equilibrium relationship between output, capital, labour and FDI. This dual representation is particularly useful in the context of FDI-driven growth, where short-run effects of capital inflows may differ substantially from their long-run impact. Third, compared with alternative cointegration methods, ARDL performs well in small samples and yields unbiased long-run estimates and valid t-statistics even when the sample size is limited, which is a relevant consideration given the length of the quarterly data set used in this study.

Within this framework, the baseline ARDL growth equation is specified as;

$$\begin{aligned} \Delta LY_t = & \beta_0 + \sum_{i=1}^p \beta_{1i} \Delta LY_{t-i} + \sum_{i=0}^p \beta_{2i} \Delta LK_{t-i} + \sum_{i=0}^p \beta_{3i} \Delta LLAB_{t-i} \\ & + \sum_{i=0}^p \beta_{4i} \Delta LFDI_{t-i} + \beta_5 LY_{t-1} + \beta_6 LK_{t-1} + \beta_7 LLAB_{t-1} \\ & + \beta_8 LFDI_{t-1} + \gamma D_{2009} + \gamma D_{2020} + u_t \end{aligned} \quad (2)$$

In equation (2), ΔLY_t denotes the quarterly growth rate of real output (log-difference of real GDP), while ΔLK_t , $\Delta LLAB_t$ and $\Delta LFDI_t$ are the first differences of the logarithms of gross fixed capital formation, employment and sectoral FDI, respectively. The summation terms with the differenced variables capture short-run dynamics, allowing past changes in output, capital, labour and FDI to affect current output growth. The lagged level terms LY_{t-1} , LK_{t-1} , $LLAB_{t-1}$ and $LFDI_{t-1}$ enter the equation to represent the long-run relationship among these variables; their joint significance is used in the ARDL bounds test for cointegration. The coefficient on the lagged output level, together with the coefficients on the other lagged levels, forms the error-correction term that measures the speed at which deviations from the long-run equilibrium are corrected. Finally, D_{2009} and D_{2020} are the dummy variables in order to control crisis and pandemic. The short-run dynamics and the associated error-correction representation of the ARDL model can be written as follows:

$$\begin{aligned} \Delta LY_t = & \delta_0 + \sum_{i=1}^p \delta_{1i} \Delta LY_{t-i} + \sum_{i=1}^p \delta_{2i} \Delta LK_{t-i} + \sum_{i=1}^p \delta_{3i} \Delta LLAB_{t-i} \\ & + \sum_{i=1}^p \delta_{4i} \Delta LFDI_{t-i} + \varphi ECM_{t-1} + u_t \end{aligned} \quad (3)$$

Results

Before presenting the ARDL bounds test and coefficient estimates, the time-series properties of the data have to be examined. ARDL bounds test allows to model I(0) and I(1) variables together. However, the unit root test has to ensure that none of the variables is integrated of order two, as the presence of I(2) series would invalidate the bounds testing procedure (Ouattara, 2004).

Table 2: Unit root test results

	ADF		PP	
	Level	1 st difference	Level	1 st difference
LY	-0.38 (0.90)	-12.07*** (0.00)	-0.42 (0.89)	-12.06*** (0.00)
LK	-1.15 (0.69)	-8.90*** (0.00)	-1.20 (0.67)	-8.95*** (0.00)
LLAB	-0.67 (0.85)	-7.58*** (0.00)	-0.67 (0.85)	-7.59*** (0.00)
FDI_IND	-6.71*** (0.00)	-	-6.67*** (0.00)	-
FDI_SER	-8.40*** (0.00)	-	-8.56*** (0.00)	-

***Denotes significant at 1% and ** denotes significant at %5. The probability values could be followed in parenthesis. The models reported are the models with intercept, but the other models also reveal the same result.

The ADF and PP unit root test results in Table 2 indicate that all variables are stationary either in levels or after first differencing, and none of them is integrated of order two. This confirms that there are no issues with the time-series properties of the data and that the ARDL bounds testing framework can be validly applied. Two separate ARDL models are estimated: Model 1 relates output to FDI in industry, whereas Model 2 relates output to FDI in services. Based on the Akaike Information Criteria (AIC), the optimal lag structure for the industry specification is ARDL(6,1,2,8), while the services specification is represented by ARDL(1,1,1,5). The presence of a long-run equilibrium relationship among the variables in each model is examined using the ARDL bounds testing procedure proposed by Pesaran, Shin and Smith (2001). Given the trending behaviour of the series, both specifications include an unrestricted constant and a linear time trend to adequately capture deterministic components of the long-run dynamics, and the resulting bounds test statistics together with their corresponding critical value bounds are reported in Table 3.

Table 3: Bounds test results

$H_0 = \beta_5 = \beta_6 = \beta_7 = \beta_8$ (no cointegration)		Bounds Critical Values		
Model 1	Model 2		I(0)	I(1)
k=3	k=3	10%	3.58	4.60
7.10***	6.82***	5%	4.20	5.32
		1%	5.62	6.36

***means statistical significance at the 1% level and k is the number of regressors.

Note: Critical values are drawn from Narayan (2005)

The bounds test results reported in Table 3 indicate that the calculated F-statistics for both models are well above the upper critical value at the 1 per cent significance level. This implies that the null hypothesis of no cointegration among output, capital, labour and sectoral FDI can be rejected

for both the industry (Model 1) and services (Model 2) specifications. Consequently, a stable long-run equilibrium relationship is found to exist between output and its determinants in each model, justifying the estimation of long-run coefficients and the associated short-run error-correction representations. Table 4 represents both short and long-run results of the two models.

Table 4: Estimated long and short run results

	Model 1 (6,1,2,8)		Model 2 (1,1,1,5)	
	Coefficient	P-value	Coefficient	P-value
Dependent Variable: LY				
Long-run Coefficients				
<i>LK</i>	0.52***	0.00	0.27***	0.01
<i>LLAB</i>	-0.49**	0.02	-0.07	0.79
<i>FDI IND</i>	-0.05***	0.01		
<i>FDI SER</i>			0.05***	0.00
Short-run Coefficients				
$\Delta LY (-1)$	-0.21***	0.01		
$\Delta LY (-2)$	-0.19***	0.00		
$\Delta LY (-3)$	-0.17**	0.02		
$\Delta LY (-4)$	-0.11*	0.09		
$\Delta LY (-5)$	-0.07	0.18		
$\Delta LK (-1)$	0.38***	0.00	0.33***	0.00
$\Delta LLAB$	0.33***	0.00	0.75***	0.00
$\Delta LLAB (-1)$	0.31***	0.00		
$\Delta LFDI IND$	-0.01	0.45		
$\Delta LFDI IND (-1)$	0.02***	0.00		
$\Delta LFDI IND (-2)$	0.02***	0.00		
$\Delta LFDI IND (-3)$	0.02***	0.00		
$\Delta LFDI IND (-4)$	0.01***	0.00		
$\Delta LFDI IND (-5)$	0.01***	0.00		
$\Delta LFDI IND (-6)$	0.01***	0.01		
$\Delta LFDI IND (-7)$	0.01***	0.01		
$\Delta LFDI SER$			0.01***	0.00
$\Delta LFDI SER(-1)$			-0.01***	0.00
$\Delta LFDI SER (-2)$			-0.01***	0.00
$\Delta LFDI SER (-3)$			-0.01*	0.08
$\Delta LFDI SER (-4)$			-0.01*	0.09
<i>DUM2009</i>	0.18	0.32	0.01	0.71
<i>DUM2020</i>	-0.03***	0.00	-0.02**	0.02
<i>C</i>	7.14***	0.00	7.09***	0.00
<i>TREND</i>	0.01***	0.00	0.01***	0.00
<i>ECM</i>	-0.48***	0.00	-0.47***	0.00
Diagnostic Tests				
	F- Test	P- Value	F- Test	P- Value
Serial Correlation (Breusch-Godfrey)	0.20	0.81	1.38	0.25
Heteroskedasticity (Breusch-Pagan-Godfrey)	1.04	0.43	0.99	0.47
Model Specification (Ramsey RESET)	3.57	0.12	0.20	0.65
Normality of Residuals (Jarque-Bera)	4.50	0.11	4.94	0.10

***denotes significance at 1%, ** denotes significance at 5% and * denotes significance at 10%

In the industry model (Model 1), the long-run coefficient on capital is positive and statistically significant, indicating that higher real gross fixed capital formation is associated with higher output in the long run, in line with standard growth theory. The long-run coefficient on labour is negative and significant, which may reflect diminishing returns to labour, structural rigidities in the labour market and suggests that increases in labour without commensurate capital deepening may reduce labour productivity and overall output. Industry-related FDI has a negative and statistically significant long-run coefficient, implying that, once domestic capital and labour are controlled for, FDI in industry exerts a negative long-run effect on aggregate output, possibly because technology spillovers and efficiency gains are offset by crowding-out or profit repatriation effects.

Regarding short-run dynamics, they are characterised by significant lagged changes in output and in industry-related FDI. Several lags of output growth enter with alternating signs, indicating pronounced output persistence and cyclical adjustment: positive shocks to growth tend to be followed by partial reversals before the system converges back towards its long-run path. Changes in industry FDI display a mixed pattern as well; the first lag has a positive and statistically significant coefficient, suggesting that an increase in industry-sector FDI initially boosts output growth, but subsequent significant lags carry negative signs, implying that these gains are later offset as adjustment costs, competitive restructuring or profit repatriation start to dominate. Taken together, the short-run coefficients point to a hump-shaped response of output to industry FDI, with short-lived expansions followed by some payback in later quarters.

The deterministic components of the model also provide useful insights. The estimated constant term is positive and significant. The time trend enters with a positive and statistically significant coefficient, suggesting the presence of an underlying upward drift in output that may be interpreted as exogenous technological progress or other gradual structural improvements that are not explicitly modelled. By contrast, the 2009 crisis dummy is statistically insignificant. The 2020 dummy, however, is negative and significant, pointing to a distinct break in output associated with the pandemic period.

In the services model (Model 2), the long-run coefficient on capital is positive and statistically significant, indicating that higher real gross fixed capital formation is associated with higher output in the long run, even after controlling for labour and services-sector FDI. This finding is consistent with standard growth theory and underscores the importance of capital deepening in supporting services-led growth. By contrast, the long-run coefficient on labour is statistically insignificant. The long-run coefficient on services FDI remains positive and highly significant, implying that sustained increases in

FDI inflows to the services sector are strongly associated with higher output and that services-oriented FDI constitutes an important driver of long-run growth alongside domestic capital.

In the short run, changes in services FDI affect output growth at several lags, but the signs of the significant coefficients are mixed rather than uniformly positive. Early lags tend to have negative and statistically significant effects, while later lags turn positive and significant, indicating that an increase in services FDI may initially dampen output growth before generating stronger positive effects as new investments are absorbed and productivity gains materialise. Short-run output growth also exhibits notable persistence through its own significant lag, suggesting that positive or negative shocks to growth propagate into subsequent quarters rather than being immediately reversed. Together with the negative and highly significant error-correction term, these results imply that although services FDI can cause sizeable short-run fluctuations—both downward and upward—the system ultimately converges back towards the long-run equilibrium path at a steady pace.

The deterministic components and adjustment mechanisms further clarify the behaviour of the services model. The constant term is positive and significant. The trend coefficient is positive and statistically significant, indicating an underlying upward drift in output that may be interpreted as reflecting autonomous technological progress or gradual institutional and structural improvements. With respect to crisis episodes, the dummy for the 2020 pandemic period is negative and significant, signalling a discrete downward shift in output during the pandemic over and above what can be explained by movements in capital, labour and services FDI, while the 2009 dummy is (as in the industry model) statistically insignificant. The error-correction term is negative and highly significant, confirming the existence of a stable long-run equilibrium and indicating that deviations of output from its long-run path are partially corrected each quarter, so shocks to the services-growth relationship have only transitory effects.

For both the industry and services models, standard diagnostic checks suggest that the ARDL specifications are statistically adequate. The Breusch–Godfrey LM test statistics fail to reject the null of no serial correlation in either case, indicating that the residuals are free from problematic autocorrelation. Likewise, the Breusch–Pagan–Godfrey heteroskedasticity tests do not reject the null hypothesis of homoskedastic errors, suggesting that the disturbance variance is stable over time. The Ramsey RESET test statistics are also insignificant for both models, implying that there is no evidence of functional form misspecification. Finally, the Jarque–Bera normality tests indicate that the residuals are approximately normally distributed at conventional significance levels.

In addition to these formal tests, CUSUM and CUSUM of Squares plots for both the industry and services models are reported in the Appendix. The stability curves remain within the 5 per cent significance bounds throughout the sample period, providing further evidence that the estimated coefficients are structurally stable and that no major parameter instability or structural break has been left unmodelled.

Discussion

The empirical results reveal several important aspects of the relationship between sectoral FDI and output growth in Türkiye. First, the industry model points to a short-run positive but long-run negative effect of industrial FDI on output. In the short run, new FDI projects in manufacturing can boost activity through construction, installation, and the rapid expansion of production capacity, which shows up as higher quarterly growth. Over the longer horizon, however, the negative long-run coefficient suggests that these benefits may be outweighed by adverse channels such as the displacement of less competitive domestic firms, increased import dependence in intermediate goods, or the repatriation of profits abroad (Akinlo, 2004; Carkovic and Levine, 2005; Shittu et al., 2022). This configuration is consistent with a scenario in which industrial FDI initially stimulates demand and investment, but later leads to a restructuring of the production base that does not necessarily translate into sustained gains in domestic value added.

Second, the contrast between the two sectoral models is striking: while industry-related FDI exerts a negative long-run effect, services-sector FDI has a positive and statistically significant impact on output in the long run. One plausible interpretation is that services FDI is more closely associated with technology diffusion, managerial know-how, and improvements in backbone services such as finance, telecommunications, transport and business services, which raise productivity across the entire economy (Morasco et al., 2004). In contrast, industrial FDI in a middle-income economy may be concentrated in relatively low-value-added assembly activities or enclave-type operations, limiting spillovers to local suppliers. The results therefore, suggest that the composition of FDI matters for growth: attracting efficiency-enhancing and knowledge-intensive FDI into services could be more growth-friendly than relying primarily on traditional manufacturing FDI.

Third, the negative contribution of labour in the industry model hints at important labour-market frictions. The significant long-run coefficient on labour with a negative sign suggests that increases in total employment have coincided with lower output per worker, which may reflect a deterioration in average skill levels or a mismatch between the skills demanded by FDI-intensive sectors and those supplied by the domestic workforce. One natural explanation is related to brain drain: while total headcount employment

may have risen, high-skilled workers could have emigrated or shifted into more dynamic service activities, leaving the industrial sector with a larger but relatively less productive pool of labour. In such a context, additional low-skilled employment may contribute little to, or even detract from, overall productivity, so that output falls once capital and FDI are held constant (Yu, 2021; Docquier and Rappoport, 2012). This interpretation underscores the importance of retaining and upgrading human capital if industrial FDI is to generate durable growth benefits.

These findings are broadly consistent with the mixed evidence in the literature on FDI–growth linkages in developing and emerging economies, which emphasises that the sign and magnitude of FDI spillovers depend critically on sectoral composition and host-country absorptive capacity (Vu and Noy, 2009; Yimer, 2023).

At the same time, the analysis is subject to several limitations. First, the empirical work relies on FDI flows rather than sectoral stocks of foreign capital, because sufficiently long and consistent quarterly stock series are not available; as a result, the cumulative effects of FDI on production capacity and productivity may be only partially captured. Second, the industrial FDI aggregate cannot be disaggregated into more detailed manufacturing subsectors, even though spillovers are likely to differ markedly between, for example, automotive, textiles and machinery; the negative long-run impact found for industry as a whole may therefore mask substantial heterogeneity across subsectors.

Conclusions and policy implications

This study has examined the growth effects of sectoral FDI in Türkiye using an ARDL framework that accommodates a mixture of $I(0)$ and $I(1)$ variables and small-sample quarterly data. The bounds tests strongly support the existence of long-run cointegrating relationships in both the industry- and services-based models, validating the use of an error-correction representation to distinguish between short-run dynamics and long-run equilibrium effects. In the industry model, domestic capital exerts a positive and significant long-run impact on output, while labour enters with a negative coefficient and industry-related FDI is significantly negative. In contrast, in the services model, both capital and services-sector FDI have positive and significant long-run coefficients, and services FDI emerges as a particularly important engine of growth, whereas labour remains insignificant.

These findings yield several policy implications. First, the weak or adverse long-run impact of industry-related FDI suggests that Türkiye’s manufacturing-oriented FDI strategy should move beyond the sheer volume of inflows and instead prioritise projects that create stronger local linkages, foster technology transfer and upgrade domestic suppliers—for example,

through structured supplier-development programmes and closer collaboration between foreign investors, local firms and universities. Second, the robust positive effect of services-sector FDI indicates that reforms encouraging high-quality investment in backbone and knowledge-intensive services—such as finance, telecommunications, logistics and business services—can play a central role in sustaining growth, provided that regulatory frameworks promote competition, transparency and avoid excessive market concentration.

Future research could build on these results in several directions. One avenue would be to disaggregate industrial FDI further and estimate separate ARDL models for key manufacturing subsectors—such as automotive, textiles or machinery—in order to identify which segments drive the negative long-run effect and whether some niches generate more favourable spillovers than others. Another promising extension would be to complement flow-based measures of FDI with sectoral stocks of foreign capital, which may better capture the cumulative impact of FDI on production capacity and productivity, especially in capital-intensive industries.

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Appendix

The stability of the estimated ARDL models is examined using the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests. For both the industry and services specifications, the plots reported below show that the recursive residuals remain within the 5 percent significance bands over the entire sample period. This indicates that there is no evidence of structural instability or parameter drift in either model and that the long-run coefficients and short-run dynamics reported in the main text can be regarded as stable and reliable.

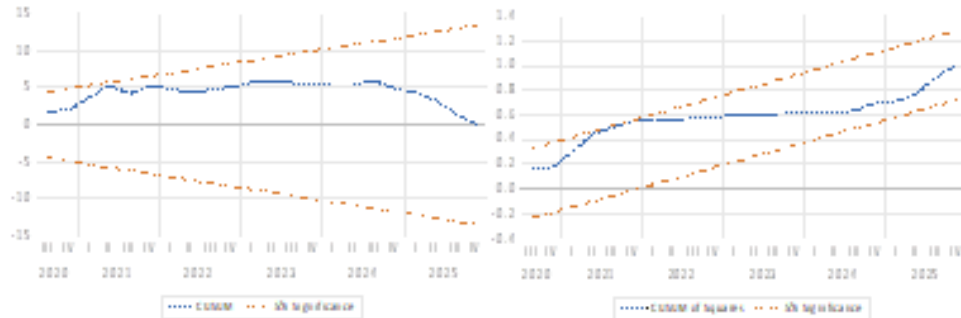


Figure A.1 Cusum and cusum square test results. Industry

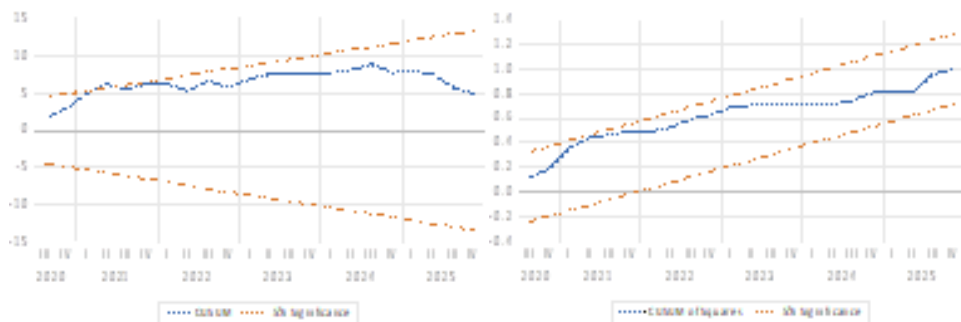


Figure A.2 Cusum and cusum square test results. Services

Relationship Between Outdoor Adventure Education Programs and Environmental Sustainability Behaviors Among Youths in Ondo State, Nigeria

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Abstract

This study examined the relationship between outdoor adventure education (OAE) programs and environmental sustainability behaviors among 360 youths in Ondo State, Nigeria (63.6% male, 36.4% female; 70.5% aged 18-34; Yoruba, with low-to-middle income and secondary/higher education). Using a correlational survey design and self-report questionnaire data collection across amusement parks, recreation, sports, and tourism, the study revealed a significant positive relationship between participation in these programs and sustainability behaviors among youths. Mean ratings across contexts ranged from 2.76 to 3.04, indicating consistent agreement. Statistical analysis further showed significant correlations between OAE context: amusement park ($r = .660$), recreation ($r = .515$), sports ($r = .832$), tourism ($r = .703$), and environmental sustainability behaviors among youths ($p < .05$). Regression analysis showed these contexts jointly explain 30.2% of variance in sustainability behaviors ($R = .302$, $F = 38.85$, $p < .001$). The findings

recommend integrating environmental education into youth programs across these sectors.

Keywords: OAE programs; Environmental sustainability; Pro-environmental behaviors; Youths; Nigeria; Amusement parks; Sports

Introduction

Outdoor adventure education (OAE) is a pedagogical approach that combines experiential learning and adventure-based activities in natural environments to promote personal growth, environmental awareness, and sustainable behaviors. It often involves structured programs to foster critical life skills such as teamwork, resilience, and problem-solving while developing an understanding of ecological systems and sustainability (Brymer et al., 2019). Outdoor learning has the potential to improve social, emotional, and cognitive development, especially among youth, who are at a critical stage of forming behavioral patterns (Molyneux et al., 2023). Nigeria faces numerous environmental challenges, including deforestation, pollution, urbanization, and biodiversity loss. Urbanization and industrial activities further contribute to air and water pollution, affecting public health and reducing the quality of life in urban and rural areas (Dipeolu et al., 2020).

Furthermore, poor waste management practices, including the improper disposal of plastics and hazardous materials, have contributed to soil and water contamination, posing risks to both human and environmental health (Maingi et al., 2021). These challenges are compounded by a lack of awareness and participation in sustainability practices among youth. This is partly due to insufficient exposure to practical, hands-on environmental education programs that emphasize sustainability (Ngobua *et al.*, 2021). However, observations suggest that many young Nigerians lack the awareness and skills necessary to address environmental challenges effectively (Fyfe-Johnson *et al.*, 2021).

OAE programs have been identified as effective tools for fostering environmental awareness and sustainability behaviors among youth. By engaging in outdoor activities, young participants develop a sense of responsibility for nature and an understanding of the ecological consequences of their actions (Pomohaci et al., 2018). Outdoor education programs, which emphasize experiential learning, have proven effective in embedding these principles among youth (Kuo *et al.*, 2019).

In Nigeria, where over 60% of the population is under 30, the youth demographic holds immense potential for driving sustainability initiatives (Oyeleke & Bakare, 2020). Their active participation in OAE programs has been linked to increased environmental awareness and advocacy for conservation policies. Moreover, youth are not only participants but also

catalysts for change. Their unique perspective allows them to identify and address gaps in existing sustainability strategies (Dipeolu *et al.*, 2020). According to Eigenschenk *et al.* (2019), outdoor settings such as parks, recreation areas, sports fields, and tourism destinations provide unique opportunities for environmental education. Parks, for example, serve as natural laboratories where participants can observe ecosystems and learn about conservation firsthand. Recreational activities like hiking and camping offer experiential learning opportunities that deepen participants' connection to nature.

Sports and tourism also play a crucial role in OAE. Sporting activities such as cycling or kayaking can be designed to emphasize environmental stewardship, teaching participants about the importance of protecting natural resources (Ogunsemere, 2019). Similarly, eco-tourism initiatives allow individuals to explore natural habitats while learning about sustainable practices and the need for conservation (Jamieson & Ostermeyer, 2017). Despite their potential, these platforms are underutilized in Nigeria. Poor maintenance of recreational and sporting facilities, limited funding for parks, and unregulated tourism practices hinder their effectiveness as tools for environmental education (Ngobua *et al.*, 2021).

Research by Wang *et al.* (2023) demonstrates that outdoor activities significantly reduce screen time among adolescents, promoting healthier lifestyles and greater environmental consciousness. Similarly, studies by Ayaga and Okaya (2020) highlight the role of outdoor education in enhancing students' understanding of ecological interdependencies and their commitment to sustainability. In Nigeria, OAE programs have been successfully implemented in schools and community settings, providing youth with practical skills for environmental conservation (Odekunle *et al.*, 2022). These programs emphasize collaborative learning, where participants work together to solve real-world environmental problems, fostering teamwork and a shared sense of responsibility. The integration of sustainability principles into outdoor education programs has also been linked to improved academic performance and social skills among participants. For example, Olajide *et al.* (2017) found that students who participated in outdoor learning activities demonstrated higher levels of environmental literacy and critical thinking. This underscores the potential of outdoor settings to serve as holistic platforms for personal and social development.

OAE programs have garnered increasing attention worldwide due to their multifaceted benefits for personal development, academic growth, and sustainable behaviors. These programs integrate experiential learning in nature, nurturing critical thinking, teamwork, and environmental consciousness, which are instrumental in promoting sustainable behaviors (Brymer *et al.*, 2019).

In Nigeria, the concept of OAE is largely unexplored, despite its potential to address the country's pressing environmental challenges. Youth engagement in structured OAE programs remains limited, with most recreational activities revolving around informal sports or unstructured leisure (Oyeleke & Bakare, 2020). While programs in other nations link outdoor activities with sustainability goals, Nigeria's initiatives rarely incorporate this crucial dimension (Ngobua *et al.*, 2021). This absence is particularly concerning given Nigeria's vulnerability to environmental degradation, deforestation, and climate change (Dipeolu, Ibem, & Fadamiro, 2020).

Despite the growing recognition of outdoor learning as a tool for promoting sustainability, there is a paucity of research on its application and effectiveness in Nigeria. Existing studies predominantly focus on the recreational or health benefits of outdoor activities, neglecting their potential role in fostering environmental behaviors. Furthermore, while international research highlights the transformative role of OAE in shaping pro-environmental attitudes, similar studies in Nigeria remain scarce. The lack of data on Nigerian youth's engagement with nature and its influence on their environmental behaviors limits the development of targeted interventions.

With a significant proportion of the population under 30 years old, engaging youth in environmental education is vital for fostering a generation of sustainability advocates (Jamieson & Ostermeyer, 2017). However, the limited availability of structured outdoor learning opportunities restricts their exposure to nature, reducing their likelihood of adopting pro-environmental practices.

Research Questions

The following research questions are raised in this study:

1. What are participants' perceptions of the relationship between OAE programs in amusement parks and environmental sustainability behaviors among youth?
2. What are participants' perceptions of the relationship between OAE programs in recreation and environmental sustainability behaviors among youth?
3. What are participants' perceptions of the relationship between OAE programs in sports and environmental sustainability behaviors among youth?
4. What are participants' perceptions of the relationship between OAE programs in tourism and environmental sustainability behaviors among youth?

Research Hypotheses (H0):

- **H11:** Participants perceive a positive relationship between OAE programs in amusement parks and environmental sustainability behaviors among youth.
- **H12:** Participants perceive a positive relationship between OAE programs in recreation and environmental sustainability behaviors among youth.
- **H13:** Participants perceive a positive relationship between OAE programs in sports and environmental sustainability behaviors among youth.
- **H14:** Participants perceive a positive relationship between OAE programs in tourism and environmental sustainability behaviors among youth.
- **H15:** Participants perceive relative contribution from all four OAE contexts to environmental sustainability behaviors among youth.
- **H16:** Participants perceive joint contributions from all four OAE contexts to environmental sustainability behaviors among youth.

Methodology

Study Area

Ondo State, located in the southwestern region of Nigeria, has a land area of 15,500 km² and a population exceeding 5 million. The state is characterized by diverse topography, including lowland rainforest zones in the south and central regions and the undulating highlands in the northern parts. Notably, the Idanre Hills are a UNESCO-recognized tourist site (>900 m elevation). Ondo State experiences a tropical rainforest climate, with two distinct seasons: the rainy season (April to October) and the dry season (November to March).

Ondo State has numerous recreational parks, sports complexes, and tourist centers, making it an ideal location for studying OAE programs. Sites like the Idanre Hills Tourist Centre, Manuex Amusement Park, Akure Recreational Club, and FUTA Sports Complex make it a suitable location for studying OAE programs on youth sustainability behaviors.

Ethical Statement

The study “Impact of Outdoor Adventure Education Programs on Environmental Sustainability Behaviors among Youths in Ondo State, Nigeria” was reviewed and approved by the Ethics Committee of the School of Agriculture and Agricultural Technology (SAAT), Federal University of Technology, Akure, Nigeria. All participants were informed about the study's purpose and procedures and provided voluntary informed consent before participating.

Research Design

The research approach used in this study was a descriptive survey to examine the relationship between OAE programs and environmental sustainability behaviors among youth.

Participants and Demographics

The target population comprised youth visitors to 12 purposively selected organizations (three each from amusement parks, recreation, sports, and tourism) in Ondo State. Using Yamane's formula for a finite population (1967) at 5% margin of error, a sample of 360 respondents was drawn via proportionate stratified random sampling (30 per site).

The sample (N=360) comprised 229 males (63.6%) and 131 females (36.4%). The majority (70.5%) were under age 34, with 36.9% aged 18-24 and 33.6% aged 25-34. For this study, youth were identified as individuals aged 18-34 years, consistent with national categorizations of young people in Nigeria. Participants above this age range (29.5%) were also included because they were actively engaged in OAE programs at the selected locations; their responses were retained to reflect the actual population. Most respondents were single (43.1%) or married (39.7%). Income was predominantly low to middle (27.5% earned below #50,000 monthly). Educational attainment was diverse: 26.4% secondary education, 21.4% bachelor's degree, 19.7% diploma/technical, and 14.7% master's or higher. The sample was predominantly Yoruba (65.6%), with Igbo (26.9%) and Hausa (7.5%) minorities, reflecting the state's ethnic composition.

Literature Justification for Design

The descriptive survey design is appropriate for exploratory assessments of experiential program's effects on behaviors, as confirmed by studies on youth environments (Kuo et al., 2019; Eigenschenk et al., 2019). Stratified sampling guarantees representation across OAE contexts (Brymer et al., 2019), while Pearson correlation/regression tests associations for self-reported data (Creswell & Creswell, 2018).

Population, Sample, and Sampling Technique

- **Stage 1:** Four categories of organizations were identified: amusement parks, sports, recreation, and tourism.
- **Stage 2:** To ensure equal representation across OAE contexts, three organizations were selected from each category (a total of 12 organizations), using stratified sampling.
- **Stage 3:** Since the total visitor population of the selected organizations is unknown, a proportionate stratified random sampling technique was used to determine the sample size and ensure fair representation across

all twelve (12) organizations. Using Yamane’s formula for unknown population size, a sample size of 360 respondents was determined (margin of error:5%), with 30 respondents per organization.

Table 1 presents the distribution of 360 respondents across the 12 selected organizations.

Table 1: Distribution of the Sample

S/N	Category	Number of selected organizations	Respondents per organization	Total respondents per category
1-3	Amusement parks	3	30	90
4-6	Sports	3	30	90
7-9	Recreation	3	30	90
10-12	Tourism	3	30	90
Total	All Categories	12	30	360

Research Instrument

The instrument used to gather data for this study was a well-structured questionnaire titled “OAE Programs and Environmental Sustainability Behaviors Questionnaire (OAEPLESBQ)”. Five (5) sections made up the subdivided questionnaire (A, B, C, D, and E). Section A had the respondents' demographic information, including their age, gender, marital status, income, education, and tribe. Section B-E measured the correlation of the relationship between OAE programs in amusement parks, recreation, sports, and tourism, respectively, and environmental sustainability behaviors among youths.

Each portion of the instrument used a four-point scale: Strongly Disagree (SD), Agree (A), Disagree (D), and Strongly Agree (SD).

Validation of the Instrument

The researcher's supervisor examined each item in the study instrument to ensure that it aligned with the research questions and hypotheses, a process known as face and content validity. Prominent academics also verified the questionnaire further. After all necessary modifications were completed, the final version was used to gather data.

Reliability of the Instrument

A pilot test was carried out using a subset of respondents who were not part of the primary research and copies of the questionnaire. Upon retrieval, the administered questionnaires were divided into two groups: even and odd numbers. The OAE was examined using Cronbach’s alpha, which is widely recommended for reliability assessment of multi-item scales in survey research (Creswell & Creswell, 2018). The reliability of the instrument was

assessed and determined by the reliability coefficient to indicate if the instrument was reliable within an acceptable limit. The overall scale yielded a Cronbach’s alpha coefficient of 0.82, indicating acceptable reliability for survey research.

Procedure for Data Collection

To help with the questionnaire distribution, a letter of introduction was submitted, which introduced the researcher to the respondents. The questionnaires were distributed to the respondents with the assistance of six (6) skilled research assistants. To guarantee a high rate of return, the researcher and research assistants collected all 360 copies of the complete questionnaire from the respondents once it was finished. Before being analyzed, the copies of the questionnaire were coded.

Procedure for Data Analysis

The data gathered was subjected to descriptive statistics (frequency counts, percentage, mean, and standard deviation), Pearson’s correlation, and multiple regression. Descriptive statistics (frequency counts and percentages) were used to analyze the demographic data of the respondents; descriptive statistics (mean and standard deviation) were used to analyze the research questions, while Pearson’s correlation and multiple regression were used to inferentially test hypotheses at the 0.05 level of significance, using Statistical Package for Social Science (SPSS) version 26.

Results

This study utilizes self-reported questionnaire data to evaluate participants' perceptions and beliefs about how OAE programs relate to environmental sustainability behaviors. Results are based on subjective associations rather than objective behavioral measures or causal effects.

Research Question 1: What are participants’ perceptions of the relationship between OAE programs in amusement parks and environmental sustainability behaviors among youth?

Table 2 reveals respondents’ mean ratings for the items measuring perceived relationships between OAE programs in amusement parks and sustainability behaviors among youth.

Table 2: Descriptive Analysis of Research Question 1

S/N	Items	SA (Freq. %)	A (Freq. %)	D (Freq. %)	SD (Freq. %)	Mean	Std. Dev.
1	Engaging in outdoor adventure activities helps Nigerian youths develop skills for sustainable living.	130 (36.1%)	95 (26.4%)	77 (21.4%)	58 (16.1%)	2.82	1.09

2	National park-based education programs significantly influence youths' attitudes toward waste management and recycling.	125 (34.7%)	99 (27.5%)	78 (21.7%)	58 (16.1%)	2.81	1.08
3	Hands-on learning experiences in Amusement parks improve youths' understanding of climate change and its impacts.	123 (34.2%)	101 (28.1%)	80 (22.2%)	56 (15.6%)	2.81	1.07
4	Participation in outdoor adventure activities fosters a sense of responsibility for protecting natural resources.	122 (33.9%)	100 (27.8%)	82 (22.8%)	56 (15.6%)	2.80	1.07
5	OAE programs encourage Nigerian youths to adopt eco-friendly practices in their daily lives.	126 (35.0%)	98 (27.2%)	75 (20.8%)	61 (16.9%)	2.80	1.09
6	Exposure to nature through adventure programs strengthens youths' commitment to biodiversity conservation.	120 (33.3%)	102 (28.3%)	79 (21.9%)	59 (16.4%)	2.79	1.08
7	Implementation of OAE in Amusement parks increases youths' advocacy for environmental policies.	119 (33.1%)	103 (28.6%)	81 (22.5%)	57 (15.8%)	2.79	1.07
8	Amusement parks provide an ideal setting for experiential learning that promotes sustainable environmental behaviors.	118 (32.8%)	104 (28.9%)	78 (21.7%)	60 (16.7%)	2.78	1.08
9	Outdoor adventure programs create lifelong environmental stewardship among participants.	121 (33.6%)	97 (26.9%)	79 (21.9%)	63 (17.5%)	2.77	1.10
10	OAE programs in Amusement parks enhance youths' awareness of environmental conservation.	115 (31.9%)	105 (29.2%)	80 (22.2%)	60 (16.7%)	2.76	1.07
Average Mean						2.79	1.08

Decision rule: It has been adjudged that a criterion mean score of 2.50 and above is significant.

Note. SA = Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree

Table 2 reveals the descriptive analysis of respondents' self-reported perceptions of the relationship between OAE programs in amusement parks and environmental sustainability behaviors among youths. The result showed that most respondents strongly agreed across most of the items, with mean Result showed that most respondents strongly agreed and agreed across most of the items, with mean scores ranging from 2.76 to 2.82. For instance, respondents affirmed that engaging in outdoor adventure activities helps Nigerian youths develop skills for sustainable living ($\bar{x} = 2.82$) and that national park-based education programs significantly influence attitudes toward waste management and recycling ($\bar{x} = 2.81$). Similarly, hands-on learning experiences in amusement parks were perceived to improve understanding of climate change and its impacts ($\bar{x} = 2.81$).

These consistently high mean values, above the set criterion of 2.50, indicate that respondents perceive a strong relationship between OAE programs in amusement parks and the development of long-term environmental sustainability behaviors among youths.

Research Question 2: What are participants’ perceptions of the relationship between OAE programs in recreation and environmental sustainability behaviors among youth?

Table 3 reveals respondents’ mean ratings for the items measuring perceived relationships between OAE programs in recreation and sustainability behaviors among youth.

Table 3: Descriptive Analysis of Research Question 2

S/N	Items	SA (Freq. %)	A (Freq. %)	D (Freq. %)	SD (Freq. %)	Mean	Std. Dev.
11	Implementing OAE in recreational spaces cultivates environmental stewardship among Nigerian youths.	148 (41.1%)	122 (33.9%)	52 (14.4%)	38 (10.6%)	3.06	0.99
12	Recreational adventure programs promote eco-friendly habits such as reducing waste and minimizing pollution.	147 (40.8%)	121 (33.6%)	55 (15.3%)	37 (10.3%)	3.05	0.99
13	OAE programs in recreational settings help instill a culture of environmental responsibility among Nigerian youths.	145 (40.3%)	123 (34.2%)	53 (14.7%)	39 (10.8%)	3.04	0.98
14	Engaging in outdoor recreation activities increases youths’ awareness of the need for environmental conservation.	141 (39.2%)	129 (35.8%)	54 (15.0%)	36 (10.0%)	3.04	0.97
15	Implementing outdoor education programs in recreational spaces enhances youths’ understanding of the importance of biodiversity.	143 (39.7%)	125 (34.7%)	56 (15.6%)	36 (10.0%)	3.04	0.98
16	Recreational outdoor programs improve youths’ attitudes toward responsible land and water use.	144 (40.0%)	124 (34.4%)	54 (15.0%)	38 (10.6%)	3.04	0.98
17	Outdoor adventure experiences in recreational areas encourage Nigerian youths to engage in environmental advocacy.	137 (38.1%)	133 (36.9%)	53 (14.7%)	37 (10.3%)	3.03	0.97
18	Participation in outdoor recreation activities strengthens commitment to sustainable tourism practices.	142 (39.4%)	126 (35.0%)	54 (15.0%)	38 (10.6%)	3.03	0.98
19	Adventure-based recreational education fosters teamwork and leadership in addressing environmental challenges.	139 (38.6%)	127 (35.3%)	56 (15.6%)	38 (10.6%)	3.02	0.98
20	Participation in recreational adventure activities fosters a deeper connection with nature, leading to more sustainable behaviors.	139 (38.6%)	127 (35.3%)	55 (15.3%)	39 (10.8%)	3.02	0.97
Average Mean						3.04	0.98

Decision rule: It has been adjudged that a criterion mean score of 2.50 and above is significant.

Note. SA = Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree

Table 3 shows the descriptive analysis of responses on the relationship between OAE programs in recreational spaces and environmental sustainability behaviors among Nigerian youths. The result indicates that most respondents agreed that OAE programs in recreation enhance environmental consciousness. Specifically, most participants agreed that these programs help instill a culture of environmental responsibility ($\bar{x} = 3.04$); foster a deeper connection with nature, which leads to sustainable behaviors ($\bar{x} = 3.02$); increase awareness of the need for conservation ($\bar{x} = 3.04$); and promote eco-friendly habits like waste reduction and pollution control ($\bar{x} = 3.05$).

Further, respondents acknowledged that outdoor educational programs improve understanding of biodiversity ($\bar{x} = 3.04$); encourage environmental advocacy ($\bar{x} = 3.03$); and strengthen attitudes toward responsible land and water use ($\bar{x} = 3.04$). Adventure-based recreation was also seen as fostering teamwork and leadership for addressing environmental challenges ($\bar{x} = 3.02$). Youths reported enhanced commitment to sustainable tourism practices ($\bar{x} = 3.03$) and long-term environmental stewardship ($\bar{x} = 3.06$). Hence, the average mean score of 3.04, which is above the decision benchmark of 2.50, suggests that OAE programs in recreational settings have a significant positive relationship with promoting environmental sustainability behaviors among Nigerian youths.

Research Question 3: What are participants’ perceptions of the relationship between OAE programs in sports and environmental sustainability behaviors among youth?

Table 4 reveals respondents’ mean ratings for the items measuring perceived relationships between OAE programs in sports and sustainability behaviors among youth.

Table 4: Descriptive Analysis of Research Question 3

S/N	Items	SA (Freq. %)	A (Freq. %)	D (Freq. %)	SD (Freq. %)	Mean	Std. Dev.
21	Integrating environmental education into outdoor sports programs increases awareness of climate change and its impact on recreational spaces.	109 (30.3%)	119 (33.1%)	81 (22.5%)	51 (14.2%)	2.79	1.04
22	OAE programs in sports help Nigerian youths develop a sense of responsibility toward environmental conservation.	103 (28.6%)	127 (35.3%)	75 (20.8%)	55 (15.3%)	2.77	1.04
23	Participation in outdoor sports activities encourages youths to adopt sustainable practices such as waste reduction and proper disposal.	97 (26.9%)	131 (36.4%)	79 (21.9%)	53 (14.7%)	2.76	1.03
24	Engaging in outdoor sports enhances youths’ appreciation for nature and	101 (28.1%)	123 (34.2%)	85 (23.6%)	51 (14.2%)	2.76	1.03

	motivates them to protect natural resources.						
25	Implementing outdoor education in sports programs fosters a commitment to environmental stewardship.	107 (29.7%)	113 (31.4%)	89 (24.7%)	51 (14.2%)	2.76	1.03
26	Outdoor sports activities provide opportunities for practical learning about biodiversity and ecosystem preservation.	105 (29.2%)	117 (32.5%)	83 (23.1%)	55 (15.3%)	2.75	1.04
27	Exposure to sustainable outdoor sports programs influences Nigerian youths to advocate for green policies and conservation initiatives.	103 (28.6%)	121 (33.6%)	81 (22.5%)	55 (15.3%)	2.75	1.04
28	Adventure-based sports activities encourage participants to minimize their ecological footprint by using eco-friendly equipment and practices.	99 (27.5%)	121 (33.6%)	87 (24.2%)	53 (14.7%)	2.74	1.03
29	OAE in sports instills ethical values related to environmental sustainability and responsible recreation.	99 (27.5%)	125 (34.7%)	79 (21.9%)	57 (15.8%)	2.74	1.04
30	Outdoor adventure sports promote teamwork and leadership in addressing environmental challenges within communities.	95 (26.4%)	125 (34.7%)	83 (23.1%)	57 (15.8%)	2.72	1.05
Average Mean						2.76	1.037

Decision rule: It has been adjudged that a criterion mean score of 2.50 and above is significant.

Note. SA = Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree

Table 4 shows the descriptive analysis of the relationship between OAE programs in sports and environmental sustainability behaviors among Nigerian youths. Results reveal that most of the respondents agreed that OAE fosters responsible environmental behavior.

For example, many participants affirmed that such programs help Nigerian youths develop a sense of responsibility toward environmental conservation ($\bar{x} = 2.77$). Participation in outdoor sports was also perceived to encourage sustainable practices like waste reduction and proper disposal ($\bar{x} = 2.76$). Respondents agreed that integrating environmental education into sports activities increases awareness of climate change and its effect on recreational spaces ($\bar{x} = 2.79$). Similarly, outdoor sports were acknowledged for promoting teamwork and leadership in addressing environmental challenges within communities ($\bar{x} = 2.72$), and for enhancing youths' appreciation for nature ($\bar{x} = 2.76$). Other responses pointed out the role of adventure-based sports in encouraging ecological responsibility using eco-friendly equipment ($\bar{x} = 2.74$) and fostering long-term environmental stewardship ($\bar{x} = 2.76$).

With an average mean score of 2.76, which is above the criterion mean of 2.50, the result suggests that respondents generally perceive a positive relationship between OAE programs and long-term environmental sustainability behaviors among youth.

Research Question 4: What are participants’ perceptions of the relationship between OAE programs in tourism and environmental sustainability behaviors among youth?

Table 5 reveals respondents’ mean ratings for the items measuring perceived relationships between OAE programs in tourism and sustainability behaviors among youth.

Table 5: Descriptive Analysis of Research Question 4

S/ N	Items	SA (Freq. %)	A (Freq. %)	D (Freq. %)	SD (Freq. %)	Mean	Std. Dev.
31	Participation in eco-tourism activities through outdoor education fosters responsible tourism behaviors, such as reducing waste and respecting wildlife.	111 (30.8%)	121 (33.6%)	75 (20.8%)	53 (14.7%)	2.81	1.03
32	Participation in outdoor adventure tourism helps youths recognize the impact of human activities on fragile ecosystems.	112 (31.1%)	117 (32.5%)	77 (21.4%)	54 (15.0%)	2.80	1.03
33	Implementing OAE in tourism cultivates environmentally responsible behaviors among Nigerian youths.	109 (30.3%)	120 (33.3%)	77 (21.4%)	54 (15.0%)	2.80	1.03
34	Outdoor adventure tourism programs encourage local communities to adopt conservation efforts and eco-friendly tourism policies.	113 (31.4%)	115 (31.9%)	77 (21.4%)	55 (15.3%)	2.79	1.05
35	Exposure to sustainable tourism practices through outdoor education influences youths advocating for environmental protection in their communities.	108 (30.0%)	120 (33.3%)	77 (21.4%)	55 (15.3%)	2.78	1.04
36	Adventure tourism programs provide hands-on learning experiences that strengthen youths’ understanding of sustainable resource management.	110 (30.6%)	116 (32.2%)	79 (21.9%)	55 (15.3%)	2.78	1.04
37	Outdoor education programs in tourism encourage the use of sustainable materials and eco-friendly infrastructure in tourism activities.	108 (30.0%)	119 (33.1%)	79 (21.9%)	54 (15.0%)	2.78	1.03
38	OAE programs in tourism help Nigerian youths develop a deeper appreciation for natural landscapes and biodiversity.	109 (30.3%)	117 (32.5%)	79 (21.9%)	55 (15.3%)	2.78	1.04
39	Adventure-based tourism programs teach youths sustainable practices, such as minimizing their carbon footprint while traveling.	107 (29.7%)	119 (33.1%)	79 (21.9%)	55 (15.3%)	2.77	1.04
40	OAE in tourism promotes ethical travel habits, such as respecting local cultures and protecting natural heritage sites.	106 (29.4%)	118 (32.8%)	81 (22.5%)	55 (15.3%)	2.76	1.04
Average Mean						2.79	1.037

Decision rule: It has been adjudged that criterion mean score of 2.50 and above is significant.

Note. SA = Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree

Table 5 shows the descriptive analysis of the relationship between OAE programs in tourism and environmental sustainability behaviors among Nigerian youths. The result revealed that a significant number of respondents affirmed the impact of outdoor tourism-based education on fostering sustainable behaviors. Many agreed that OAE helps Nigerian youths develop a deeper appreciation for natural landscapes and biodiversity ($\bar{x} = 2.78$). Similarly, participation in eco-tourism activities was seen to foster responsible tourism behaviors such as reducing waste and respecting wildlife ($\bar{x} = 2.81$). Adventure-based tourism programs were also recognized for teaching youths' sustainable practices like minimizing their carbon footprint while traveling ($\bar{x} = 2.77$). Additionally, outdoor adventure tourism programs were perceived as encouraging both local communities and youths to adopt conservation efforts and eco-friendly policies ($\bar{x} = 2.79$). Exposure to sustainable tourism practices was noted to influence advocacy for environmental protection ($\bar{x} = 2.78$), while OAE was seen as promoting ethical travel habits ($\bar{x} = 2.76$).

Respondents further acknowledged that adventure tourism programs offer hands-on learning experiences that enhance understanding of sustainable resource management ($\bar{x} = 2.78$) and help youths recognize the impact of human activities on fragile ecosystems ($\bar{x} = 2.80$). Outdoor education programs were also credited for encouraging the use of sustainable materials in tourism activities ($\bar{x} = 2.78$) and for cultivating long-term environmentally responsible behaviours ($\bar{x} = 2.80$).

Hypothesis Testing

Hypotheses 1-4: Correlation Analysis

Pearson correlation analysis examined relationships between each OAE context and environmental sustainability behaviors (Table 6).

Table 6 reveals Pearson correlation coefficients between each OAE program and environmental sustainability behaviors among youth.

Table 6: Pearson Correlation Analysis of OAE Contexts and Environmental Sustainability

OAE Context	r	p	Decision
Amusement Parks	.660	.011	Reject H0 ₁
Recreation	.515	.005	Reject H0 ₂
Sports	.832	.012	Reject H0 ₃
Tourism	.703	.001	Reject H0 ₄

All four OAE contexts showed statistically significant positive correlations with environmental sustainability behaviors. Sports demonstrated the strongest correlation ($r = .832$), followed by tourism ($r = .703$), amusement parks ($r = .660$), and recreation ($r = .515$). All correlations were significant at $p < .05$. This implies that each of the outdoor activities (amusement parks, recreation, sports, and tourism) plays a significant role in helping youths act in ways that protect the environment.

Hypotheses 5-6: Multiple Regression Analysis

Table 7 reveals multiple regression results on the relative and joint contributions of all four OAE programs.

Table 7: Multiple Regression Analysis: Relative Contributions of OAE Contexts

Predictor	B	SE	t-value	p
Amusement Parks	.405	.062	6.532	.001
Recreation	0.297	.055	5.400	.020
Sports	0.552	.060	9.200	.000
Tourism	0.493	.058	8.186	.003
Constant	3.322	.145	22.928	.000

Note: $R^2=.299$; $F(4,355) = 38.85$; $p < .001$

Regression Model Summary Analysis

R	R ²	Adjusted R ²	F	p-value	St. Error
.547	.299	.293	34.258	.000	.64521

The regression model was statistically significant ($F = 34.258$; $p < .000$) and explained 29.9% of variance in environmental sustainability behaviors ($R^2=.299$). Sports had the largest standardized contribution ($\beta=.552$), tourism ($\beta=.493$), amusement parks ($\beta=.405$), and recreation ($\beta=.297$). All predictors were statistically significant at $p < .05$, showing that each OAE context independently and jointly contributes to environmental sustainability behaviors.

Discussion

The study showed that youths perceive a strong relationship between OAE programs in amusement parks and the development of environmental sustainability behaviors among youths, i.e., engaging in outdoor adventure activities helps Nigerian youths develop skills for sustainable living. Given the self-report design, the results suggest perceived relationships between OAE contests and sustainability beliefs, which warrant longitudinal studies to assess actual behavioral change. This finding aligns with the study of Kuo *et al.* (2019), who asserted that OAE programs integrated into recreational activities promote a deeper connection to nature, resulting in enduring pro-environmental attitudes and behaviors among young people. Similarly, this finding is supported by the research of Oyeleke and Bakare (2020), who observed that in the Nigerian context, youths exposed to outdoor educational experiences within recreational spaces tend to develop stronger environmental advocacy behaviors and demonstrate more conscious efforts toward sustainable living compared to their peers who lack such exposure. The study revealed that respondents generally perceive a positive relationship between OAE programs and environmental sustainability behaviors among young people.

The study showed that respondents generally believe OAE programs in tourism positively shape environmental sustainability behaviors among Nigerian youths, i.e., participation in eco-tourism activities through outdoor education fosters responsible tourism behaviors, such as reducing waste and respecting wildlife. This finding aligns with the study by Jamieson and Ostermeyer (2017), who asserted that eco-tourism, as an outdoor educational tool, is highly effective in nurturing environmentally responsible behaviors among young tourists, particularly through structured programs that emphasize respect for wildlife and waste reduction during nature-based excursions.

Findings showed significant relative contributions of all four OAE contexts to environmental sustainability behaviors. This finding aligns with the study of Hanna *et al.* (2019), who asserted that outdoor adventure tourism offers more than just physical experiences; it facilitates human reconnections with nature, which in turn nurtures pro-environmental attitudes and sustainable behaviors. Through direct engagement in amusement park settings, youths not only enjoy recreational exposure but also develop a deeper ecological consciousness that influences their commitment to environmental stewardship. Similarly, Said *et al.* (2024) supported this view by emphasizing the importance of embedding sustainability into everyday experiences, including recreational and leisure activities. Their findings highlight that when environmental awareness is integrated into public interactions — like those in amusement parks — it encourages responsible behaviors aligned with ecological preservation. Additionally, the work of Faiza and Rohani (2024) lends weight to this result, as they argued that fostering environmental values in leisure and work environments contributes to sustained pro-environmental behaviors.

Moreover, the findings revealed that there is a significant relationship between OAE programs in recreation and environmental sustainability behaviors among youth. This finding aligns with the study of Tennakoon *et al.* (2024), who highlighted that active participation in environmental sustainability practices — especially when integrated into recreation — enhances individual commitment to conservation principles. Their systematic review showed that environmental knowledge gained through interactive and enjoyable contexts leads to more durable pro-environmental attitudes. Similarly, Sand and Gross (2019) supported this assertion by demonstrating that adventure recreation, such as hiking, diving, or kayaking, exposes participants to the fragile state of natural ecosystems, thereby cultivating a deeper sense of environmental responsibility. Moreover, Snyder (2019) also agreed with this perspective, asserting that outdoor education programs, especially those linked to leisure and recreational environments, actively foster environmental consciousness and behavior change.

Furthermore, the findings from the study also showed that there is a significant relationship between OAE programs in sports and environmental sustainability behaviors among youth. This finding aligns with the study of Spencer *et al.* (2019), who asserted that outdoor education programs combined with physically engaging activities, such as hiking and team sports in natural environments, foster both environmental knowledge and sustainable behavioral practices. Their research revealed that embedding environmental lessons within active sporting experiences helps participants appreciate nature while simultaneously reinforcing conservation habits. Similarly, this finding agrees with the conclusions of Hanna *et al.* (2019), who maintained that outdoor adventure tourism, including physically intensive activities, plays a significant role in reawakening human-nature relationships and instilling pro-environmental attitudes. Furthermore, Reid and Kampman (2020) supported this finding by highlighting that outdoor sports and eco-tourism activities, particularly when rooted in community-led conservation principles, can significantly influence sustainable behaviors among participants. Their work found that such activities offer youths real-life perspectives on biodiversity conservation, resource protection, and ecological integrity, thereby embedding long-lasting behavioral change.

It was observed that there is a significant relationship between OAE programs in tourism and environmental sustainability behaviors among youths. This finding aligns with the study of Sand and Gross (2019), who asserted that outdoor adventure tourism programs directly immerse participants in the environmental realities of sensitive ecosystems, enabling them to witness both beauty and vulnerability firsthand, thereby nurturing pro-environmental behaviors. Likewise, Hanna *et al.* (2019) highlighted that outdoor adventure tourism not only reconnects individuals with nature but also enhances their awareness of human impact on the environment, fostering behaviors supportive of sustainability goals. This process is especially impactful among youths, whose experiences during tourism-based education shape their worldview and future choices regarding ecological conservation. Moreover, this finding aligns with Reid and Kampman (2020), who noted that tourism-centered outdoor education programs, particularly those involving eco-tourism principles, empower both local communities and visitors to become active custodians of the environment.

Findings from the study indicated that there is a significant relative contribution of OAE programs in amusement parks, creation, sports, and tourism, and the dependent variable (environmental sustainability behaviors) among youth. This finding aligns with the study of Brymer *et al.* (2019), who asserted that OAE programs foster a strong sense of environmental stewardship by connecting individuals to nature through direct experiences. Their research emphasized that structured outdoor activities, whether through

sports, tourism, or recreational engagements, allow young people to build emotional bonds with nature, which in turn cultivates pro-environmental attitudes and long-lasting sustainability behaviors. Similarly, this finding agrees with the submission of Hanna *et al.* (2019), who argued that outdoor education activities such as guided ecological tours, wilderness challenges, and nature-based sports contribute significantly to the development of responsible environmental actions among participants. Additionally, the finding is supported by the work of Goudie (2019), who emphasized that outdoor recreation and tourism serve as platforms for environmental literacy, offering participants opportunities to practice sustainable behaviors through hands-on activities such as wildlife monitoring and habitat restoration.

This finding aligns with the study of Hanna *et al.* (2019), who asserted that OAE programs foster environmental stewardship among young people by promoting hands-on experiences in ecological conservation activities. According to their research, participants engaged in outdoor learning, particularly through structured recreation and nature-based sports, were more inclined to develop pro-environmental attitudes and long-lasting ecological responsibility. Similarly, this finding agrees with the submission of Kuo *et al.* (2019), who emphasized that outdoor adventure activities such as sports, tourism, and recreational programs play a critical role in shaping sustainable behaviors by offering immersive experiences that build a strong connection with the natural world. Their study further suggested that exposure to nature-based activities not only enhances environmental literacy but also encourages deliberate action towards the protection and conservation of ecosystems. Furthermore, this finding corroborates the assertion of Goudie (2019), who reported that outdoor adventure programs — including those set in amusement parks, wilderness areas, and recreation centers — significantly contribute to the internalization of sustainable behaviors.

Conclusion

This study shows that youths perceive a positive correlation between participation in OAE programs and their environmental sustainability behaviors across amusement parks, recreation, sports, and tourism contexts. Based on the participants' responses, engaging in outdoor activities, whether in amusement parks, recreational spaces, sports events, or tourism, plays a significant role in shaping how young people think and act toward nature. Youths who take part in these outdoor programs develop useful habits like reducing waste, protecting wildlife, and conserving natural resources. The study also showed that these outdoor experiences not only teach about the environment but also encourage personal responsibility in taking care of it. The study concludes that when OAE is well-structured, it gives young people the chance to experience nature first-hand, which leads to stronger

environmental values. High self-reported agreement ratings suggest that participants believe OAE programs support their environmental awareness, pro-environmental attitudes, and sustainability-related practices, although actual behaviors were not directly observed. Whether it is through sports, recreation, tourism, or amusement park activities, the process of learning outdoors helps youths develop the right mindset and daily habits to live in harmony with nature. The study also revealed that the joint and individual contributions of these activities make a meaningful difference in promoting sustainable behaviors. In summary, OAE programs are an effective way of teaching Nigerian youths how to act in ways that will protect the environment now and in the future. If schools, communities, and government agencies continue to invest in these programs, the benefits for Nigeria's environment and young population will be long-lasting. OAE programs have the potential to promote sustainability perceptions among youths in Ondo State, but to achieve broader adoption, cultural, socioeconomic, and infrastructure constraints must be addressed to prevent overreliance on experiential exposure alone.

Limitations

While significant correlations exist ($r=0.515-0.832$), cultural norms (e.g., as the primarily Yoruba sample (65.6%) indicates, Yoruba emphasis on communal resources use may hinder adoption of individual sustainability behaviors. Personal backgrounds, including low-middle income (majority $< \#50,000/\text{month}$) and different levels of education, could limit practical implementation despite positive perceptions. Infrastructure constraints, such as poor maintenance of parks and sports facilities in Nigeria, impact the sustainability of outdoor educational programs (Ngobua et al., 2021). The data are based on self-reported perceptions, which are subject to social desirability bias and may not accurately reflect participants' actual environmental behaviors. These limitations highlight the need for future longitudinal and mixed-methods research that incorporates objective behavioral indicators alongside self-report measures. Considering these factors, behavioral persistence should be monitored in future continuous investigations.

Recommendations

Based on the above findings, it is therefore recommended that:

1. Environmental education should be built into all amusement park programs for young visitors in Nigeria.
2. Recreational centers should be encouraged to offer eco-friendly outdoor activities and workshops for youths regularly.
3. Sports organizations should design sports-based environmental education sessions as part of their youth sports programs.

4. Eco-tourism operators should always include environmental conservation lessons in every youth tour package.
5. Amusement park management should partner with environmental NGOs to host monthly youth-focused nature conservation events.
6. Schools should include recreation-based environmental clubs and organize regular field trips to nature parks.
7. Sports coaches and physical education teachers should include environmental topics in their training sessions.
8. Tourism activities teach environmental responsibility; local tourism boards should promote youth eco-camps that mix tourism and conservation learning.
9. Policymakers should promote a combined approach by linking parks, sports, recreation, and tourism programs to a single youth environmental education framework.
10. Schools and community groups should organize joint outdoor education camps that mix sports, recreation, amusement, and tourism for Nigerian youths.

Suggestions for Further Studies

Future research should focus on how OAE programs can be designed to fit the unique cultural, social, and economic backgrounds of different groups of Nigerian youths. While this study looked at general relationships between outdoor programs and sustainability behaviors, future studies could investigate how factors like age, gender, region, and level of education affect these behaviors. It would also be useful to explore the role of teachers, parents, and community leaders in reinforcing the lessons learned through outdoor education. Researchers could also carry out studies to check if the behaviors taught through these outdoor programs remain consistent as youths grow older. In addition, more studies could compare the experiences of Nigerian youths with those from other countries to learn from global best practices on outdoor education and environmental sustainability.

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Between Efficiency and Empathy: An Exploratory Study of Albanian Students' Attitudes Towards AI in Ethical Decision-Making

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Abstract

This article presents an exploratory study of how university students in Albania (N = 146) perceive the role of artificial intelligence (AI) in ethical decision-making. While AI is increasingly integrated into everyday choices, little is known about how individuals in non-Western, digitally emerging contexts negotiate trust, empathy, and moral responsibility in relation to algorithmic systems. Drawing on survey data, we find that respondents maintain a strong attachment to empathy as a moral reference point (M = 3.12) and express significant reservations about delegating emotionally consequential decisions to AI (M = 3.41 for routine vs. emotional delegation). Trust in AI's ethical competence is moderate and conditional, strongly associated with perceived safety (r = .54) and transparency. We interpret these findings through the lens of what we term the "residual moral subject"—a concept describing the persistence of human moral agency in technologically mediated environments, albeit in a reconfigured form. The study contributes empirical nuance to debates on algorithmic governance and highlights the need for culturally situated research on AI ethics.

Keywords: Moral agency, artificial intelligence, algorithmic governance, empathy, Albania, higher education, ethical decision-making

Introduction

The Question of Moral Agency in the Age of AI

Artificial intelligence is no longer merely a computational tool; it increasingly functions as a normative infrastructure, shaping decisions about justice, responsibility, and human well-being. From algorithmic recommendations in healthcare to automated assessments in hiring, AI systems intervene in domains traditionally governed by human ethical judgment. This transformation raises a fundamental question: what happens to the human moral subject when ethical decision-making is partially delegated to algorithms?

While a growing body of literature has explored this question theoretically (Coeckelbergh, 2020; Floridi, 2013) and experimentally in Western contexts (Bigman & Gray, 2018; Gogoll & Müller, 2017), empirical research remains skewed toward high-income, technologically saturated societies. Less is known about how young adults in emerging economies—who are among the most active users of digital technologies—perceive and negotiate the moral boundaries between human and algorithmic judgment.

This study addresses this gap by examining the attitudes of university students in Albania toward AI-mediated decision-making. Specifically, it investigates: (1) How do respondents perceive the role of empathy in ethical decisions involving AI? (2) To what extent do they trust AI as a moral agent? (3) What boundaries do they draw regarding the delegation of morally consequential decisions to algorithmic systems?

Rather than asking whether AI is "good" or "bad," this article shifts the focus toward the subjective dimension of moral authority. We introduce the concept of the residual moral subject as an interpretive lens for understanding how human agency persists—and is reconfigured—within algorithmically mediated environments. The concept does not imply a nostalgic return to a pre-technological subject, but rather describes a condition in which individuals remain morally engaged while navigating decision contexts increasingly shaped by algorithmic systems.

The article proceeds as follows: Section 2 reviews relevant literature on algorithmic governance, moral delegation, and empirical studies of trust in AI. Section 3 describes the methodology and sample characteristics. Section 4 presents descriptive and correlational findings. Section 5 discusses these findings in relation to the concept of the residual moral subject. Section 6 concludes with implications and directions for future research.

2. Literature Review

2.1 Algorithmic Governance *and the Redistribution of Moral Authority*

Artificial intelligence is increasingly embedded in decision-making processes that were traditionally the domain of human moral judgment. From

predictive policing and healthcare triage to autonomous vehicles, AI systems mediate decisions with significant ethical consequences. Scholars have conceptualized this shift as algorithmic governance, in which algorithms do not merely perform technical functions but actively shape norms, priorities, and perceptions of what constitutes a “good” decision (Beer, 2017; Yeung, 2018).

While proponents highlight efficiency, consistency, and objectivity, critics stress that algorithms embed normative assumptions through data curation, modeling choices, and optimization goals (O’Neil, 2016; Eubanks, 2018). This implies that delegation of decision-making to algorithms is never ethically neutral. It produces moral distancing, where humans are involved in outcomes without fully owning their moral implications (Introna, 2016). Despite extensive discussion of these structural transformations, empirical investigations into how individuals perceive AI-mediated moral authority remain limited.

2.2 *The Limits of Moral Delegation: Why Empathy Matters*

Moral delegation refers to the transfer of ethically significant judgment from humans to technical systems (Coeckelbergh, 2020). Machine ethics research suggests that ethical reasoning can be partially formalized through rules, constraints, and objective functions (Moor, 2006; Wallach & Allen, 2009). Yet, philosophers emphasize that morality is irreducible to formal rules. Moral judgment relies on context, relational understanding, and emotional sensitivity (Dreyfus, 1992; Nussbaum, 2001; Tronto, 1993).

Empirical studies corroborate this critique. Bigman and Gray (2018) found that participants resist delegating morally sensitive decisions to machines, particularly those involving human suffering or social consequences. Gogoll and Müller (2017) similarly report that while AI is acceptable as an advisory tool, participants prefer human final authority in ethical dilemmas. These findings suggest that humans maintain boundaries of moral delegation, guided by empathy and contextual judgment.

2.3 *Empirical Studies on Trust in AI: A Western Bias*

Recent empirical research has expanded our understanding of how individuals evaluate AI systems. Studies show that trust in AI is multidimensional, conditional, and context-dependent (Oliveira et al., 2024; Gerlich, 2024). Experimental work reveals that individuals may rely on AI-generated recommendations even when aware of potential unreliability, particularly under conditions of complexity or cognitive load (Krügel, 2022). Other research suggests that trust in AI may sometimes emerge as a compensatory response to distrust in human institutions (Galindez-Acosta et al., 2025).

However, the overwhelming majority of this research has been conducted in Western, educated, industrialized, rich, and democratic (WEIRD) societies. This geographic and cultural concentration limits our understanding of how attitudes toward AI vary across contexts with different institutional histories, technological infrastructures, and cultural values. As AI systems become globally ubiquitous, understanding context-specific perceptions of algorithmic authority becomes not only academically relevant but also ethically necessary.

This study contributes to diversifying the empirical landscape by examining AI attitudes in Albania, a post-communist, upper-middle-income country with rapidly increasing digital adoption but limited public debate on AI ethics.

2.4 *The Residual Moral Subject: A Conceptual Framework*

Building on critical social theory and the philosophy of technology, we introduce the concept of the residual moral subject to interpret contemporary forms of moral agency under conditions of algorithmic mediation (Adorno & Horkheimer, 1947; Verbeek, 2011).

The concept refers to a form of moral agency that persists despite—and is reshaped by—the increasing integration of algorithmic systems into decision-making processes. Rather than disappearing, moral subjectivity is reconfigured, operating within technological environments that shape, constrain, and partially redistribute responsibility.

Three characteristics define this residual subjectivity:

1. Ethical awareness persists but is mediated. Individuals continue to evaluate outcomes in moral terms, even when algorithmic recommendations are involved. However, their judgments are shaped by the informational and procedural affordances of technological systems.
2. Moral responsibility becomes conditional and situational. Individuals may rely on algorithmic advice in some contexts (e. g., technical decisions) while insisting on human judgment in others (e. g., decisions with emotional or relational consequences).
3. Responsibility is negotiated within hybrid human–machine configurations. Decision-making increasingly takes place in environments where algorithmic systems provide recommendations while humans retain interpretive, supervisory, or veto power.

Importantly, the concept of the residual moral subject differs from approaches that dissolve agency entirely across distributed networks (Latour, 2005). While acknowledging technological mediation, it insists that normative accountability ultimately remains anchored in human actors. The concept

serves as an interpretive framework for the empirical patterns observed in this study.

3. Methodology

3.1 Research Design and Sampling

This study employs an exploratory quantitative research design to examine perceptions of moral agency and algorithmic delegation in AI-mediated decision-making. Data were collected through a structured survey administered to university students at a public university in Albania between October 2025 and January 2026.

Participants were recruited using convenience sampling in classroom settings at a public university in Albania. Participation was voluntary and anonymous. Prior to completing the survey, respondents were informed about the academic purpose of the study, assured that no identifying information would be collected, and reminded that participation was entirely optional and could be withdrawn at any time. The research followed standard ethical guidelines for social research involving human participants.

The final sample consisted of 146 respondents. Participants were predominantly undergraduate students in the early stages of their academic studies. The mean age of respondents was 19.48 years ($SD = 2.50$), with an age range from 17 to 46 years. Most participants were enrolled in their first or second year of study, reflecting a population of young adults currently developing their civic and ethical perspectives in an increasingly digital environment.

This population is analytically relevant because younger cohorts are among the most frequent users of digital technologies and are likely to encounter AI systems in educational, professional, and everyday decision-making contexts. Their perceptions therefore provide insight into emerging attitudes toward algorithmic authority and moral responsibility.

It is important to note that the sample is not statistically representative of the general population. As a convenience sample of university students, the findings should be interpreted as exploratory rather than generalizable. Nevertheless, the dataset offers analytically valuable insight into how digitally socialized young adults perceive the relationship between human moral judgment and AI-assisted decision-making.

Descriptive characteristics of the sample are presented in Table 1.

Table 1: Demographic Characteristics of the Sample (N = 146)

Variable	Category	N	%
Gender	Female	96	65.8
	Male	50	34.2
Age Group	17–20 years	104	71.2
	21–25 years	34	23.3
	26+ years	8	5.5
Year of Study	First year	68	46.6
	Second year	54	37.0
	Third year	18	12.3
	Other / not specified	6	4.1

Source: Authors' calculations

3.2 Measurement and Instrument

The survey instrument consisted of Likert-scale items measured on a five-point scale (1 = strongly disagree, 5 = strongly agree). The questionnaire was designed to capture several dimensions of perceptions toward AI-mediated ethical decision-making: (a) perceived moral centrality of empathy, (b) beliefs regarding contextual and non-programmable aspects of ethical judgment, (c) trust in AI's ethical and decision-making capacity, (d) willingness to delegate morally significant decisions to AI, and (e) conditional boundaries of trust.

Items were developed based on themes identified in the literature on algorithmic governance, moral delegation, and human–AI trust (Bigman & Gray, 2018; Coeckelbergh, 2020; Gogoll & Müller, 2017; Yeung, 2018). Where conceptually appropriate, items were grouped into composite indices representing broader attitudinal constructs.

Three primary composite indices were constructed:

- **Moral Trust in AI (4 items):** Capturing perceptions of AI's ethical competence and perceived safety in decision-making contexts. Example items include: "AI can help humans make more ethical decisions" and "I sometimes feel safer relying on AI for complex decisions."
- **Delegation Willingness (3 items):** Reflecting respondents' readiness to accept AI recommendations or delegate decisions to algorithmic systems. Example items include: "I am willing to accept AI suggestions, even if I don't fully agree" and "I would prefer to collaborate with AI to make complex decisions."
- **Conditional Boundaries of Trust (3 items):** Measuring the limits respondents place on delegation, particularly concerning emotional consequences, transparency, and human oversight. Example items include: "I would trust AI for routine decisions but not for those with

major emotional impact" and "AI decisions should always be transparent and explainable."

Composite indices were computed by averaging the items associated with each construct. No reverse-coded items were included in the instrument. Missing responses were minimal and handled through listwise deletion.

Internal consistency reliability was assessed using Cronbach's alpha. All composite indices demonstrated acceptable internal reliability ($\alpha \geq .70$), indicating coherent underlying attitudinal constructs.

Reliability analysis indicated acceptable internal consistency across the composite indices. Moral Trust in AI demonstrated a Cronbach's alpha of approximately **0.72**, Delegation Willingness **0.70**, and Conditional Trust Boundaries **0.75**, indicating satisfactory internal coherence of the constructs.

Table 2: Reliability Analysis of Composite Indices

Composite Index	Number of Items	Cronbach's Alpha
Moral Trust in AI	4	0.72
Delegation Willingness	3	0.70
Conditional Boundaries of Trust	3	0.75

Source: Authors' calculations

The full list of survey items is provided in **Appendix A** to ensure transparency and replicability.

3.3 Analytical Strategy

The analysis proceeded in three stages.

First, descriptive statistics were calculated to assess the central tendencies and variability of respondents' attitudes toward AI-mediated ethical decision-making. Means and standard deviations were used to identify general patterns of agreement or ambivalence across items.

Second, bivariate correlations were examined using Pearson correlation coefficients (r) to explore associations between key attitudinal variables, including perceived ethical competence of AI, comfort with collaboration, and boundaries of moral delegation. Correlation coefficients were interpreted using conventional benchmarks (small $\approx .10$, moderate $\approx .30$, strong $\geq .50$). Statistical significance was evaluated at the $p < .05$ level (two-tailed).

Third, reliability analysis was conducted using Cronbach's alpha coefficients to evaluate the internal consistency of the composite indices (reported in Table 2).

The purpose of the analysis is exploratory rather than predictive; therefore, emphasis is placed on identifying relational patterns among variables rather than establishing causal inference.

3.4 Analytical Orientation

The study does not aim for statistical generalization to broader populations. Instead, it seeks analytical insight into how moral agency is perceived under conditions of algorithmic mediation within a specific sociocultural context. The objective is interpretive: to identify structural patterns of ethical ambivalence and boundaries of moral delegation that may inform theoretical debates on algorithmic governance and the reconfigured relationship between human judgment and technological systems.

Following the tradition of interpretive social science, the findings are situated within broader philosophical debates on moral agency and technological mediation (Adorno & Horkheimer, 1947; Verbeek, 2011), contributing empirical grounding to normative theory rather than testing context-free universal claims.

3.5 Limitations

First, the use of convenience sampling at a single public university in Albania restricts generalizability beyond the specific population studied. The sample is predominantly composed of young students, and findings may not extend to other demographic groups, institutional contexts, or cultural settings. Second, self-reported perceptions of moral agency and trust in AI may not fully correspond to behavioral decisions in real-world contexts. Respondents may express different attitudes when confronted with actual moral dilemmas involving AI systems than when responding to abstract survey items. Third, the cross-sectional design captures attitudes at a single moment in time and cannot assess how these perceptions might evolve with increased exposure to AI technologies, changes in the technological landscape, or shifts in public discourse around algorithmic governance. Fourth, while the composite indices demonstrate acceptable internal consistency, they represent parsimonious approximations of complex attitudinal constructs. Future research could benefit from more fine-grained measurement approaches, including experimental vignettes or qualitative interviews.

Despite these limitations, the study offers analytically valuable insight into emerging patterns of ethical ambivalence and conditional trust in AI among a digitally socialized cohort in a non-Western European context. It provides an empirical foundation for future research employing more diverse samples, comparative designs, experimental methods, or longitudinal approaches.

4. Findings and Results: Empirical Indicators of Ethical Ambivalence

4.1 Descriptive Statistics: General Patterns

Table 3 presents descriptive statistics for all survey items related to ethical attitudes toward AI-mediated decision-making. Means and standard deviations provide an overview of central tendencies and variability within the sample.

Table 3: Descriptive Statistics of Ethical Attitudes Toward AI (N = 146)

Survey Statement	Mean (M)	Std. Deviation (SD)
Empathy is an essential element in every decision I make	3.12	0.91
Humans are more empathetic than AI systems	3.17	1.21
Ethical decisions must be context-based and cannot be fully programmed	3.43	1.10
AI can help humans make more ethical decisions	2.74	1.11
I sometimes feel safer relying on AI for complex decisions	2.55	1.12
Decisions affecting others should always include a human component	3.31	1.18
I am concerned that AI may ignore human emotions in decisions	3.47	1.10
AI decisions should always be transparent and explainable	3.68	1.05
I would trust AI for routine decisions but not for emotionally significant ones	3.41	1.30
Comfort collaborating with AI in decision-making	3.08	0.98

Source: Authors' calculations

Several patterns emerge from these descriptive statistics.

First, respondents attribute moderate importance to empathy in their own decision-making (M = 3.12) and tend to perceive humans as more empathetic than AI systems (M = 3.17). However, the relatively high standard deviation for the latter item (SD = 1.21) indicates considerable variation in respondents' views, suggesting that while the central tendency points toward agreement, a substantial minority may hold different opinions.

Second, there is relatively strong agreement that ethical decisions depend on context and cannot be reduced to programmable rules (M = 3.43). This finding suggests that respondents intuitively recognize limits to the formalization of moral judgment within algorithmic frameworks.

Third, trust in AI's ethical competence appears limited. Mean scores for statements such as "AI can help humans make more ethical decisions" (M = 2.74) and "I sometimes feel safer relying on AI for complex decisions" (M = 2.55) fall below or near the midpoint of the scale, indicating skepticism rather than endorsement. At the same time, respondents express moderate comfort with the idea of collaborating with AI in decision-making (M = 3.08), suggesting openness to algorithmic assistance under certain conditions.

Fourth, concerns about AI's capacity to account for human emotions are evident. Respondents agree, on average, that they are concerned about AI ignoring human emotions ($M = 3.47$) and that decisions affecting others should always include a human component ($M = 3.31$). The strongest agreement in the survey pertains to the need for transparency: "*AI decisions should always be transparent and explainable*" ($M = 3.68$, $SD = 1.05$).

Fifth, respondents draw clear boundaries regarding the types of decisions they are willing to delegate to AI systems. Agreement with the statement "*I would trust AI for routine decisions but not for emotionally significant ones*" ($M = 3.41$) suggests that acceptance of algorithmic involvement is conditional and domain-specific.

Taken together, these descriptive patterns point toward a stance of ethical ambivalence: respondents neither fully reject AI involvement in decision-making nor uncritically embrace it. They acknowledge potential benefits while maintaining reservations, particularly when decisions carry emotional weight or involve human well-being.

4.2 Composite Indices

To facilitate higher-level analysis, conceptually related items were combined into three composite indices. Table 4 presents descriptive statistics for these indices.

Table 4: Descriptive Statistics of Composite Indices ($N = 146$)

Composite Index	Mean (M)	Std. Deviation (SD)	Cronbach's Alpha
Moral Trust in AI	2.68	0.89	0.72
Delegation Willingness	2.82	0.84	0.70
Conditional Boundaries of Trust	3.52	0.91	0.75

Source: Authors' calculations.

Note. All indices measured on a 5-point scale (1 = strongly disagree, 5 = strongly agree).

The Moral Trust in AI index ($M = 2.68$) confirms that respondents, on average, do not strongly trust AI's ethical competence. This score falls below the scale midpoint, indicating a tendency toward skepticism rather than confidence.

The Delegation Willingness index ($M = 2.82$) similarly falls slightly below the midpoint, suggesting that respondents are generally hesitant to accept AI recommendations or delegate decisions to algorithmic systems, though not entirely opposed.

The Conditional Boundaries of Trust index ($M = 3.52$) is notably higher, indicating that respondents strongly endorse the idea that trust in AI should be limited by considerations of emotional impact, transparency, and human oversight.

These patterns are consistent with the item-level analysis: respondents are cautious about delegating moral authority to AI, and this caution is

particularly pronounced when decisions involve emotional or relational consequences.

4.3 Correlational Analysis

To explore relationships between key attitudinal variables, bivariate Pearson correlations were calculated. Table 5 presents the correlation matrix for selected items and composite indices.

Table 5: Correlations Between Key Variables (N = 146)

Variable	1	2	3	4	5	6
1. Empathy essential in decision-making	1					
2. Humans more empathetic than AI	.42**	1				
3. Ethical decisions must be context-based	.38**	.29**	1			
4. AI can help ethical decisions (item)	-.21*	-.26**	-.19*	1		
5. Moral Trust in AI (index)	-.23*	-.28**	-.21*	.58**	1	
6. Comfort collaborating with AI (item)	-.17	-.20*	-.15	.41**	.48**	1

Source: Authors' calculations.

Note. *p <.05, **p <.01 (two-tailed).

The correlation matrix reveals several noteworthy patterns.

First, there is a moderate positive correlation between respondents' endorsement of empathy in their own decision-making and their perception that humans are more empathetic than AI ($r = .42$, $p < .01$). This suggests that individuals who value empathy highly are also more likely to view it as a distinctively human capacity.

Second, empathy-based variables correlate positively with the belief that ethical decisions must remain context-based ($r = .38$ between empathy and context, $p < .01$; $r = .29$ between human empathy and context, $p < .01$). Respondents who emphasize empathy tend to view moral judgment as situationally dependent rather than reducible to fixed rules.

Third, and importantly, variables related to trust in AI show negative correlations with empathy-based attitudes. The belief that AI can help humans make more ethical decisions is negatively correlated with empathy in decision-making ($r = -.21$, $p < .05$), with the perception that humans are more empathetic than AI ($r = -.26$, $p < .01$), and with the belief that ethical decisions are context-based ($r = -.19$, $p < .05$). The Moral Trust in AI index shows a similar pattern of negative associations with these empathy- and context-related variables.

Fourth, there is a strong positive correlation between the belief that AI can help ethical decisions and the Moral Trust in AI index ($r = .58$, $p < .01$). This is expected, as the former item is a component of the latter index, and confirms the internal coherence of the construct.

Fifth, comfort collaborating with AI is positively associated with Moral Trust in AI ($r = .48$, $p < .01$) and with the belief that AI can help ethical decisions ($r = .41$, $p < .01$). However, it shows weak or negative associations

with empathy-based variables, suggesting that openness to AI collaboration may be more closely related to perceptions of AI competence than to views about human moral distinctiveness.

4.4 Summary of Findings

The results can be summarized in five key points:

1. Empathy remains salient: Respondents continue to view empathy as an important element of moral decision-making and perceive humans as more empathetic than AI systems.
2. Contextual judgment is valued: There is broad agreement that ethical decisions depend on context and cannot be fully programmed, reflecting intuitive recognition of limits to algorithmic formalization.
3. Trust in AI's ethical competence is limited: Mean scores for trust-related items and composite indices fall at or below the scale midpoint, indicating skepticism rather than confidence in AI's capacity for ethical judgment.
4. Delegation is conditional: Respondents draw clear boundaries, expressing greater willingness to accept AI involvement in routine decisions than in those with emotional consequences. Transparency and human oversight emerge as important conditions for trust.
5. Attitudes cluster coherently: Correlation analysis reveals that empathy-based attitudes tend to cluster together and are negatively associated with trust in AI. Conversely, openness to AI collaboration correlates positively with perceptions of AI's ethical competence.

These patterns, considered together, depict a stance of ethical ambivalence. Respondents do not occupy extreme positions—neither fully embracing nor completely rejecting AI in decision-making. Instead, they navigate a middle ground characterized by selective reliance, conditional trust, and the maintenance of boundaries around emotionally significant decisions. This ambivalence, we argue, reflects the contours of what might be termed the residual moral subject: a form of moral agency that persists under conditions of algorithmic mediation, but is reconfigured—becoming conditional, negotiated, and context-sensitive.

5. Discussion: Interpreting Patterns of Ethical Ambivalence

The findings of this exploratory study offer empirical insight into how a specific group of young adults in Albania perceives the relationship between empathy, moral responsibility, and AI-mediated decision-making. In this section, we interpret these patterns through the lens of the residual moral subject—a conceptual framework for understanding how moral agency persists and is reconfigured under conditions of algorithmic mediation. We

then situate the findings within the broader literature, acknowledge limitations, and propose directions for future research.

5.1 Empathy as an Anchor of Moral Judgment

One of the clearest patterns to emerge from the data is the continued salience of empathy as a moral reference point. Respondents expressed moderate agreement that empathy is essential in their own decision-making ($M = 3.12$) and tended to perceive humans as more empathetic than AI systems ($M = 3.17$). The positive correlation between these two items ($r = .42, p < .01$) suggests that valuing empathy personally is associated with viewing it as a distinctively human capacity.

This finding resonates with philosophical accounts that emphasize the cognitive and evaluative role of emotions in moral reasoning. Nussbaum (2001) argues that emotions are not merely subjective reactions but forms of evaluative judgment that help individuals identify what is morally significant in human life. Similarly, the ethics of care tradition positions empathy, attentiveness, and responsibility toward others as essential dimensions of moral agency (Gilligan, 1993; Tronto, 1993). From this perspective, respondents' attachment to empathy may reflect an intuitive understanding that moral judgment requires forms of relational sensitivity that cannot be easily reduced to algorithmic computation.

At the same time, the moderate mean scores and non-negligible standard deviations indicate that this attachment to empathy is not universal or unqualified. Some respondents may be more open to algorithmic involvement in decision-making, even in domains traditionally associated with human judgment. This variability is itself analytically interesting, suggesting that attitudes toward AI-mediated ethics are contested and evolving rather than settled.

5.2 Contextual Judgment and the Limits of Formalization

Respondents expressed relatively strong agreement that ethical decisions must be context-based and cannot be fully programmed ($M = 3.43$). This finding aligns with longstanding critiques of artificial intelligence that emphasize the irreducibility of human judgment to formal rules. Dreyfus (1992) argued that expert human reasoning depends heavily on tacit knowledge, embodied experience, and situational interpretation—dimensions that resist explicit computational specification. Although contemporary research in machine ethics has explored ways to formalize ethical principles within algorithmic frameworks (Moor, 2006; Wallach & Allen, 2009), the translation of moral judgment into computational models remains conceptually and practically challenging.

The positive correlation between belief in context-based ethics and empathy-based attitudes ($r = .38$ with empathy, $p < .01$; $r = .29$ with human empathy, $p < .01$) suggests that these two dimensions of moral reasoning are interconnected in respondents' minds. Those who emphasize empathy also tend to view ethical judgment as situationally dependent rather than rule-governed. This pattern is consistent with theoretical accounts that position empathy as a capacity for situational attunement—a way of perceiving what particular situations demand rather than applying abstract principles mechanically (Vetlesen, 1994).

5.3 Limited Trust and the Conditional Nature of Delegation

A second major pattern concerns the limited trust respondents place in AI's ethical competence. Mean scores for items such as "AI can help humans make more ethical decisions" ($M = 2.74$) and the Moral Trust in AI composite index ($M = 2.68$) fall below the scale midpoint, indicating skepticism rather than confidence. At the same time, respondents express moderate comfort with the idea of collaborating with AI in decision-making ($M = 3.08$), suggesting that they are not entirely closed to algorithmic assistance.

This apparent tension—skepticism about AI's ethical capacity alongside openness to collaboration—resolves when we consider the conditional nature of trust revealed in the data. The Conditional Boundaries of Trust index ($M = 3.52$) indicates strong endorsement of the idea that trust in AI should be limited by considerations of emotional impact, transparency, and human oversight. Respondents agree, on average, that they would trust AI for routine decisions but not for emotionally significant ones ($M = 3.41$), and the strongest agreement in the survey pertains to the need for transparency ($M = 3.68$).

These patterns are consistent with experimental research showing that individuals resist delegating morally sensitive decisions to machines, particularly those involving human suffering or social consequences (Bigman & Gray, 2018; Gogoll & Müller, 2017). They also align with survey-based studies demonstrating that trust in AI is frequently grounded in perceptions of procedural fairness and transparency rather than in beliefs that machines possess genuine moral understanding (Gerlich, 2024).

The correlation between comfort collaborating with AI and Moral Trust in AI ($r = .48$, $p < .01$) suggests that openness to algorithmic assistance is associated with perceptions of AI's ethical competence. However, the negative correlations between trust in AI and empathy-based attitudes ($r = -.23$ between Moral Trust and empathy; $r = -.28$ between Moral Trust and belief in human empathy) indicate that these two orientations may represent distinct—and somewhat opposed—ways of thinking about moral agency in relation to technology.

5.4 The Residual Moral Subject: An Interpretive Lens

How should we make sense of these patterns? We propose that they can be interpreted through the concept of the residual moral subject—a form of moral agency that persists under conditions of algorithmic mediation but is reconfigured, becoming conditional, negotiated, and context-sensitive.

The concept, introduced in Section 2.4, draws on critical social theory and the philosophy of technology (Adorno & Horkheimer, 1947; Verbeek, 2011). It differs from approaches that either celebrate the displacement of human judgment by algorithmic systems or mourn its disappearance. Instead, it describes a situation in which individuals remain morally engaged—they continue to evaluate outcomes in ethical terms, to draw boundaries around acceptable delegation, and to insist on human oversight—but do so within environments increasingly shaped by technological infrastructures.

The empirical patterns observed in this study illustrate this configuration:

- Persistence of ethical awareness: Respondents continue to view empathy and contextual judgment as morally significant, even when considering AI-mediated decisions. They do not cede the moral domain to machines.
- Conditionality of trust: Trust in AI is not absolute but contingent on factors such as transparency, emotional impact, and the presence of human oversight. Respondents are willing to accept algorithmic assistance, but on their own terms.
- Negotiation of boundaries: Respondents draw clear distinctions between decisions they would delegate to AI (routine, technical) and those they would reserve for human judgment (emotionally significant, relationally complex). These boundaries are not given but actively maintained.
- Selective reliance: The weak correlations between trust in AI and empathy-based attitudes suggest that openness to algorithmic assistance may coexist with—rather than replace—attachment to human moral capacities. Respondents appear to navigate a middle ground, neither fully embracing nor completely rejecting AI involvement.

In this interpretation, the residual moral subject is not a nostalgic figure clinging to a pre-technological past, but a contemporary agent learning to navigate a world in which efficiency and empathy, algorithm and intuition, must coexist. The ambivalence evident in the data—the simultaneous openness to and wariness of AI—reflects the challenges of maintaining moral agency within hybrid human-machine decision environments.

5.5 The Specificity of Context: Albania as a Non-WEIRD Setting

It is important to situate these findings within the specific context in which they were produced. The sample consists of university students in Albania—a post-communist, upper-middle-income country with rapidly increasing digital adoption but limited public infrastructure for AI governance and minimal public debate on AI ethics.

Several contextual factors may shape the attitudes observed:

First, Albania's educational system, particularly in economics and social sciences, continues to emphasize humanistic values and ethical reflection. Students may be socialized to view empathy and contextual judgment as central to professional and civic life, potentially reinforcing skepticism toward purely technical approaches to decision-making.

Second, exposure to AI systems in everyday life, while growing, remains less pervasive than in highly digitized societies such as the United States, China, or Northern Europe. Respondents may have less direct experience with AI-mediated decisions in high-stakes domains (healthcare, finance, criminal justice), potentially making their attitudes more abstract and less calibrated to actual technological capabilities.

Third, cultural norms in Albania—as in many Mediterranean and post-communist societies—continue to emphasize interpersonal relationships, family ties, and community bonds. These relational orientations may make individuals particularly sensitive to the emotional and social dimensions of decision-making, and consequently more cautious about delegating such decisions to machines.

Fourth, the sample's disciplinary concentration in economics (93%) may introduce specific biases. Economics students are trained to think in terms of efficiency, optimization, and rational choice—frameworks that might, in principle, make them more receptive to algorithmic decision-making. Yet the findings show only modest trust in AI, suggesting that disciplinary training does not simply translate into techno-optimism. Future research could usefully compare attitudes across disciplines.

Given these contextual specificities, we do not claim that the patterns observed here generalize to other populations. Rather, we offer them as a contribution to diversifying the empirical landscape of AI ethics research, which remains heavily skewed toward Western, educated, industrialized, rich, and democratic (WEIRD) societies (Henrich, Heine, & Norenzayan, 2010). Understanding how attitudes toward algorithmic governance vary across cultural and institutional contexts is essential for developing globally relevant ethical frameworks.

5.6 Relationship to Existing Literature

The findings both align with and extend existing research on human–AI interaction and moral delegation.

Consistent with previous studies, we find that individuals are reluctant to delegate morally sensitive decisions to machines (Bigman & Gray, 2018; Gogoll & Müller, 2017). The Conditional Boundaries of Trust index ($M = 3.52$) and the item on routine versus emotional decisions ($M = 3.41$) provide clear evidence that respondents maintain boundaries around delegation.

The findings also resonate with research on the multidimensional nature of trust in AI. Studies have shown that individuals distinguish between technical competence and moral authority (Oliveira et al., 2024), and that trust is often conditional on perceived transparency and fairness (Gerlich, 2024). The strong endorsement of transparency in our data ($M = 3.68$) reinforces this point.

Where this study extends existing work is in its focus on a non-WEIRD population and its attempt to interpret empirical patterns through a theoretically grounded concept—the residual moral subject. Most experimental and survey-based research on AI attitudes has been conducted in Western contexts, leaving open the question of how cultural and institutional factors shape perceptions of algorithmic authority. By documenting patterns of ethical ambivalence in Albania, we contribute to building a more globally diverse evidence base.

5.7 Implications for AI Governance and Design

The findings also carry implications for the governance and design of AI systems.

First, they suggest that public acceptance of algorithmic decision-making depends not only on technical performance but on perceived ethical legitimacy. Transparency, explainability, and human oversight are not optional add-ons but central conditions for trust. Developers and policymakers should prioritize these features in system design and regulatory frameworks.

Second, the persistence of empathy as a moral reference point indicates that AI governance frameworks should avoid assuming that ethical responsibility can be fully delegated to technological systems. Decision-making models that combine algorithmic support with human judgment—so-called "human-in-the-loop" configurations—may be more socially acceptable and normatively defensible than fully automated systems, particularly in domains involving emotional or relational consequences.

Third, the conditional nature of trust observed in this study suggests that acceptance of AI is not a binary proposition but a matter of degree and domain. Public engagement and deliberation should acknowledge this

complexity, exploring not whether AI should be used but under what conditions, for what purposes, and with what safeguards.

Fourth, the contextual specificity of the findings underscores the importance of culturally situated approaches to AI ethics. Global principles and guidelines must be adapted to local contexts, taking account of varying institutional histories, cultural values, and technological infrastructures.

Conclusions

This study examined how university students in Albania perceive the relationship between empathy, moral responsibility, and AI-mediated decision-making. The findings reveal that empathy remains a central moral reference, guiding respondents' judgments and shaping their perceptions of AI's ethical capacity.

Trust in AI is conditional and limited. Participants are more willing to delegate routine or low-stakes decisions to AI but retain human oversight for decisions with emotional or ethical significance. Attitudes toward AI are not random; they reflect coherent interpretive frameworks in which empathy, trust, and openness to collaboration interact.

The concept of the residual moral subject captures this dynamic. Moral agency is not lost but reconfigured: it persists, adapts, and is negotiated within hybrid human-machine contexts. Individuals selectively delegate responsibility, maintain boundaries, and balance efficiency with ethical reflection.

These insights have practical implications for AI design and governance. Systems that prioritize transparency, explainability, and support for human ethical judgment are more likely to be accepted. Furthermore, culturally and contextually sensitive approaches are essential, as perceptions of moral delegation vary across environments and populations.

Overall, the study highlights that human moral agency endures in algorithmically mediated contexts. Understanding how individuals navigate trust, delegation, and ethical responsibility is crucial for developing AI that complements rather than replaces human moral reasoning.

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Appendix A: Survey Questionnaire

This appendix presents the questions from the survey "Empathy and Decision-Making in the Age of Artificial Intelligence," translated from the original Albanian. The response formats are as they appeared in the data collection sheet.

Part 1: Demographics and AI Familiarity

1. **Gender:**
 - Male
 - Female
 - Other/Prefer not to say
2. Age: (Open-ended numerical response)
3. **Year of Study:**
 - 1.0
 - 2.0
 - 3.0
 - Master
4. **Faculty/Department:**
 - Economics
 - Engineering / Technology
 - Social Sciences
 - (Other open-ended responses)
5. **Your knowledge about AI:**
 - 1 = No knowledge
 - 2 = Little knowledge
 - 3 = Average knowledge
 - 4 = Good knowledge
 - 5 = Advanced knowledge
6. How often do you use AI (e. g., ChatGPT, virtual assistants) in your studies or decision-making:
 - 1 = Never
 - 2 = Rarely
 - 3 = Sometimes
 - 4 = Often
 - 5 = Very often

Part 2: Attitudes Towards AI in Decision-Making

For questions 7-21, the response scale was: **Plotësisht kundër (Strongly disagree), Kundër (Disagree), Neutral / Nuk jam i sigurt (Neutral / Not sure), Dakord (Agree), Plotësisht dakord (Strongly agree)**

7. AI can make more objective decisions than humans.
8. AI decisions can often be unfair to certain individuals.
9. I prefer that decisions affecting me are made by a human and not AI.
10. AI can help in making complex ethical decisions.
11. AI can improve social fairness in decision-making.
12. I believe AI can have a programmed sense of empathy.
13. Humans are more reliable than AI in decision-making related to ethics.
14. AI decisions should always be transparent and reasoned.
15. In a distribution of resources, I would be more at ease if AI decided on the allocation.
16. I am concerned that AI can make decisions without considering people's feelings.
17. I believe AI decisions can be more efficient but less fair.
18. I am willing to accept AI suggestions, even if I don't fully agree.
19. I would prefer to collaborate with AI to make complex decisions.
20. I would often change my personal decision if AI suggested a more "efficient" but less empathetic solution.
21. When decisions affect people's feelings, I prefer that AI systems consider the emotional consequences before proposing solutions.

Part 3: Empathy, Ethics, and Trust in AI

For questions 22-29, the response scale was a Likert scale from 1 to 5, with anchors: 1 = Plotësisht kundër (Strongly disagree) and 5 = Plotësisht dakord (Strongly agree)

22. Empathy is an essential element in every decision I make.
23. I am willing to sacrifice personal benefits to help others.
24. I believe that humans are more empathetic than AI.
25. Ethical decisions should be based on context and cannot be programmable.
26. I think AI can help people make more ethical decisions.
27. Sometimes I feel more confident relying on AI for complex decisions.
28. Decisions that affect others should always have a human component.
29. For decisions that affect people, I always prefer a person's decision, even if AI suggests a more 'efficient' solution.

Part 4: Preferences and Future Outlook

- 30. How comfortable do you feel collaborating with AI in decision-making?**
- 1 = Not comfortable at all
 - 2
 - 3 = Neutral
 - 4
 - 5 = Very comfortable
- 31. How much do you think AI can improve society in ethical decision-making?**
- 1 = Not at all
 - 2
 - 3 = Moderately
 - 4
 - 5 = Very much
- 32. Would you like to participate in other experiments related to AI and ethics?**
- Yes
 - No
- 33. If you could choose, what role would you give to AI in your decision-making?**
- Limited assistance
 - Decision-making partner
 - Full decision-making
 - No role
34. Write a situation where you think AI can make better decisions than humans. (Open-ended)
35. What are your main concerns in using AI for ethical decision-making? (Open-ended)

Part 5: Concluding Statements on Emotional Impact

For questions 36-39, the response scale was a Likert scale from 1 to 5, with anchors: 1 = Plotësisht kundër (Strongly disagree) and 5 = Plotësisht dakord (Strongly agree)

36. When decisions affect people's feelings, I prefer that AI systems consider the emotional consequences before proposing solutions.
37. I would feel more at ease if a decision proposed by AI was accompanied by an explanation of how the AI considered human aspects (emotions, well-being).
38. For decisions that affect people, I always prefer a person's decision, even if AI suggests a more 'efficient' solution.
39. I would be willing to allow AI to make routine decisions, but not decisions that have a major emotional impact on people.

Perceived Counseling Support as a Predictor of Young Adults' Participation in Adult Literacy Programs in Amuwo-Odofin, Lagos State: A Descriptive Survey Study

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Abstract

Low participation of young adults in adult literacy programmes continues to undermine efforts aimed at improving functional literacy and socio-economic inclusion in Nigeria. This study examined the relationship between perceived counselling support and young adults' participation in adult literacy programmes in Amuwo-Odofin Local Government Area, Lagos State. Specifically, the study investigated how perceived motivational, psychosocial, and career-related counselling support are associated with attendance, engagement, persistence, and learning motivation. A descriptive survey design was adopted. A structured questionnaire was administered to 300 young adults, of whom 285 returned usable responses. The reliability of the instrument was confirmed with Cronbach's alpha coefficients ranging from 0.78 to 0.86. Data analysis comprised descriptive statistics, Pearson correlation coefficients, and multiple regression techniques. Results indicated significant positive correlations between perceived counselling support and participation levels, with motivational counselling exhibiting the strongest correlation ($r = 0.62$, $p < 0.01$), followed by psychosocial counselling ($r = 0.58$, $p < 0.01$) and career counselling ($r = 0.55$, $p < 0.01$). Multiple regression showed that these three dimensions collectively accounted for 53% of the variance in participation outcomes ($R = 0.73$, $R^2 = 0.53$, $p < 0.001$). The study concludes that perceived counselling support is strongly associated with

participation outcomes among young adult learners. While the findings reflect statistical associations rather than causal impact, they highlight the importance of supportive learning environments in strengthening adult literacy engagement.

Keywords: Programmes for adult literacy; Perceived support from counselling; Participation of young adults; Motivational counselling; Psychosocial assistance; Guidance for careers

Introduction

Adult literacy programmes play a critical role in promoting socio-economic development, workforce participation, and lifelong learning, particularly in developing countries where significant segments of the population lack functional literacy. In Nigeria, adult literacy programmes are delivered primarily through non-formal education systems, overseen by the National Commission for Mass Literacy, Adult and Non-Formal Education (NMEC). They aim to offer “second-chance” educational opportunities for those who have not completed formal schooling or acquired functional literacy.

Despite their importance, participation in adult literacy programmes remains low among young adults. Many learners struggle with irregular attendance, weak engagement, and programme discontinuation. These challenges have been widely linked to socio-economic pressures, psychological barriers, and limited institutional support systems (Adefila & Adedokun, 2022; Mwangi & Wanjiru, 2021). Young adults in particular often face competing economic responsibilities, social stigma associated with returning to learning, and limited confidence in their academic abilities.

Adult literacy learners differ significantly from students in formal educational institutions. Many adult learners combine education with employment, family responsibilities, and financial constraints. Their participation is therefore highly sensitive to motivational and emotional factors. Psychological barriers such as shame, low self-efficacy, and fear of failure have been identified as major deterrents to sustained engagement (Bandura, 1997; Merriam & Bierema, 2014).

Increasingly, research emphasises that adult literacy participation is influenced not only by instructional quality but also by the broader learning environment, including emotional and motivational support structures. Counselling-related support within learning centres, such as encouragement, confidence-building interactions, and guidance linking literacy to economic opportunities, may shape learners’ commitment to participation.

However, empirical evidence examining how multiple dimensions of counselling support collectively relate to participation among young adults

remains limited, particularly in Nigerian contexts. This study addresses this gap by examining the relationship between perceived motivational, psychosocial, and career-related counselling support and participation in adult literacy programmes in Amuwo-Odofin Local Government Area of Lagos State.

Statement of the Problem

Participation in adult literacy programmes among young adults remains persistently low relative to the number of individuals requiring literacy support. Available programme reports indicate that only a small proportion of eligible young adults enrol in literacy programmes, and many who enrol do not maintain consistent attendance or complete instructional cycles. According to report data from the National Commission for Mass Literacy, Adult and Non-Formal Education (NMEC, 2022), while an estimated 38% of young adults in certain urban clusters like Lagos require functional literacy support, less than 12% actually enrol in non-formal education centres.

Low participation has been linked to economic pressures, limited programme relevance, learning anxiety, and social stigma associated with adult illiteracy. In addition, many literacy centres lack structured learner support mechanisms capable of addressing motivational and psychosocial barriers to engagement.

While counselling-related support is widely regarded as beneficial for learner engagement, limited empirical evidence exists on how young adults' perceptions of such support relate to their participation in adult literacy programmes. Understanding this relationship is important for designing learner-centred literacy interventions and strengthening programme effectiveness

Purpose of the Study

The purpose of this study is to examine the relationship between perceived counselling support and young adults' participation in adult literacy programmes in Amuwo-Odofin Local Government Area.

Specifically, the study seeks to:

- i. determine the extent to which perceived counselling support is associated with participation.
- ii. examine the relationship between perceived motivational counselling and participation.
- iii. assess the association between perceived psychosocial support and learners' confidence and persistence.

- iv. investigate how perceived career counselling relates to perceived programme relevance.
- v. determine the joint predictive contribution of counselling dimensions to participation

Research Questions

- i. To what extent is perceived counselling support associated with young adults' participation?
- ii. How is perceived motivational counselling related to participation?
- iii. How is perceived psychosocial support associated with confidence and persistence?
- iv. How is perceived career counselling related to perceived programme relevance?
- v. What is the combined predictive contribution of counselling dimensions to participation?

Research Hypotheses

- H₀₁: Perceived counselling support is not significantly associated with young adults' participation.
- H₀₂: Perceived counselling dimensions do not significantly predict participation outcomes.

Literature Review

Participation in adult literacy programmes is influenced by multiple factors, including socio-economic constraints, programme relevance, and psychological readiness (Mwangi & Wanjiru, 2021; Ogunlade & Ajayi, 2023). Adult learners frequently experience learning anxiety, stigma, and low academic self-confidence, which can undermine persistence.

Motivational support has been shown to enhance self-efficacy, goal commitment, and persistence (Deci & Ryan, 2000; Knowles et al., 2015). Psychosocial support can reduce anxiety and improve emotional readiness for learning (Bandura, 1997; Merriam & Bierema, 2014). Career-related guidance strengthens perceived relevance by linking literacy to employment and livelihood opportunities (Super, 1990; Watts, 2013).

Supportive learning environments that address emotional and motivational needs are associated with improved engagement (Broek, 2024; OECD, 2025). However, limited research has examined these counselling dimensions jointly as predictors of participation among young adults in Nigerian adult literacy settings.

Research Methodology

Research Design

A descriptive survey design was adopted to examine relationships between perceived counselling support and participation.

Population

The population comprised young adults (18–35 years) enrolled in adult literacy programmes in Amuwo-Odofin LGA (N = 1,500).

Sample

Using Yamane’s formula, 300 participants were selected through proportional and simple random sampling. A total of 285 valid responses were analysed.

Table 1: Proportional Allocation of Sample Size Across Adult Literacy Centres

Literacy Centre	Total Enrolment	Proportion of Total Population	Allocated Sample Size
Centre A	180	0.12	36
Centre B	150	0.10	30
Centre C	120	0.08	24
Centre D	200	0.13	40
Centre E	170	0.11	34
Centre F	160	0.11	32
Centre G	140	0.09	28
Centre H	130	0.09	26
Centre I	110	0.07	22
Centre J	140	0.09	28
Total	1,500	1.00	300

Source: Researcher Field Survey, 2025

Operational Definition of Participation

Participation in this study was measured using a structured Participation Scale assessing four dimensions: attendance consistency, engagement during learning activities, persistence in the programme, and learning motivation. These indicators were measured through self-reported responses on a 4-point Likert scale.

Although self-report measures are appropriate for capturing learners’ perceptions and internal states (e.g., motivation and engagement), it is acknowledged that behavioural validation (such as attendance registers or facilitator reports) could provide additional objectivity. However, due to logistical and access constraints across multiple literacy centres, participation was assessed through validated perceptual indicators commonly used in adult education research.

Data were gathered through a structured questionnaire that was created by the researcher. This instrument consisted of three distinct sections:

- **Section A:** Demographic details (such as age, gender, occupation, and duration in the program).
- **Section B:** Counselling Interventions Scale (which included motivational, psychosocial, and career-focused counselling).
- **Section C:** Participation Scale (covering aspects such as motivation, attendance, engagement, and persistence).

The questionnaire employed a 4-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree" to assess the perceptions and behaviours of respondents. The design of this instrument was informed by existing literature, theoretical frameworks, and context-specific issues highlighted in the background and problem statement.

A structured questionnaire measured:

- Perceived motivational counselling
- Perceived psychosocial support
- Perceived career counselling
- Participation (attendance, engagement, persistence, motivation)

Items were rated on a 4-point Likert scale.

Validity of the Instrument

In order to establish content and face validity, a group of specialists in adult education, counselling psychology, and educational measurement and evaluation evaluated the preliminary version of the questionnaire. Their feedback facilitated enhancements in wording, clarity, item relevance, and the overall framework.

Construct validity was ensured by correlating each question with the study's research objectives, questions, and variables.

Reliability of the Instrument

A pilot study was carried out involving a selection of young adult learners from Surulere Local Government, an independent adult literacy center excluded from the final analysis. The instrument's reliability was assessed using Cronbach's Alpha to determine internal consistency; a reliability coefficient of 0.70 or higher was achieved, indicating satisfactory reliability.

Data Analysis

Descriptive statistics, Pearson correlation, and multiple regression were used.

Method of Data Collection

Data was gathered through in-person interactions to enhance response rates.

1. Approval was secured from the appropriate authorities managing adult literacy initiatives in Amuwo-Odofin LGA.
2. Questionnaires were provided directly to learners during their class sessions or designated programme hours.
3. Participants were allotted sufficient time to fill out the questionnaires, and all submitted forms were checked for completeness prior to analysis.

When necessary, trained research assistants facilitated the distribution and collection of the questionnaires.

Ethical Considerations

Informed consent, voluntary participation, anonymity, and confidentiality were ensured.

Method of Data Analysis

The quantitative data gathered from the field were examined through both descriptive and inferential statistical methods.

Descriptive Statistics

To summarise demographic features and overall perceptions of counselling interventions and levels of participation, descriptive statistics such as frequencies, percentages, means, and standard deviations were utilized.

Inferential Statistics

The hypotheses for the study were evaluated using various statistical techniques:

Regression Analysis: To assess the predictive influence of counselling interventions on participation outcomes.

Independent Samples t-test or ANOVA: Utilised for comparisons between different groups or centres as necessary.

Ethical Considerations

Ethical guidelines were adhered to at every phase of the research process.

Informed Consent: Participants received comprehensive information regarding the study's objectives and procedures prior to completing the questionnaire.

Voluntary Participation: Respondents engaged in the study willingly and retained the right to withdraw at any time without repercussions.

Confidentiality: Personal information was handled with utmost confidentiality and utilised exclusively for research purposes.

Anonymity: The identities of participants were not disclosed in the data or final reports.

Respect for Participants: The data collection process was conducted in a manner that minimised disruption to class activities, ensuring that participants' comfort and dignity remained a priority throughout.

Data Analysis and Results

Response Rate

Among the 300 questionnaires distributed, 285 were accurately filled out and returned, resulting in a substantial response rate of 95.0%. This elevated response rate contributes to the reliability and generalizability of the results.

Demographic Characteristics of Respondents

Table 2 displays the demographic profile of the 285 young adults involved in the study.

Table 2: Demographic Characteristics of Respondents (N = 285)

Variable	Category	Frequency (f)	Percentage (%)
Gender	Male	132	46.3
	Female	153	53.7
	Total	285	100.0
Age Group (years)	18–22	88	30.9
	23–27	114	40.0
	28–35	83	29.1
	Total	285	100.0
Duration in Programme	< 6 months	102	35.8
	6–12 months	117	41.1
	> 12 months	66	23.2
	Total	285	100.0

Source: Researcher's Field Survey, 2025

The data presented in the table indicates that male participants made up 46.3% of the total respondents. The largest age group represented was individuals between 23 and 27 years, accounting for 40.0%. Additionally, a significant portion of the respondents had been involved in the program for a duration ranging from 6 to 12 months, representing 41.1%.

Research Question 1: What is the impact of counselling interventions on young adults' engagement in adult literacy programs?

To address this question, a multiple regression analysis was conducted to assess the collective influence of motivational, psychosocial, and career counselling on participation levels.

Table 3: Regression Summary of Counselling Interventions on Participation (N = 285)

Model	R	R ²	Adjusted R ²	Std. Error
1	0.73	0.53	0.52	0.33

Source: Researcher's Field Survey, 2025

Interpretation

The findings indicate an R value of 0.73, which suggests a robust correlation between counselling interventions and participation levels. The R² value of 0.53 signifies that counselling interventions account for 53% of the variation observed in participation. This represents a substantial effect, demonstrating that counselling significantly improves attendance, engagement, and persistence.

Conclusion: Respondents' experiences of counselling were measured through self-reported exposure to and perceived benefits from motivational, psychosocial, and career-related support provided within literacy centres.

Research Question 2: In what ways does motivational counselling affect the enrollment and continued attendance of young adults?

Table 4: Average Values and Correlation Between Motivational Counselling and Participation

Variable	Mean	SD	r-value	p-value
Motivational Counselling	3.21	0.49	0.62**	< 0.01
Participation	3.15	0.47		

Source: Researcher's Field Survey, 2025

Note: p < 0.01 (significant)

Interpretation

The average score for motivational counselling (M = 3.21) suggests a significant level of motivational support. The correlation coefficient (r = 0.62, p < 0.01) reflects a robust positive association with participation. This indicates that when students are provided with encouragement, assistance in setting goals, and motivational direction, they tend to engage more consistently and maintain their commitment to learning.

Conclusion: Motivational counselling, as perceived by respondents, was strongly associated with higher levels of enrolment, attendance, and persistence among young adult learners.

Research Question 3: In what ways is perceived psychosocial support within literacy centres associated with learners' confidence, emotional adjustment, and persistence?

Table 5: Mean and Correlation between Psychosocial Counselling and Participation

Variable	Mean	SD	r-value	p-value
Psychosocial Counselling	3.08	0.52	0.58**	< 0.01
Participation	3.15	0.47		

Source: Researcher's Field Survey, 2025

Interpretation

The average score for psychosocial counselling was 3.08, reflecting a substantial level of emotional and psychological assistance. The correlation coefficient ($r = 0.58$, $p < 0.01$) indicates a significant positive association with participation levels. This suggests that when students are provided with emotional support, interventions aimed at building confidence, and stress management resources, they experience increased feelings of security, reduced anxiety, and a greater willingness to pursue their education.

Conclusion

Psychosocial counselling plays a crucial role in enhancing individuals' confidence, emotional resilience, and persistence in their studies.

Research Question 4

What impact does career-focused counselling have on young adults' views regarding the significance of adult literacy programmes?

Table 6: Mean and Correlation between Career Counselling and Participation

Variable	Mean	SD	r-value	p-value
Career Counselling	2.97	0.56	0.55**	< 0.01
Participation	3.15	0.47		

Source: Researcher's Field Survey, 2025

Interpretation

The average score for career counselling ($M = 2.97$) reflects a moderately high degree of vocational guidance. The correlation coefficient ($r = 0.55$, $p < 0.01$) indicates a significant moderate-to-strong association with participation levels. This implies that when learners recognise the impact of literacy skills on improving job prospects or entrepreneurial opportunities, they place greater importance on the program and engage more actively.

Conclusion: Career-focused counselling effectively enhances learners' perceptions of relevance and increases their level of participation.

Summary of Analysis of Research Questions

Research Question	Key Finding	Interpretation
RQ1: Overall counselling → Participation	$R^2 = 0.53$	Counselling explains 53% of participation variance.
RQ2: Motivational counselling	$r = 0.62$	Strong influence on enrolment, attendance, and persistence.
RQ3: Psychosocial counselling	$r = 0.58$	Strong effect on confidence, emotional readiness, and persistence.
RQ4: Career counselling	$r = 0.55$	Enhances perceived relevance and motivates participation.

General Interpretation

The research findings indicate that various counselling interventions, including motivational, psychosocial, and career-focused methods, have a notably positive impact on young adults' involvement in adult literacy programmes.

Hypotheses Testing Using Multiple Regression

Hypothesis 1: Counselling interventions do not significantly influence young adults' participation in adult literacy programmes.

Evidence: The results from the multiple regression analysis revealed that counselling interventions accounted for 53% of the variance in participation ($R^2 = 0.53$, $F(3, 281) = 74.00$, $p < 0.001$).

Decision: H_{01} is rejected.

Conclusion: There is a significant effect of counselling interventions on young adults' participation in adult literacy programs.

Hypothesis 2: Collective counselling strategies do not significantly improve learner engagement or decrease dropout rates among young adults.

Evidence: The collective use of counselling strategies demonstrated a strong correlation with improved learner engagement and a reduction in dropout rates ($r = 0.62$, $p < 0.01$), along with a significant regression coefficient ($\beta = 0.39$, $t = 6.33$, $p < 0.001$).

Decision: H_{02} is rejected.

Conclusion: There is a significant correlation between collective counselling strategies and enhanced learner engagement as well as decreased dropout rates among young adults participating in these programmes.

Analysis of Discussion of Findings

Because this study adopted a descriptive survey design, the findings indicate statistical associations and predictive relationships rather than direct

causal effects. Therefore, interpretations are made in terms of influence, contribution, or association, not causation. The findings of this research present compelling evidence that counselling interventions greatly improve young adults' participation in adult literacy programmes. The descriptive data revealed overall increased levels of motivational, psychosocial, and career-focused counselling, alongside high participation rates. This is in accordance with previous studies indicating that young adults flourish in nurturing educational settings that address their emotional, psychological, and academic requirements.

Correlation analyses uncovered strong and significant relationships between various aspects of counselling and participation. In particular, **motivational counselling** exhibited the highest correlation with participation ($r = 0.62$), signifying that support from counsellors, goal-setting initiatives, and positive reinforcement play a vital role in enhancing learner attendance and persistence. This aligns with the claims made by Kassahun and Mohammed (2023) that motivational encouragement reduces dropout rates and bolsters learners' resolve.

Moreover, **psychosocial counselling** showed a significant influence on participation ($r = 0.58$), demonstrating that tackling emotional issues such as anxiety and self-esteem can help learners engage more deeply in literacy activities. This observation is consistent with the arguments put forth by Okoro and Mensah (2023), who contended that acknowledging learners' psychosocial needs within literacy programs fosters greater commitment.

While **career-oriented counselling** had a slightly lower effect size ($r = 0.55$), it still displayed a meaningful connection to participation. This suggests that when learners understand how literacy skills relate to job prospects or income potential, they are more likely to remain engaged. Ogunlade and Ajayi (2023) supported this notion by highlighting the significance of aligning educational content with economic goals as a major motivating factor for youth.

Furthermore, **multiple regression analysis** revealed that these three aspects of counselling together accounted for 53% of the variance in participation levels, emphasising that counselling is not merely an ancillary component but a crucial factor affecting participation outcomes. Each type of counselling contributed unique statistically significant impacts, underscoring the importance of an integrated counselling strategy.

In conclusion, these results indicate that low participation rates among young adults arise not only from academic difficulties but are also significantly influenced by emotional, psychological, and

socioeconomic elements. Thus, counselling interventions emerge as effective tools for addressing obstacles and improving learner engagement within adult literacy frameworks.

Conclusion

This study utilised a descriptive survey design, leading to findings that reveal statistical correlations and predictive relationships rather than direct causal connections. Thus, interpretations are framed in terms of influence, contribution, or association instead of causation. The results strongly indicate that counselling interventions significantly boost young adults' participation in adult literacy programs. Descriptive data showed generally increased levels of motivational, psychosocial, and career-focused counselling alongside high rates of engagement. This observation is consistent with previous research suggesting that young adults flourish in supportive educational environments that address their emotional, psychological, and academic needs.

Correlation analyses demonstrated strong and significant relationships between each aspect of counselling and participation. Specifically, motivational counselling exhibited the highest correlation with participation ($r = 0.62$), underscoring the importance of counsellor encouragement, goal-setting support, and reinforcement in influencing learner attendance and persistence. This aligns with the views of Kassahun and Mohammed (2023), who noted that motivational support reduces withdrawal tendencies while bolstering learner determination.

Psychosocial counselling also had a significant impact on participation ($r = 0.58$), indicating how addressing emotional hurdles like anxiety and self-esteem issues equips learners to engage more fully with literacy tasks. This finding supports Okoro and Mensah's (2023) argument that acknowledging learners' psychosocial needs within literacy settings enhances their commitment.

Although career-oriented counselling had a slightly lower effect size ($r = 0.55$), it still reflected a meaningful relationship with participation. This suggests that when learners understand how literacy skills relate to employability or income potential, they are more likely to remain engaged. Ogunlade and Ajayi (2023) echoed this by stressing the necessity of aligning learning content with economic aspirations as a vital motivator for youth.

Moreover, multiple regression analysis revealed that these three dimensions of counselling collectively accounted for 53% of the variance in participation, emphasising that counselling is not merely an ancillary component but a crucial factor influencing engagement outcomes. Each type of counselling made statistically significant,

unique contributions, illustrating the importance of an integrated approach to counselling.

In summary, these findings imply that low participation rates among young adults arise not solely from academic difficulties but are also profoundly influenced by emotional, psychological, and socioeconomic factors. Consequently, counselling interventions serve as effective tools for overcoming obstacles and enhancing learner engagement within adult literacy contexts.

The study highlights a strong association between perceived counselling support and participation among young adults in adult literacy programs; those who perceive greater motivational, emotional, and vocational assistance report higher levels of engagement and persistence.

While direct causal conclusions cannot be drawn from this data, the findings underscore the significance of supportive educational environments in adult literacy initiatives.

Recommendations

Based on the findings outlined above, the following recommendations are proposed:

- 1. Integrate Structured Counselling into Adult Literacy Programmes**

Adult literacy centres should formally incorporate various types of counselling services—motivational, psychosocial, and career-focused—into their program frameworks as standard practice rather than optional features for learner assistance.

- 2. Train Facilitators in Essential Counselling Skills**

Facilitators should receive training in fundamental counselling techniques such as active listening, empathy building, goal setting, and recognising early signs of disengagement to create supportive educational environments.

- 3. Establish Dedicated Counsellor Positions at Each Centre**

Where feasible, adult literacy centres ought to hire dedicated counsellors responsible for coordinating interventions as well as providing individual or group sessions.

- 4. Embed Career Guidance within the Literacy Curriculum**

Curriculum developers should integrate straightforward modules addressing entrepreneurship opportunities along with vocational

relevance to demonstrate practical benefits associated with literacy skills for young adults.

5. Enhance Psychosocial Support Services

Literacy centres should offer initiatives such as peer-support groups along with workshops focused on confidence-building or stress management to assist learners facing personal challenges.

6. Implement Monitoring Systems for Participation

Attendance tracking systems should be established to identify early indicators signalling disengagement among learners so counsellors can take timely action before any withdrawals occur.

7. Engage Community Stakeholders Collaboratively

Local leaders, including NGOs, should work together to raise awareness about adult literacy while reducing stigma associated with seeking help or promoting emotional well-being among learners.

8. Conduct Regular Evaluations of Counselling Services

Ongoing assessments should be conducted to evaluate the effectiveness of various counselling interventions, ensuring improvements are driven by data-informed insights combined with evidence-based practices.

Conflict of Interest: The author reported no conflict of interest.

Data Availability: All data are included in the content of the paper.

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Declaration for Human Participants

This study was reviewed and approved by the University Ethics Committee, Lagos State University of Education, Oto/Ijanikin, Lagos State, Nigeria (Adult and Special Education Department). The study was conducted in compliance with the principles of the Declaration of Helsinki regarding research involving human participants.

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L'étude de cas comme levier d'apprentissage et d'évaluation dans le système LMD : apports pédagogiques et conditions d'efficacité aux études en psychologie

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Résumé

Cette étude analyse l'étude de cas comme dispositif pédagogique et évaluatif dans le système Licence–Master–Doctorat (LMD) à l'Université de Lubumbashi (UNILU), en particulier dans la formation en psychologie du travail, clinique et scolaire. Elle s'inscrit dans un contexte universitaire où les pratiques pédagogiques transmissives et les évaluations centrées sur la restitution des connaissances demeurent prédominantes, en décalage avec les

objectifs de professionnalisation et de développement des compétences du LMD.

La recherche adopte une démarche qualitative fondée sur une analyse documentaire d'un corpus de travaux scientifiques consacrés aux pédagogies actives, à l'étude de cas, à l'engagement cognitif et à l'évaluation des compétences dans l'enseignement supérieur. Une analyse thématique structure les résultats autour de trois axes : les apports pédagogiques de l'étude de cas, son rôle comme dispositif d'apprentissage et d'évaluation authentique des compétences, et les conditions de son efficacité dans le contexte institutionnel de l'UNILU.

Les résultats montrent que l'étude de cas favorise un engagement cognitif élevé, soutient le développement du raisonnement psychologique et scientifique et renforce l'articulation entre théorie et pratique professionnelle. Sur le plan évaluatif, elle constitue un outil pertinent pour apprécier des compétences complexes grâce à l'articulation d'évaluations collective et individuelle. Toutefois, son efficacité dépend de conditions précises, notamment la conception de cas contextualisés de qualité, le rôle de l'enseignant comme facilitateur du raisonnement et l'existence de critères d'évaluation explicites et partagés.

En conclusion, l'étude de cas apparaît comme un dispositif pédagogique intégrateur soutenant l'apprentissage, l'évaluation des compétences et la professionnalisation des étudiants en psychologie dans le cadre du système LMD à l'UNILU.

Mots-clés : Etude de cas ; apprentissage actif ; évaluation des compétences ; système LMD ; psychologie universitaire

The Case Study Method as a Lever for Learning and Competency-Based Assessment in the LMD System: Pedagogical Contributions and Conditions for Effectiveness in Work, Clinical, and School Psychology

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Abstract

This study examines the case study method as a pedagogical and assessment device within the Licence–Master–Doctorat (LMD) system at the University of Lubumbashi (UNILU), with a particular focus on work, clinical, and school psychology programs. It is situated in a higher education context where transmissive teaching practices and knowledge-recall assessments remain predominant, despite the LMD system’s emphasis on professionalization and competency development.

The study adopts a qualitative documentary research approach based on a corpus of scholarly works addressing active learning, case-based pedagogy, cognitive engagement, and competency-based assessment in higher education. A thematic analysis structures the findings around three analytical axes: the pedagogical contributions of the case study method, its role as a learning and authentic assessment device, and the conditions required for its effective implementation in the institutional context of UNILU.

The results indicate that case studies promote high levels of cognitive engagement, foster the development of psychological and scientific reasoning, and strengthen the articulation between theoretical knowledge and

professional practice. From an assessment perspective, the case study method provides a relevant framework for evaluating complex competencies through a complementary combination of individual and group assessment modalities. However, its effectiveness depends on specific conditions, including the design of well-contextualized and high-quality cases, the teacher's role as a facilitator of reasoning and reflection, and the use of explicit and shared assessment criteria.

In conclusion, the case study method emerges as an integrative pedagogical device that supports learning, competency-based assessment, and the professionalization of psychology students within the LMD system at UNILU.

Keywords: Case study; active learning; competency-based assessment; LMD system; university psychology

Introduction

Réforme LMD et enjeux pédagogiques dans l'enseignement universitaire en psychologie

La mise en œuvre du système Licence–Master–Doctorat (LMD) dans l'enseignement supérieur africain s'inscrit dans une dynamique internationale visant l'amélioration de la qualité des formations universitaires, la comparabilité des diplômes et la professionnalisation des parcours académiques (UNESCO, 2015). Cette réforme implique un changement profond des logiques pédagogiques, passant d'une transmission cumulative des savoirs à une approche centrée sur le développement de compétences mobilisables en situation professionnelle.

Dans cette perspective, l'Université de Lubumbashi (UNILU), à l'instar d'autres universités publiques congolaises, a adopté formellement le cadre LMD dans ses formations en psychologie. Les référentiels de formation mettent l'accent sur des compétences telles que l'analyse de situations humaines complexes, le raisonnement scientifique appliqué, la prise de décision contextualisée et l'éthique professionnelle. Toutefois, plusieurs travaux soulignent que l'alignement entre objectifs, méthodes pédagogiques et dispositifs d'évaluation demeure partiel dans de nombreux contextes universitaires, notamment lorsque les pratiques pédagogiques restent dominées par le cours magistral et des évaluations centrées sur la restitution des connaissances (Biggs & Tang, 2011 ; Prince, 2004).

Biggs (2014) insiste sur le principe de *constructive alignment*, selon lequel la qualité de l'apprentissage dépend de la cohérence entre les résultats d'apprentissage visés, les activités pédagogiques proposées et les modalités d'évaluation. Or, dans de nombreux contextes LMD, cette cohérence reste

davantage déclarative que réellement opérationnelle, ce qui limite la portée professionnalisante des formations.

Problématique de l'apprentissage et de l'évaluation en psychologie à l'UNILU

Dans les formations en psychologie du travail, clinique et scolaire à l'UNILU, les enseignants sont confrontés à un double défi. D'une part, ils doivent assurer la transmission de cadres théoriques indispensables à la compréhension des phénomènes psychologiques. D'autre part, ils sont appelés à former des étudiants capables de mobiliser ces cadres dans des situations complexes, incertaines et contextualisées, telles que celles rencontrées dans les entreprises minières, les établissements scolaires ou les structures de santé de Lubumbashi.

Cependant, les modalités pédagogiques et évaluatives dominantes peinent encore à répondre pleinement à ces exigences. Les évaluations écrites traditionnelles, souvent centrées sur la mémorisation et la restitution, permettent difficilement d'apprécier des compétences telles que le raisonnement clinique, l'analyse psychosociale ou la prise de décision professionnelle (Bouchamma & Lambert, 2023). Cette situation entretient un écart entre la formation académique et les attentes du terrain professionnel, particulièrement marqué dans les contextes où les futurs psychologues doivent faire preuve d'autonomie et d'adaptabilité.

La question centrale devient alors celle de l'identification de dispositifs pédagogiques capables de soutenir à la fois l'apprentissage actif et une évaluation authentique des compétences, tout en restant compatibles avec les contraintes institutionnelles de l'enseignement universitaire congolais.

L'étude de cas comme réponse pédagogique et évaluative

Parmi les méthodes issues des pédagogies actives, l'étude de cas apparaît comme un dispositif particulièrement pertinent pour répondre à ces enjeux. Définie comme l'analyse structurée d'une situation complexe inspirée de la réalité, l'étude de cas place l'étudiant dans une posture active d'analyse, d'interprétation et de prise de décision (Guilbert & Ouellet, 1997 ; Lalancette, 2014).

La littérature montre que l'étude de cas favorise un engagement cognitif élevé, en mobilisant des processus d'analyse, d'évaluation et de création, correspondant aux niveaux supérieurs de l'apprentissage (Chi & Wylie, 2014). Elle constitue également un support privilégié pour l'articulation entre théorie et pratique, en permettant aux étudiants de donner du sens aux concepts théoriques à partir de situations concrètes (Kolb, 1984). Sur le plan évaluatif, l'étude de cas est reconnue comme un outil d'évaluation authentique, capable d'apprécier des compétences complexes difficilement

mesurables par des épreuves standardisées (Nicol & Macfarlane-Dick, 2006). Elle permet d'articuler évaluation formative et sommative, individuelle et collective, tout en favorisant la réflexivité et l'autorégulation des apprentissages.

Objectif et question de recherche

Dans ce contexte, le présent article vise à analyser, à partir d'une étude documentaire, les apports de l'étude de cas comme levier d'apprentissage et d'évaluation dans le système LMD, en prenant comme cadre institutionnel l'Université de Lubumbashi et les formations en psychologie du travail, clinique et scolaire.

La question de recherche qui guide cette analyse est la suivante : En quoi l'étude de cas constitue-t-elle un dispositif pertinent d'apprentissage et d'évaluation des compétences dans le système LMD à l'Université de Lubumbashi ?

Méthodologie

Nature et type de l'étude

La présente recherche s'inscrit dans une démarche qualitative de type étude documentaire, également qualifiée de revue analytique et intégrative de la littérature. Ce choix méthodologique est cohérent avec l'objectif principal de l'article, qui vise non pas à mesurer empiriquement l'efficacité d'un dispositif pédagogique spécifique, mais à analyser de manière critique et structurée les apports pédagogiques et évaluatifs de l'étude de cas dans le système LMD, en psychologie universitaire.

L'étude documentaire permet de mobiliser un corpus de travaux scientifiques reconnus afin d'identifier des régularités conceptuelles, des principes pédagogiques stabilisés et des conditions d'efficacité éprouvées. Selon Hlady-Rispal (2002), cette approche est particulièrement pertinente lorsqu'il s'agit d'examiner des dispositifs complexes, tels que les méthodes pédagogiques actives, dont la compréhension nécessite une mise en relation de cadres théoriques, de modèles pédagogiques et de contextes d'application.

Dans le cadre de l'enseignement supérieur, cette démarche est fréquemment mobilisée pour analyser les fondements et les effets des pédagogies actives, notamment l'apprentissage par problèmes, l'apprentissage expérientiel et l'étude de cas (Guilbert & Ouellet, 1997; Prince, 2004). Elle permet ainsi de produire une généralisation analytique, fondée sur la transférabilité raisonnée des résultats vers un contexte institutionnel donné, plutôt qu'une généralisation statistique.

Justification du recours à l'étude documentaire dans le contexte de l'UNILU

Le recours à une étude documentaire se justifie par plusieurs considérations scientifiques et contextuelles.

Premièrement, l'étude de cas comme méthode pédagogique et évaluative fait l'objet d'une littérature abondante et structurée dans les champs des sciences de l'éducation et de la pédagogie universitaire. Des travaux fondateurs et récents ont mis en évidence son potentiel pour soutenir l'apprentissage actif, le raisonnement complexe et l'évaluation des compétences dans l'enseignement supérieur (Lalancette, 2014 ; Bouchamma & Lambert, 2023). Il apparaissait dès lors pertinent de capitaliser sur cet état des connaissances afin d'en proposer une lecture intégrative, plutôt que de conduire une étude empirique isolée.

Deuxièmement, dans le contexte de l'Université de Lubumbashi, où les pratiques pédagogiques innovantes sont encore en cours d'appropriation, une analyse documentaire approfondie constitue une étape préalable nécessaire à toute expérimentation pédagogique à plus grande échelle. Elle permet de fonder les choix didactiques sur des bases théoriques solides et d'éviter une transposition mécanique de modèles conçus dans des contextes institutionnels très différents.

Troisièmement, cette approche méthodologique offre une souplesse compatible avec les contraintes structurelles de l'enseignement universitaire congolais (effectifs élevés, ressources matérielles limitées), tout en répondant aux exigences de rigueur scientifique attendues dans une publication académique internationale.

Constitution du corpus documentaire

Nature des sources mobilisées

Le corpus documentaire analysé est constitué exclusivement de sources scientifiques reconnues, sélectionnées pour leur pertinence directe par rapport à l'objet de recherche. Il comprend :

- des ouvrages de référence consacrés à l'étude de cas, à l'apprentissage expérientiel et à la pédagogie universitaire (Kolb, 1984 ; Guilbert & Ouellet, 1997 ; Lalancette, 2014) ;
- des articles scientifiques à comité de lecture portant sur les pédagogies actives, l'engagement cognitif et l'évaluation des apprentissages dans l'enseignement supérieur (Prince, 2004 ; Chi & Wylie, 2014 ; Nicol & Macfarlane-Dick, 2006) ;
- des travaux récents sur l'évaluation des compétences et l'alignement pédagogique dans le contexte universitaire (Biggs, 2014 ; Bouchamma & Lambert, 2023).

Le corpus intègre également des travaux académiques réalisés à l'Université de Lubumbashi, notamment en psychologie du travail et en psychologie clinique (Mukalu, 2024 ; Ngwej Mpandamadi, 2024), mobilisés comme illustrations contextualisées et non comme données empiriques centrales.

Critères de sélection des sources

La sélection des sources s'est appuyée sur des critères explicites afin de garantir la validité scientifique et la cohérence de l'analyse :

- Pertinence thématique : les sources devaient traiter explicitement de l'étude de cas, de l'apprentissage actif, de l'évaluation des compétences ou de la pédagogie universitaire ;
- Crédibilité scientifique : seules des publications issues d'éditeurs universitaires reconnus ou de revues à comité de lecture ont été retenues ;
- Ancrage dans l'enseignement supérieur : une attention particulière a été accordée aux travaux portant sur le niveau universitaire, en cohérence avec le cadre LMD ;
- Actualité et valeur de référence : les travaux récents ont été privilégiés lorsqu'ils apportaient des éclairages nouveaux, tandis que les travaux plus anciens ont été retenus pour leur caractère fondateur.

Démarche d'analyse documentaire

Approche analytique et interprétative

L'analyse du corpus s'est déroulée selon une approche qualitative analytique, reposant sur une lecture approfondie et itérative des sources. Chaque document a été examiné afin d'identifier :

- les concepts clés associés à l'étude de cas (engagement cognitif, contextualisation, raisonnement, évaluation authentique) ;
- les modalités pédagogiques proposées (travail de groupe, rôle de l'enseignant, types de cas) ;
- les modalités d'évaluation évoquées (collective, individuelle, formative, sommative) ;
- les conditions de réussite et les limites identifiées par les auteurs.

Cette analyse visait moins à quantifier les occurrences qu'à comprendre la logique interne des dispositifs et leurs implications pédagogiques.

Analyse thématique

Les éléments issus de la lecture ont été organisés selon une analyse thématique, structurée autour de trois axes analytiques, en cohérence avec les objectifs de l'article :

1. Les apports pédagogiques de l'étude de cas dans le système LMD ;
2. L'étude de cas comme dispositif d'apprentissage et d'évaluation des compétences ;
3. Les conditions d'efficacité de l'étude de cas dans le contexte de l'UNILU.

Ces axes ont servi de cadre à la présentation des résultats (section 3), tout en permettant l'émergence de sous-thèmes spécifiques liés au contexte universitaire congolais.

Stratégie de contextualisation à l'Université de Lubumbashi

La contextualisation constitue un enjeu méthodologique central de cette étude. Les principes pédagogiques identifiés dans la littérature ont été mis en correspondance avec les réalités institutionnelles de l'UNILU, notamment :

- les effectifs étudiants importants ;
- l'hétérogénéité des profils académiques ;
- les contraintes matérielles ;
- la richesse des situations professionnelles locales (entreprises minières, écoles, structures de santé).

Cette démarche vise une transférabilité raisonnée des résultats, en évitant toute généralisation abusive et en tenant compte des spécificités socio-économiques et éducatives de Lubumbashi.

Rigueur scientifique et limites méthodologiques

Plusieurs éléments contribuent à la rigueur de la démarche : la transparence des critères de sélection, l'utilisation de sources reconnues et une analyse thématique cohérente avec les objectifs de recherche. Néanmoins, comme toute étude documentaire, cette recherche ne permet pas d'établir des relations causales ni de mesurer empiriquement l'impact réel de l'étude de cas sur les apprentissages. Ces limites ouvrent la voie à des recherches empiriques ultérieures, notamment sous forme d'expérimentations pédagogiques ou de recherches-action à l'UNILU.

Résultats

Les résultats présentés dans cette section sont issus de l'analyse thématique du corpus documentaire sélectionné et de sa mise en perspective avec le contexte institutionnel de l'Université de Lubumbashi (UNILU). Cette analyse a permis d'organiser les travaux consultés autour de trois axes analytiques complémentaires : les apports pédagogiques de l'étude de cas dans le système LMD, l'étude de cas comme dispositif d'apprentissage et d'évaluation des compétences, et les conditions d'efficacité de cette méthode dans la formation en psychologie du travail, clinique et scolaire. Cette

structuration thématique constitue le cadre de lecture des résultats qui suivent et permet de dégager, de manière cohérente, les principaux enseignements du corpus en lien avec les objectifs de l'article.

Axe 1 – Apports pédagogiques de l'étude de cas dans le système LMD

Sous-thème analytique	Apport clé pour l'étude	Source
1. Apprentissage expérientiel	Cadre théorique de l'articulation expérience–réflexion	Kolb (1984)
2. Pédagogies actives	Preuves d'efficacité de l'apprentissage actif	Prince (2004)
3. Engagement cognitif (ICAP)	Justification des apprentissages profonds	Chi & Wylie (2014)
4. Effets mesurés des méthodes actives	Argument empirique fort en faveur du changement pédagogique	Freeman et al. (2014)
5. Raisonnement et APP	Développement du raisonnement complexe	Hmelo-Silver (2004)
6. Méta-analyse active learning	Confirmation récente des effets positifs	Ting et al. (2022)
7. Consolidation cognitive	Apprentissage durable et transfert	Greving & Richter (2022)
8. Transfert et rétention	Apprentissage appliqué à long terme	Corral et al. (2025)
9. PBL et pensée critique	Développement des compétences supérieures	Anggraeni et al. (2023)
10. Case-based learning	Efficacité pédagogique du raisonnement par cas	Zainal et al. (2024)

L'étude de cas constitue un levier pédagogique majeur du système LMD en favorisant l'apprentissage actif, l'engagement cognitif et le développement du raisonnement. Inscrite dans l'apprentissage expérientiel, elle facilite l'articulation théorie–pratique et soutient des apprentissages profonds et durables. Les travaux empiriques et méta-analyses montrent que les pédagogies actives et le raisonnement par cas améliorent la compréhension, la pensée critique, la rétention et le transfert des connaissances. Dans le contexte de l'UNILU, l'étude de cas apparaît ainsi comme une réponse pertinente pour dépasser l'enseignement transmissif et renforcer la professionnalisation des étudiants, même dans des groupes nombreux.

Axe 2 – L'étude de cas comme dispositif d'apprentissage et d'évaluation des compétences

Sous-thème analytique	Apport clé pour l'étude	Source
11. Évaluation formative	Autorégulation et feedback	Nicol & Macfarlane-Dick (2006)
12. Feedback pédagogique	Rôle central de la rétroaction	Hattie & Timperley (2007)
13. Évaluation des compétences	Cadre conceptuel supérieur	Bouchamma & Lambert (2023)
14. Authentic assessment	Alignement évaluation–professionnalisation	Vlachopoulos (2024)
15. Authenticité évaluative	Discussion critique des usages	Ajjawi et al. (2025)
16. Rubrics	Transparence et guidance	Panadero & Romero (2014)

17. Co-construction des critères	Responsabilisation étudiante	Fraile et al. (2017)
18. Méta-analyse rubrics	Effets mesurés sur performance et SRL	Panadero et al. (2023)
19. Évaluation par les pairs	Développement des HOT skills	Zhan et al. (2023)
20. Design du peer assessment	Conditions d'équité et d'efficacité	Fleckney et al. (2025)

L'étude de cas apparaît comme un dispositif privilégié d'apprentissage et d'évaluation authentique des compétences complexes dans le système LMD. Elle permet d'articuler l'évaluation formative et sommative, individuelle et collective, tout en favorisant la métacognition, l'autorégulation et le développement des compétences de haut niveau. Les travaux sur le feedback, les rubrics et l'évaluation par les pairs montrent que ces outils renforcent la transparence, l'équité et l'efficacité évaluative. Dans le contexte de l'UNILU, l'étude de cas offre ainsi une modalité réaliste et rigoureuse pour évaluer les compétences professionnelles, malgré les contraintes liées aux effectifs élevés et aux ressources limitées.

Axe 3 – Conditions d'efficacité de l'étude de cas dans le contexte de l'UNILU

Sous-thème analytique	Apport clé pour l'étude	Source
21. Alignement pédagogique	Cohérence Acquis d'apprentissage– méthodes–évaluation	Biggs & Tang (2011)
22. Constructive alignment	Cadre structurant du LMD	Biggs (2014)
23. Conditions de mise en œuvre	Facteurs pédagogiques clés	Lalancette (2014)
24. Ingénierie du cas	Conception et animation	Guilbert & Ouellet (1997)
25. Méthode des cas	Rigueur méthodologique	Hlady-Rispal (2002)
26. Outils d'alignement	Instrumentation pédagogique	Macquarie University (2022)
27. Rubrics & faisabilité	Adaptation aux grands groupes	Bono et al. (2018)
28. Contraintes institutionnelles	Ajustements contextuels	Akcaay et al. (2024)
29. Innovation pédagogique	Adaptation aux contextes	Galdames-Calderón et al. (2024)
30. Auto-régulation	Soutien à l'autonomie étudiante	Guo et al. (2024)

L'efficacité de l'étude de cas repose sur un alignement pédagogique rigoureux entre acquis d'apprentissage, méthodes d'enseignement et dispositifs d'évaluation, conformément aux principes du *constructive alignment*. La qualité de la conception des cas, l'ingénierie pédagogique mise en œuvre et le rôle de l'enseignant comme facilitateur constituent des conditions essentielles de réussite. Les travaux analysés montrent également que des outils tels que les rubrics et les dispositifs d'autorégulation permettent d'adapter l'étude de cas à des contextes institutionnels contraints. Dans le contexte de l'UNILU, ces apports identifient des stratégies réalistes

d'implémentation de l'étude de cas, conciliant exigences du LMD, contraintes structurelles et innovation pédagogique.

Les résultats issus de l'analyse thématique du corpus documentaire, contextualisée à l'Université de Lubumbashi (UNILU), montrent que l'étude de cas constitue un levier central d'apprentissage et d'évaluation dans le système LMD.

Premièrement, sur le plan pédagogique, l'étude de cas favorise un engagement cognitif élevé, en mobilisant des activités constructives et interactives qui soutiennent des apprentissages profonds. Elle contribue au développement du raisonnement psychologique et scientifique, en amenant les étudiants à analyser des situations complexes, formuler des hypothèses et intégrer l'incertitude. Elle renforce également l'articulation théorie–pratique, en facilitant le transfert des savoirs vers des contextes professionnels réels, ce qui soutient la professionnalisation des étudiants en psychologie à l'UNILU.

Deuxièmement, l'étude de cas apparaît comme un dispositif d'évaluation authentique des compétences complexes, cohérent avec les finalités du LMD. Elle permet d'articuler évaluation collective et individuelle, ainsi que l'évaluation formative et sommative, favorisant à la fois la collaboration, la responsabilité cognitive et le développement de la métacognition et de l'autorégulation des apprentissages.

Enfin, l'efficacité de l'étude de cas dépend de conditions précises : une conception pédagogique rigoureuse et contextualisée des cas, le rôle de l'enseignant comme facilitateur fournissant un feedback structurant, et des stratégies d'adaptation face aux contraintes institutionnelles (effectifs élevés, charge de travail). Dans le contexte de l'UNILU, ces résultats montrent que l'étude de cas est à la fois pertinente et faisable, à condition d'être intégrée dans un dispositif pédagogique aligné et réfléchi.

Discussion

Cette étude visait à examiner, à partir d'une analyse thématique du corpus documentaire, la pertinence de l'étude de cas comme levier d'apprentissage et d'évaluation des compétences dans le système Licence–Master–Doctorat (LMD), en référence au contexte institutionnel de l'Université de Lubumbashi (UNILU). Les résultats confirment que l'étude de cas constitue un dispositif pédagogiquement cohérent, cognitivement exigeant et institutionnellement pertinent pour la formation en psychologie du travail, clinique et scolaire, à condition d'être intégrée dans un cadre pédagogique aligné et réfléchi.

Les résultats montrent que l'étude de cas est intrinsèquement compatible avec le principe d'alignement pédagogique (*constructive alignment*) tel que formulé par Biggs et Tang (2011) et Biggs (2014). En articulant de manière explicite les acquis d'apprentissage, les activités

d'analyse de situations complexes et les modalités d'évaluation des compétences, elle permet de traduire les prescriptions du LMD en pratiques pédagogiques effectives.

Dans le contexte de l'UNILU, marqué par une mise en œuvre parfois formelle du LMD, l'étude de cas apparaît comme un dispositif capable d'opérationnaliser les objectifs de professionnalisation inscrits dans les référentiels de formation. Cette fonction transformatrice rejoint les conclusions de Prince (2004), selon lesquelles les méthodes actives n'ont d'impact durable que lorsqu'elles sont intégrées de façon systémique au curriculum, et non utilisées comme des techniques isolées.

L'un des apports majeurs de l'étude de cas mis en évidence par les résultats réside dans le niveau élevé d'engagement cognitif qu'elle suscite. En mobilisant des activités d'apprentissage constructives et interactives, l'étude de cas correspond aux niveaux supérieurs du cadre ICAP (Chi & Wylie, 2014), favorisant ainsi des apprentissages profonds, transférables et durables.

Ce résultat est particulièrement significatif dans le contexte de la formation en psychologie à l'UNILU, où les futurs professionnels doivent développer des compétences de raisonnement, d'analyse et de prise de décision en situation d'incertitude. L'étude de cas dépasse ici une logique d'acquisition de connaissances pour soutenir la construction d'un jugement professionnel, condition essentielle à l'exercice des métiers de la psychologie dans des environnements complexes.

Les résultats confirment que l'étude de cas s'inscrit pleinement dans le modèle de l'apprentissage expérientiel (Kolb, 1984), en favorisant une dynamique itérative entre expérience, réflexion et conceptualisation. Cette logique apparaît particulièrement pertinente pour la formation en psychologie, où l'apprentissage repose sur l'analyse de situations humaines singulières, contextualisées et multidimensionnelles.

Les travaux empiriques conduits à l'UNILU (Mukalu, 2024 ; Ngwej Mpandamadi, 2024) illustrent la capacité de l'étude de cas à soutenir une professionnalisation contextualisée, sensible aux réalités socioculturelles et institutionnelles locales. Dans un environnement caractérisé par des contraintes matérielles et organisationnelles, l'étude de cas constitue ainsi un dispositif à fort rendement pédagogique, ne nécessitant pas d'infrastructures lourdes pour produire des apprentissages significatifs.

Sur le plan évaluatif, les résultats confirment que l'étude de cas constitue un dispositif d'évaluation authentique des compétences, cohérent avec les exigences du LMD. En évaluant la qualité du raisonnement, de l'argumentation et des décisions proposées, elle permet de dépasser les limites des évaluations centrées sur la restitution des connaissances (Bouchamma & Lambert, 2023).

L'articulation entre évaluation collective et individuelle apparaît comme un enjeu structurant. Si les dispositifs collectifs soutiennent la co-construction des savoirs, les modalités individuelles sont indispensables pour garantir l'équité et la responsabilité cognitive des étudiants. Cette complémentarité s'inscrit dans la perspective de l'évaluation formative et de l'autorégulation des apprentissages (Nicol & Macfarlane-Dick, 2006), particulièrement pertinente dans des contextes universitaires à effectifs élevés comme celui de l'UNILU.

Les résultats soulignent que l'efficacité de l'étude de cas dépend avant tout de son inscription dans un dispositif pédagogique cohérent. Le rôle de l'enseignant comme facilitateur du raisonnement et régulateur des interactions apparaît central, notamment à travers la qualité du feedback fourni (Hattie & Timperley, 2007).

Dans le contexte de l'UNILU, cette évolution de posture pédagogique suppose un soutien institutionnel explicite, tant en matière de formation pédagogique des enseignants que de reconnaissance du temps consacré à la conception et à l'animation des dispositifs actifs. À défaut, l'étude de cas risque d'être instrumentalisée ou réduite à une pratique marginale, sans impact structurant sur les apprentissages.

Les limites inhérentes à la démarche documentaire ne permettent pas d'inférer des effets causaux ni de mesurer empiriquement l'impact de l'étude de cas sur les apprentissages. Toutefois, cette recherche apporte une contribution scientifique significative en proposant une lecture intégrative de l'étude de cas dans le contexte universitaire congolais, encore peu documenté dans la littérature internationale.

Elle offre ainsi un cadre conceptuel transférable pour de futures recherches empiriques et contribue à enrichir les débats sur la mise en œuvre contextualisée des pédagogies actives dans les universités africaines francophones.

Conclusion

Cette étude visait à examiner la pertinence de l'étude de cas comme levier d'apprentissage et d'évaluation des compétences dans le système Licence–Master–Doctorat (LMD), à partir d'une analyse thématique d'un corpus documentaire contextualisé à l'Université de Lubumbashi (UNILU). Les résultats montrent que l'étude de cas constitue un dispositif pédagogique cohérent, cognitivement exigeant et particulièrement adapté à la formation en psychologie du travail, clinique et scolaire.

Sur le plan pédagogique, l'étude de cas favorise un engagement cognitif élevé et des apprentissages profonds, en mobilisant des activités constructives et interactives. Elle soutient le développement du raisonnement psychologique et scientifique et renforce l'articulation entre savoirs théoriques

et pratiques professionnelles. À ce titre, elle répond aux exigences du LMD, orientées vers la professionnalisation des parcours et le développement de compétences transférables. Dans le contexte de l'UNILU, caractérisé par des effectifs importants et des ressources limitées, l'étude de cas apparaît comme une alternative crédible à l'enseignement transmissif, capable de stimuler la participation intellectuelle des étudiants sans dispositifs pédagogiques lourds.

Sur le plan évaluatif, l'étude de cas se révèle pertinente pour l'évaluation authentique des compétences complexes. L'articulation entre évaluations collective et individuelle permet de concilier collaboration, équité et responsabilité cognitive, tout en favorisant la métacognition et l'autorégulation des apprentissages.

Toutefois, son efficacité repose sur des conditions précises : un alignement pédagogique rigoureux, une conception contextualisée des cas et un rôle actif de l'enseignant comme facilitateur et pourvoyeur de feedback structurant. En définitive, l'étude de cas s'impose comme un dispositif intégrateur au service de la transformation pédagogique du LMD à l'UNILU et ouvre des perspectives pour des recherches empiriques futures dans le contexte universitaire congolais.

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Niveau d'Étude et Hormonothérapie par Automédication chez les Transgenres Femmes d'Abidjan-Côte d'Ivoire

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Résumé

Sur la base de la littérature scientifique consultée, qui fait état d'un manque de ressources concernant la relation entre les variables « niveau d'éducation » et « recours aux hormones ou hormonothérapie chez les personnes transgenres », cette étude vise à évaluer le lien entre ces deux variables. L'hypothèse de recherche formulée postule qu'il existe un lien entre le niveau d'éducation et la pratique de la thérapie hormonale chez les personnes transgenres à Abidjan. Le cadre théorique s'appuie principalement sur la théorie de l'image corporelle de Dolto (1984) et la théorie de l'action raisonnée (Fishbein et Ajzen, 1970). La population cible de cette étude est constituée de femmes transgenres à Abidjan. La technique d'échantillonnage adoptée est l'échantillonnage aléatoire simple. L'observation non structurée, la revue de la littérature et les enquêtes par questionnaire à l'aide d'outils pertinents ont facilité la collecte des données. Ces données ont fait l'objet d'une analyse statistique, comprenant des statistiques descriptives et inférentielles (Chi2 et V de Cramer). Les principaux résultats révèlent qu'il existe un lien statistiquement significatif entre le niveau d'éducation et la prise d'hormones chez les populations TGF.

Mots-clés : Automédication, Traitement hormonal, Niveau d'éducation, Risque pour la santé, Personnes transgenres, Abidjan

Educational Level and Self-Medication with Hormone Therapy Among Transgender Women in Abidjan-Ivoiry Coast

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Abstract

Based on the scientific literature consulted, which reveals a lack of resources on the relationship between the variables of “level of education” and “hormone use or hormone therapy in transgender people,” this study aims to evaluate the link between these two variables. The formulated research hypothesis states that there is a link between the level of education and the practice of hormone therapy among transgender individuals in Abidjan. The theoretical framework is primarily based on Dolto's (1984) body image theory and the theory of reasoned action (Fishbein and Ajzen, 1970). The target population of this study consists of transgender women in Abidjan. The sampling technique adopted is simple random sampling. Unstructured observation, literature review, and questionnaire surveys through relevant tools have facilitated data collection. These data underwent statistical analysis, including descriptive and inferential statistics (Chi² and Cramer's V). The main results reveal that there is a statistically significant link between the level of education and hormone intake among TGF populations.

Keywords: Self-medication, Hormone therapy, Level of education, Health risk, Transgender, Abidjan

Introduction

De plus en plus la littérature scientifique sur la problématique des minorités sexuelles et plus particulièrement celui des personnes transgenres surabonde. Des auteurs orientent leur réflexion vers la discrimination ou les comportements transphobiques (Meyer, 2003 ; Danielle et Chartrand, 2005 ; Rohner, 2004 ; Veltman et Chaimowitz, 2014 . D'autres auteurs se sont intéressés aux causes de cette transphobie (Miller, Mayo et Lugg, 2017 ; Reversé et Alessandrin , 2023 ; Gabrielle et Reversé, May 2022) et à la manifestation de la transphobie (Lombardi et al., 2001; É. Lombardi et al., 2002 ; Nemoto et al., 2011; Testa et al., 2012). Enfin, la dernière catégorie d'auteurs, semble-t-il, s'est intéressée aux conséquences de la transphobie (Whittle et al., 2007).

A la lumière de cette synthèse sommaire des écrits sur la transidentité, il apparaît que la question de l'hormonothérapie n'est pas suffisamment abordée. En outre les rares auteurs à explorer ce phénomène, se sont contentés pour certains d'évoquer les causes de la prise d'hormones chez les transgenres femmes. Qu'est-ce qu'un transgenre ?

Selon Davidson, (2006), la catégorie transgenre n'a pas une définition unique. Toutefois, l'on peut admettre comme transgenre tout individu a repris le terme "transgender" et l'a défini comme "un terme parapluie" qui désigne un groupe diversifié d'individus qui remettent en cause les catégories culturelles du genre. Ce groupe inclut les transsexuels (qui féminisent ou masculinisent leur corps à l'aide de traitements hormonaux ou chirurgicaux), les "crossdressers" qui portent des vêtements culturellement associés à l'autre sexe, les "drag queens" et "kings" et les individus qui se définissent comme "bi-genres" (homme et femme à la fois), "gender queer", "gender variant" ou "transgenres" (Davidson, 2006).

C'est dans cette perspective que s'inscrit Haupt, (2020) qui affirme : « Les femmes transgenres pourraient avoir l'impression d'être nées dans un corps présentant des caractéristiques sexuelles erronées. Cela pourrait entraîner une détresse psychologique importante (dysphorie de genre) et le désir d'adapter leurs caractéristiques physiques et sexuelles masculines afin qu'elles correspondent davantage à leur sexe féminin vécu. Il s'agit d'un processus appelé transition ». Autrement dit, la prise d'hormone par les sujets transgenres vise à faire baisser la tension intérieure liée à la non acceptation de leur sexe de naissance. C'est aussi ce qu'affirment Johnson et Chabbert-Buffet (2022) qui insistent sur la faible qualité de la prise en charge médicale des personnes transgenres : « aujourd'hui encore, la prise en charge médicale des personnes transgenres pâtit d'une insuffisance d'offre de soins et de formation des soignants » (Johnson et Chabbert-Buffet, Novembre 2022).

Pourtant plusieurs études en sciences sociales et plus précisément en sciences de l'éducation sont parvenues à établir un lien de cause à effet entre niveau d'étude et le choix de comportement social. C'est par exemple le cas de l'étude de Kéi et Sadia (2016) qui établit un lien entre le niveau d'étude et le type d'actes délinquant commis par les enfants ivoiriens. Chez Zwilling (2011), il est question d'analyser la relation entre niveau d'étude et relation sexuelle.

Il découle de ce qui précède, qu'il y a un vide en ce qui concerne la relation entre les variables « niveau d'étude » et « prise d'hormone ou hormonothérapie chez les personnes transgenres ». C'est cette insuffisance qui justifie cette étude dont l'ancrage théorique est essentiellement constitué de la théorie de l'image de l'image du corps de Dolto (1984) et de la théorie de l'action raisonnée (en anglais, Theory of Reasoned Action).

Ce modèle provient de la psychologie sociale et est développé par (Fishbein et Ajzen ,1975) qui définit les liens entre les croyances, les attitudes, les normes, les intentions et les comportements des individus. Selon ce modèle, le comportement d'une personne serait déterminé par son intention comportementale à l'adopter. Cette intention serait quant à elle déterminée par l'attitude de la personne et par ses normes subjectives relatives au comportement en question. Fishbein et Ajzen (1975, p.302), définissent les normes subjectives comme étant la perception de l'individu sur le fait que la plupart des personnes qui sont importantes à ses yeux, sont d'avis qu'il devrait ou ne devrait pas effectuer le comportement en question.

L'objectif de cette étude est de mesurer le lien entre le niveau d'étude été la pratique de l'hormonothérapie. L'hypothèse de recherche formulée affirme qu'il existe un lien entre le niveau d'étude et la pratique de l'hormonothérapie chez les personnes transgenres d'Abidjan.

Méthodes

Echantillon et échantillonnage

Il s'agit comme l'explique Angers (1997, p.227) d'un ensemble d'éléments ayant une ou plusieurs caractéristiques en commun qui les distinguent d'autres éléments et sur lesquels porte l'investigation. Pour Mongeau (2008, p.90), elle correspond à l'ensemble des unités (personnes ou objets) auquel l'on s'intéresse.

En l'espèce, la population cible de cette étude se compose des populations transgenres femmes d'Abidjan.

Le nombre estimatif des personnes transgenres à toucher tire sa source de l'estimation qui a été faite au cours de « l'étude pour l'identification des besoins spécifiques en matière de prévention et prise en charge IST/VIH/SIDA chez les personnes transgenres à Abidjan – Côte d'Ivoire ». Cette étude a estimé la taille des TG à Abidjan à 806 (Alliance, 2020). A partir de la technique d'échantillonnage aléatoire simple, 251 sujets ont été retenus.

Type d'étude

A regard des objectifs qu'elle s'est fixée, cette étude est quantitative et s'inscrit dans une approche transversale. Avant l'enquête de base, une enquête exploratoire a été menée. Son objectif est d'identifier les personnes ressources pouvant constituer la cible de l'étude. Cette première prise de contact avec le terrain a permis de tester les outils de collecte et de les réajuster.

Technique de collecte de données

Pour la collecte des données, nous avons convoqués l'observation non structurée, la recherche documentaire et l'enquête par questionnaire.

Méthode d'analyse de données

Les données collectées ont fait l'objet d'une analyse statistique, notamment les statistiques descriptive et inférentielles. En effet, les données collectées ont été saisies sur Excel Microsoft 2011, puis exportées pour traitement et analyse vers le logiciel SPSS version 28. (*Statistique Package for the Social Science*). A l'aide de ce logiciel SPSS permet de calculer la corrélation entre les variables à l'étude avec le test de Khi-deux au seuil significatif alpha est fixé 5%. Enfin, la force de cette corrélation est appréciée grâce au valeur du V de Cramer.

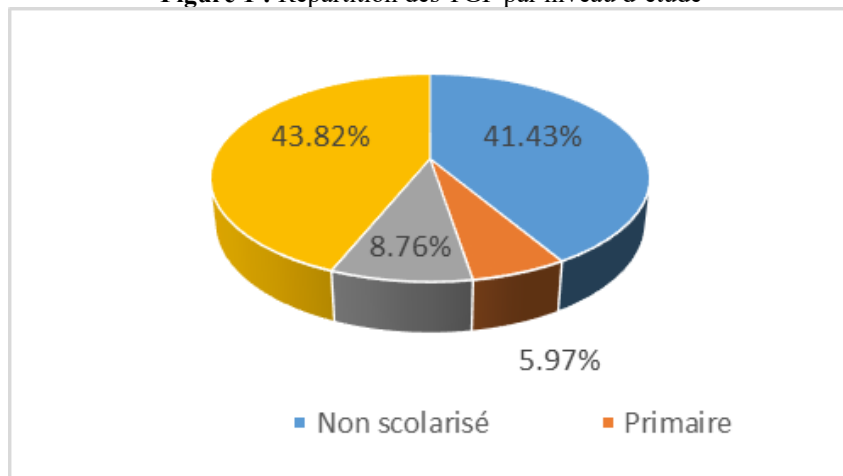
Résultats

Les résultats de cette étude quantitative, portent sur le niveau d'étude des sujets enquêtés, leur rapport aux hormones. Ensuite, ces deux variables ont été mise en corrélation avec la variable dépendante, pratique de l'hormonothérapie.

Répartition des TGF par niveau d'étude

Le rapport à l'école est une variable importante de cette étude. Les données révèlent que les TGF d'Abidjan sont plus présents dans les strates « non scolarisé » et « supérieur » dans les proportions ci-dessous :

Figure 1 : Répartition des TGF par niveau d'étude



Source : enquête Sadia, Décembre 2023.

Au regard de ce diagramme, l'on note que les transgenres de niveau primaire représentent 43,82% des sujets interrogés. Et qu'il y a une importante population de TGF non scolarisée (41,43%).

Lien entre niveau d'étude et pratique de l'hormonothérapie chez les TGF

La recherche de corrélation entre niveau d'étude et pratique de l'hormonothérapie chez les TGF, permet d'avoir le résultat suivant :

NIVEAU D'ETUDE	HORMONOTHERAPIE		TOTAL
	Oui n (%)	Non n (%)	
Non scolarisé	4(1,59%)	100(39,84%)	104
Primaire	5(1,99%)	10 (3,98%)	15
Secondaire	6(2,39%)	16(6,37%)	22
Supérieur	10 (3,98%)	100 (39,84%)	110
TOTAL	25(9,96%)	226(90,03%)	251

Source : enquête Sadia, Décembre 2023.

$$\text{Khi}^2=20,01 \quad \text{ddl}=3 \quad \text{Seuil}=0,05 \quad \text{Khi}^2_{lu}=7,81 < \text{Khi}^2 \text{ Cal. } =20,01$$

Il existe un lien significatif entre le niveau d'étude et l'hormonothérapie chez les personnes transgenres d'Abidjan. Autrement dit, le niveau d'étude influe sur la prise des hormones chez les populations TGF.

$$\mathbf{V\text{-cramer}=0,63} \quad \text{Secondaire } 6(2,39\%) \quad 10 (3,98\%)$$

Règles de décision :

- Si $v < 0.10$ = lien nulle ou très faible
- Si $v > 0.10$ et < 0.20 = Relation faible
- Si $v > 0.20$ et < 0.30 = Relation moyenne
- Si $v \geq 0.30$ = Relation forte

En l'espèce, le $\mathbf{v\text{-cramer}=0,63} > 0.30$, on en déduit que la relation est forte.

Discussion

L'objectif de cette étude est de mesurer le lien entre le niveau d'étude et la pratique de l'hormonothérapie. L'hypothèse de recherche formulée affirme qu'il existe un lien entre le niveau d'étude et la pratique de l'hormonothérapie chez les personnes transgenres d'Abidjan. Les principaux résultats de l'étude révèlent en ce qui concerne les transgenres sous hormones, que 2,39 % ont fait le secondaire et 3,98 % sont au supérieur. En revanche, les analphabètes représentent 1,59 %. Enfin, il a été établi un lien statistiquement significatif entre le niveau d'étude et la prise des hormones chez les populations TGF. Ces résultats mettent en évidence le problème de l'automédication et la perception du risque, et enfin, celui du rapport au corps.

Au niveau de l'automédication, ces résultats convergent avec ceux de Chiribagula et al., (9 juin 2015) qui soutiennent que cette pratique « est devenue un phénomène émergent et menaçant de plus en plus la santé

publique». Dans cette perspective, Bahussain et al. (2005) et Jaquier (1998) « indiquent que l'automédication a tendance à augmenter avec l'âge ». En outre, les résultats de cette étude coïncident avec celle de Chiribagula et al., (2015) qui révèlent que les étudiants sont adeptes à l'automédication.

Ce recours à l'automédication en même temps qu'il pose, la perception du risque chez les TGF, renseigne sur le fait que « les patients (adultes) cherchent à prendre soin d'eux, à être actifs dans le maintien de leur santé afin de rester autonome ; leur niveau d'éducation s'est développé, ils sont de plus en plus responsables et aptes à prendre des décisions avisées pour leur santé» (Trebutien, 2021). Or, au regard des âges, les TGF du supérieur sont des jeunes adultes. En revanche ceux du secondaire, il est établie une prédominance « de l'adolescence comme classe d'âge de première automédication ». Ainsi, l'hormonothérapie par automédication à cet âge apparaît comme un indice du faible niveau de prise de conscience, de risque en matière de médication. Bien plus, elle pourrait traduire le faible niveau de conscience sanitaire chez ces jeunes. Aussi, la prise de risque par automédication chez les adolescents, peut se justifier selon Chiribagula et al., (9 juin 2015), « par le fait que, dans cette tranche d'âge, l'individu, à la quête de son identité, d'une conscience, d'une moralité, d'une échelle de valeurs et d'un bien-être, aura tendance à faire de son mieux pour préserver sa santé. C'est la période de l'affirmation de soi et son identité ».

Dans l'ensemble, le recours à l'hormonothérapie chez les TGF soulève la question du rapport à l'identité et au corps. Pour Andro et al., (2010), l'hormonothérapie est perçue « comme un moyen pour les transgenres femmes de résoudre la question de leur identité ». C'est à ce niveau que la théorie de l'image du corps de Dolto (1984) trouve toute son importance dans l'analyse des résultats. En effet, pour Charlotte (2025), « une femme transgenre est une personne trans qui a été assignée homme à la naissance, mais qui a une identité de genre féminine. Le TGF se sent comme prisonnier dans un corps d'homme qu'il désapprouve. Le rapport au soi devient problématique avec pour conséquence majeure, la « dysphorie de genre ». Une situation d'ambivalence source de « détresse ou des troubles liés à l'inadéquation entre leur identité de genre et leur sexe de naissance ».

L'hormonothérapie apparaît donc comme une solution visant à conformer le corps à l'identité de genre.

Conclusion

La prise de conscience d'un genre distinct du sexe biologique, est un évènement qui entraîne un bouleversement mal vécu tant par l'individu que par la société. Chez les transgenres confrontés à la dysphorie du genre, la prise d'hormones est une solution préconisée de plus en plus. Dans cette étude, la prise d'hormone par les TGF est mise en corrélation avec le niveau d'étude.

Les résultats révèlent que parmi les transgenres sous hormones, il y a plus d'étudiants et d'élèves du secondaire. Bien plus cette étude a permis aussi de savoir que la prise d'hormones se fait par automédication sans tenir compte des risques sanitaires d'une telle pratique. Du coup, il apparaît qu'en plus de la stigmatisation et son corollaire de violence basée sur le genre auxquelles sont exposées les TGF, s'ajoute le problème de l'hormonothérapie par automédication. Il y a donc urgence à agir de façon concertée. Il s'agit de mettre en place un dispositif de prise en charge psychologique et médicale. Le déficit d'un tel dispositif peut conduire à un repli sur soi, à un isolement identitaire. Elle peut être source de nombreux problèmes de santé mentale. C'est pour cette raison, une autre étude est envisagée pour évaluer les problèmes de santé mentale au sein de cette population.

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Déclaration sur l'utilisation de l'IA: Je déclare avoir utilisé Gemini IA pour la correction de mon résumé en anglais académique et pour vérifier le respect de la norme APA dans les références bibliographiques.

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Conditions de travail et fonctionnement des restaurants populaires « Malewa » à Kinshasa en République Démocratique du Congo

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Résumé

Le secteur informel de l'alimentation de rue prospère dans toute l'Afrique Subsaharienne en raison du rythme accu de l'urbanisation et du manque d'opportunités d'emplois formel. En raison de son importance dans le tissu urbain de Kinshasa, cette étude réalisée dans la Commune de Masina vise à appréhender le phénomène « Malewa », notamment à cerner les conditions de travail et le mode de fonctionnement de ces établissements de vente des aliments en mettant un accent sur les pratiques et défis liés d'hygiène alimentaire. A cet effet, les entretiens approfondis ont été conduits auprès 35 tenancières de restaurants et complétés par les observations réalisées sur le terrain. Les résultats obtenus montrent une dynamique récente de la restauration « Malewa » dans la commune de Masina, animée exclusivement par les femmes. Ces établissements sont spatialement localisés dans des endroits très fréquentés (grandes artères, arrêt de bus, marchés). Si certains restaurants sont bâtis en matériaux durables, d'autres sont vulnérables car ils sont construits en planches et/ou en bâches, d'autres encore opèrent à l'air

libre (sans abris). Ces établissements opèrent à des horaires différents et offrent une diversité de plats avec une prédominance des produits locaux. Malgré les bons gestes observés tels que les dispositifs de lavage de mains et collecte de déchets dans certains restaurants, l'hygiène et l'assainissement, nécessaires pour garantir la sécurité sanitaire des aliments, manquent obstinément dans ces établissements. Dans l'ensemble, les résultats obtenus de cette étude permettent d'apporter des informations actualisées sur la restauration de rue « Malewa » dans le contexte urbain de la ville de Kinshasa.

Mots clés : Restaurant populaire « Malewa », conditions de travail, fonctionnement, Kinshasa

Working Conditions and Operation of the « Malewa » Popular Restaurants in Kinshasa, Democratic Republic of Congo

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Abstract

The informal street food sector is thriving throughout sub-Saharan Africa due to rapid urbanization and a lack of formal employment opportunities. Given its importance in the urban fabric of Kinshasa, this study conducted in the municipality of Masina aims to understand the “Malewa” phenomenon, in particular to identify the working conditions and operating methods of these food outlets, with a focus on food hygiene practices and challenges. To this end, in-depth interviews were conducted with 35 restaurant owners and supplemented by field observations. The results show a recent trend in “Malewa” catering in the commune of Masina, run exclusively by women. They are located in busy areas (main roads, bus stops, markets). While some restaurants are built with durable materials, others are vulnerable because they are constructed from boards and/or tarpaulins, while others operate in the open air (without shelters). These establishments operate at different times and offer a variety of dishes, with a predominance of local

products. Despite the good practices observed, such as hand-washing facilities and waste collection in some restaurants, hygiene and sanitation, which are necessary to ensure food safety, are stubbornly lacking in these establishments. Overall, the results of this study provide up-to-date information on “Malewa” street food in the urban context of the city of Kinshasa.

Keywords: Popular restaurant “Malewa”, working conditions, operations, Kinshasa

Introduction

Les villes d’Afrique, comme celles d’ailleurs, se caractérisent par une vitesse d’urbanisation particulièrement rapide, produisant des enjeux spécifiques pour les systèmes alimentaires (Bricas, 2017). En République Démocratique du Congo (RDC), le secteur informel du commerce des aliments s’est amplifié, particulièrement les restaurants de proximité, et ceci, dans un contexte d’expansion et d’explosion démographiques des centres urbains, notamment la ville de Kinshasa.

L’urbanisation ultra rapide qu’a connue et que connaît encore la ville de Kinshasa est sans aucun doute le facteur clé de l’évolution actuelle des modes de consommation alimentaire. Dans cette ville, la consommation alimentaire évolue et se diversifie par les plats consommés mais aussi par les modes de consommation (Muteba, 2014 ; Bonkena et al., 2018). En RDC, les restaurants populaires communément appelés « Malewa » sont des établissements informels, souvent situés dans des lieux publics. Ces restaurants prolifèrent dans presque toutes les villes densément peuplées comme Kinshasa, Lubumbashi et Kisangani (Lituka et Ndahayo, 2023) et prennent de plus en plus d’ampleur dans le parcours alimentaire des individus. Cette activité marchande (restauration de rue), qui reflète le mode de vie et de survie des Kininois, est en partie la conséquence de divers facteurs inhérents aux conditions de vie et de travail dans la mégapole de Kinshasa.

La restauration de rue, à l’instar de « Malewa » correspond à une demande alimentaire essentiellement urbaine et, ainsi à un marché en pleine croissance. En effet, cette restauration est une source importante d’emplois et de revenus en milieu urbain. Elle est aussi un moyen peu onéreux et pratique de se nourrir en dehors du foyer dans un grand nombre de pays en développement (FAO, 2013). Elle contribue, en effet, à la sécurité alimentaire et nutritionnelle des populations urbaines notamment les plus vulnérables d’entre eux mais peut aussi jouer un rôle de filet de sécurité sociale (PAM, 2013). L’alimentation de rue a aussi l’avantage de procurer des débouchés aux producteurs agricoles urbains et périurbains et aux transformateurs locaux de denrées alimentaires (Neema et Lebailly, 2021).

Malheureusement, cette grande importance socio-économique ne rime pas toujours avec sécurité sanitaire. Selon plusieurs auteurs (FAO; 1994 ; 1996; Dawson et Canet, 1991 ; Fages et Bricas, 2017 ; Kakule et al., 2024), l'alimentation de rue présente de nombreuses particularités qui soulèvent des préoccupations en matière de sécurité sanitaire. En effet, la précarité des installations et l'absence de régulation sanitaire dans les restaurants « Malewa » exposent les consommateurs à des risques sanitaires élevés (Tshimbangila et al., 2023). L'utilisation d'ustensiles mal nettoyés, l'absence d'accès à l'eau potable, la proximité avec des sources de pollution (poussière, déchets) et la conservation inadéquate des aliments favorisent la propagation de maladies d'origine alimentaire telles que la diarrhée, le choléra et les infections gastro – intestinales (ACP, 2023). L'absence de contrôles sanitaires rigoureux et la méconnaissance des bonnes pratiques d'hygiène par certains exploitants augmentent les risques de propagation de maladies d'origine alimentaire (WHO, 2015). Selon des responsables de centres de santé à Kinshasa, une proportion importante des cas d'intoxication alimentaire est liée à la consommation d'aliments provenant de ces restaurants de rue (Makuma-Henry et al., 2020).

C'est dans cette perspective que s'inscrit la présente étude qui vise à appréhender les conditions de travail et à cerner le mode de fonctionnement des restaurants « Malewa » à Kinshasa. De façon spécifique, il s'agit de : (i) décrire le profil sociodémographique des tenancières de « Malewa » ; (ii) appréhender l'organisation et les conditions de travail dans les restaurants « Malewa » et (iii) évaluer les pratiques d'hygiène alimentaire développées dans ces établissements de vente d'aliments.

Matériels et Méthodes

Présentation de la zone d'étude

La ville de Kinshasa constitue le champ d'investigation de cette recherche. Kinshasa est non seulement la capitale et une ville, mais aussi une province constituée de 4 districts et 24 communes dont 18 urbanisées et 6 rurales (De Saint Moulin, 2010) et 326 quartiers. D'une superficie de 9.999 km², la ville est située à l'Ouest du pays entre, 3,9 et 5,10° de latitude Sud et entre 15,2 et 16,6° de longitude Est. Elle est limitée au Nord-est par la province du Kwango, au Sud par celle du Kongo Central, au Nord-Ouest et à l'Ouest par la République du Congo Brazzaville, sur une frontière naturelle formée par une partie du Fleuve Congo.

La plus grande agglomération urbaine de la RDC, la ville de Kinshasa présente des disparités manifestes entre les quatre districts (Lukunga, Mont Amba, Funa et Tshangu) en termes de superficie, d'effectifs démographiques, de niveau d'urbanisation, de niveau de vie et de qualité des infrastructures de base (Lelo, 2008). Ces disparités et inégalités devraient être prises en compte

dans les études touchant la consommation alimentaire, car celles-ci ont une grande incidence dans les modes de consommation alimentaire des ménages des Kinois (Muteba, 2014). Dans le cadre de cette recherche, il a été jugé nécessaire de cibler le district de la Tshangu, communément appelé « chine populaire ».

Tshangu, situé à l'est de la ville, est de très loin le district le plus étendu de Kinshasa (environ 7.972 km²), mais aussi le plus rural ayant en son sein 4 communes (Masina, N'djili, Kimbasenke, Nsele et Maluku), avec une densité de population la plus importante de la ville : 221,3/km². Les investigations de terrain ont été menées dans la commune de Masina (69,70 km²). Cette commune compte administrativement 21 quartiers dont cinq ont été couverts par les enquêtes de terrain : Lubamba, Mapela, Mfumu Nsuka, Sans fil et Tshangu.

Collecte de données

Les données utilisées dans cette étude proviennent principalement des enquêtes et observations de terrain. Au premier degré, par choix raisonné (guidé par l'accessibilité physique et l'importance relative du commerce alimentaire), 5 quartiers représentant 5 strates (Yao, 2005), répartis sur l'ensemble de la commune ont été sélectionnés.

Au deuxième degré, étant donné le faible niveau d'organisation (et donc de statistiques) du secteur de la restauration de rue, essentiellement informel et donc caractérisé par l'absence d'une liste exhaustive de cette catégorie des restaurants produite par l'administration communale, il a été procédé un échantillonnage non aléatoire des « Malewa », en faisant recours à la technique de « boule de neige ». C'est une technique qui est généralement utilisée lorsqu'il est difficile d'avoir une idée exacte de la population mère, de sa localisation géo-spatiale, et/ou de la difficulté à trouver de potentiels répondants. Dans le cadre de cette étude, l'échantillon a été constitué en demandant à quelques tenancières de restaurants d'identifier et de localiser les autres acteurs pouvant faire partie de l'échantillon et de faciliter le contact (Délpeteau, 2000). Ce processus a permis de constituer progressivement un échantillon de 35 tenancières, réparties équitablement à raison de sept (7) par quartier enquêté.

Les entretiens semi-structurés approfondis ont été menés individuellement avec les différents prestataires de services alimentaires (en l'occurrence le gérant du restaurant). Ainsi, une série de questions ouvertes ont été posées, au sujet desquelles les informations de la part de la personne interrogée ont été recueillies. Un questionnaire structuré en trois (3) modules, à savoir (i) le profil sociodémographique des tenancières de Malewa ; (ii) le mode d'organisation et fonctionnement de l'établissement et (iii) les pratiques d'hygiène au sein des « Malewa », a été élaboré spécifiquement pour répondre

Traitement et analyse des données

Après la collecte de données, les informations ont été transmises en temps réel vers le serveur KoboToolbox, avant d'être exportées vers le logiciel SPSS (version 20). Ce dernier a été utilisé pour la création de la base de données, l'analyse statistique et la génération des résultats. Le logiciel Excel 2016 a également été mobilisé, notamment pour la production des tableaux et figures pour les données qualitatives et quantitatives.

Limites méthodologiques

Malgré la pertinence de l'approche adoptée et l'intérêt de la recherche, certaines limites méthodologiques méritent d'être soulignées afin de nuancer l'interprétation des résultats.

L'échantillon de 35 restaurants, bien que pertinent pour une étude exploratoire, demeure relativement restreint au regard de l'ampleur et de l'hétérogénéité du secteur de la restauration de rue à Kinshasa. Cette limitation réduit les possibilités de généralisation des résultats à l'ensemble des restaurants « Malewa » de la commune de Masina, voire de la ville de Kinshasa.

Les investigations ont été circonscrites à une seule commune (Masina) et à cinq quartiers spécifiques. Or, les pratiques de restauration de rue et les conditions sanitaires peuvent varier significativement d'une commune à une autre, voire d'un quartier à un autre, en fonction du niveau d'urbanisation, de la densité de population et de l'accès aux infrastructures de base.

Bien que riche en informations qualitatives, l'observation participante peut être affectée par l'effet d'observation, les tenancières modifiant temporairement leurs comportements en présence du chercheur. En outre, la collecte des données s'est effectuée à un moment donné, sans suivi longitudinal. Cette approche ne permet pas de saisir les variations saisonnières des pratiques ni l'évolution des conditions de travail et d'hygiène dans le temps.

Résultats

Profil sociodémographique des tenancières de restaurants « Malewa »

Tous les restaurants « Malewa » visités dans la commune de Masina sont détenus exclusivement par des femmes. Cette homogénéité, sans distinction entre quartiers, souligne que le « Malewa » constitue un espace économique fortement investi par les femmes. Cette prédominance féminine traduit une forme d'autonomisation économique, les tenancières étant à la fois actrices économiques et détentrices d'un savoir-faire culinaire local, participant ainsi activement à l'économie informelle.

Les résultats des enquêtes montrent que les tenancières de « Malewa » ont un niveau d'étude relativement élevé dans tous les quartiers. Au total, 74,3% d'entre elles ont atteint ou achevé le cursus d'éducation secondaire. Elles sont suivies par celles qui ont atteint le niveau supérieur d'enseignement (20,0%). Seuls 5,7% d'entre elles se sont limitées au niveau primaire. Les tenancières de niveau secondaire sont majoritaires dans les quartiers Lubamba, Mapela et Mfumu Nsuka (6 enquêtées sur 7 dans chaque quartier). À l'inverse, à Sans Fil, le niveau universitaire est plus représenté (3 enquêtées, soit 42,9 %), contrastant avec les autres quartiers. Le quartier Tshangu présente un profil mixte, avec 71,4 % au secondaire et 28,6 % à l'universitaire. Il découle de ces résultats que le secteur de la restauration de rue « Malewa » dans la commune de Masina est majoritairement constitué d'entrepreneures instruites.

Globalement, les tenancières de restaurants « Malewa » sont soit des femmes mariées (48,6%), soit des célibataires (40,0%). Toutefois, le profil matrimonial varie selon les quartiers. Dans le quartier Mapela, 85,7 % des enquêtées sont célibataires, traduisant une possible concentration de femmes jeunes ou indépendantes. À l'opposé, les quartiers Mfumu Nsuka, Sans Fil et Tshangu comptent majoritairement des femmes mariées ; respectivement 57,1 %, 71,4 % et 57,1 %. Le quartier Lubamba par contre, présente une répartition équilibrée entre célibataires et mariées (42,9 % chacune), avec la présence d'une veuve.

S'agissant de la direction des ménages, 60 % des tenancières déclarent être cheffes de ménage. Cette proportion est particulièrement élevée dans les quartiers Tshangu (85,7 %) et Lubamba (71,4 %). En revanche, à Mfumu Nsuka et Sans Fil, la majorité des personnes interviewées ne sont pas cheffes de ménage (57,1 %). Le quartier Mapela présente une situation plus ou moins équilibrée (57,1 % de cheffes). Le fait qu'une majorité soit cheffe de ménage montre le rôle central des femmes dans la survie économique de leurs foyers.

L'âge moyen des tenancières est de 39,29 ans, avec une moyenne modale de 30 ans. La majorité des tenancières (65,7 %) a entre 25 et 50 ans, notamment à Mfumu Nsuka (85,7 %), Mapela (71,4 %), Sans Fil (71,4 %) et, dans une moindre mesure, à Tshangu (57,1 %) et Lubamba (42,9 %). Les moins de 25 ans représentent 14,3 % de l'échantillon. Les plus de 50 ans constituent 20 % des enquêtées, surtout dans les quartiers Lubamba, Sans Fil et Tshangu (28,6 % respectivement). Cela montre que l'activité de Malewa attire des femmes de différentes générations.

Concernant la taille des ménages, il ressort des résultats que dans l'ensemble 51,4 % des enquêtées vivent dans des foyers de moins de 5 personnes, particulièrement à Sans Fil (85,7 %), Mapela (71,4 %) et Mfumu Nsuka (57,1 %). À l'inverse, dans l'ensemble 45,7 % vivent dans des ménages

de 5 à 10 personnes, tandis que seulement 2,9 % vivent dans des ménages de plus de 10 personnes.

D'après les résultats des enquêtes, le secteur de la restauration « Malewa » dans la commune de Masina présente une dynamique d'entrée récente avec 68,6% d'individus enquêtés qui exercent cette activité depuis moins de cinq mois. Cette courte ancienneté est particulièrement marquée à Mfumu Nsuka (85,7 %), Mapela (71,4 %), Tshangu (71,4 %), Lubamba et Sans Fil (57,1 % chacun).

Tableau 1 : Profil socio-démographiques des tenancières des Malewa

Variable	Modalités	Quartier											
		Lubamba		Mapela		Mfumu Nsuka		Sans fil		Tshangu		Total	
		Eff.	%	Eff.	%	Eff.	%	Eff.	%	Eff.	%	Eff.	%
Sexe du propriétaire de Malewa	Féminin	7	100,0%	7	100,0%	7	100,0%	7	100,0%	7	100,0%	35	100,0%
Sexe de l'enquêté	Féminin	7	100,0%	7	100,0%	7	100,0%	7	100,0%	7	100,0%	35	100,0%
Niveau d'instruction	Primaire	1	14,3%	0	0,0%	0	0,0%	1	14,3%	0	0,0%	2	5,7%
	Secondaire	6	85,7%	6	85,7%	6	85,7%	3	42,9%	5	71,4%	26	74,3%
	Universitaire	0	0,0%	1	14,3%	1	14,3%	3	42,9%	2	28,6%	7	20,0%
Etat - civil	Célibataire	3	42,9%	6	85,7%	3	42,9%	1	14,3%	1	14,3%	14	40,0%
	Divorcé (e)	0	0,0%	0	0,0%	0	0,0%	1	14,3%	1	14,3%	2	5,7%
	Marié (e)	3	42,9%	1	14,3%	4	57,1%	5	71,4%	4	57,1%	17	48,6%
	Veuf (ve)	1	14,3%	0	0,0%	0	0,0%	0	0,0%	1	14,3%	2	5,7%
Direction du ménage	Non	2	28,6%	3	42,9%	4	57,1%	4	57,1%	1	14,3%	14	40,0%
	Oui	5	71,4%	4	57,1%	3	42,9%	3	42,9%	6	85,7%	21	60,0%
Tranche - âge	Moins de 25 ans	2	28,6%	1	14,3%	1	14,3%	0	0,0%	1	14,3%	5	14,3%
	25 - 50 ans	3	42,9%	5	71,4%	6	85,7%	5	71,4%	4	57,1%	23	65,7%
	Plus de 50 ans	2	28,6%	1	14,3%	0	0,0%	2	28,6%	2	28,6%	7	20,0%
Tranche taille ménage	Moins de 5 personnes	1	14,3%	5	71,4%	4	57,1%	6	85,7%	2	28,6%	18	51,4%
	5 - 10 personnes	5	71,4%	2	28,6%	3	42,9%	1	14,3%	5	71,4%	16	45,7%
	Plus de 10 personnes	1	14,3%	0	0,0%	0	0,0%	0	0,0%	0	0,0%	1	2,9%
Tranche ancienneté	Moins de 5 mois	4	57,1%	5	71,4%	6	85,7%	4	57,1%	5	71,4%	24	68,6%
	5 - 10 mois	3	42,9%	0	0,0%	0	0,0%	1	14,3%	1	14,3%	5	14,3%
	Plus de 10 mois	0	0,0%	2	28,6%	1	14,3%	2	28,6%	1	14,3%	6	17,1%

Conditions et organisation du travail dans les restaurants « Malewa » Emplacement spatial des restaurants « Malewa »

De la figure 2, on peut voir que les restaurants « Malewa » visités dans la commune de Masina sont majoritairement situés le long des artères principales (34%), très fréquentées et dans des quartiers résidentiels (31%), offrant ainsi une option de restauration pratique pour les habitants des

quartiers concernés. Près d'un quart (23%) de ces établissements sont implantés dans les marchés où tous les vendeurs et prestataires de service constituent une demande plus sûre. En revanche, seuls 12 % des restaurants sont localisés à proximité d'arrêts de bus. Ces lieux de grande affluence des populations constituent aussi un grand marché pour les restaurateurs.

L'analyse par quartier indique que les « Malewa » des quartiers Lubamba et Mapela sont majoritairement implantés dans les quartiers résidentiels, tandis qu'à Sans fil et Mfumu Nsuka, ils se trouvent principalement le long des avenues et routes principales. Les restaurants situés à proximité des marchés sont quant à eux plus fréquents à Lubamba et Tshangu.

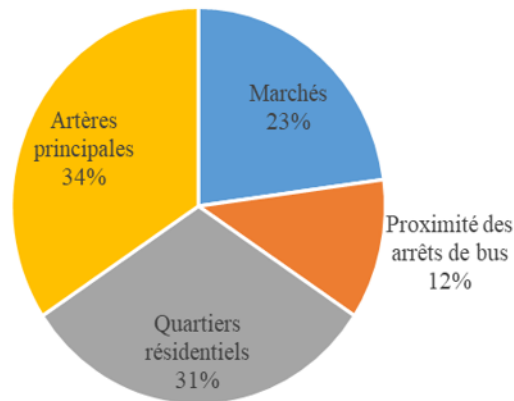


Figure 2 : Emplacement des restaurants « Malewa » dans la commune de Masina

Une diversité de matériaux de construction des restaurants « Malewa »

Les matériaux de construction d'un restaurant doivent allier esthétique, fonctionnalité et respect des normes d'hygiène et de sécurité, notamment dans les zones de cuisine. Dans la commune de Masina, les locaux de vente ne sont pas uniformes ; et cela dépend certainement des moyens financiers de la tenancière. Une grande proportion des restaurants « Malewa » visités (45,7 %) sont construits en matériaux durables, notamment en ciment et briques. Ils sont suivis par les « Malewa » installés en plein air (sans abris), qui représentent 34,3 % d'enquêtés. Les Malewa édifiés en planches et en bâches constituent respectivement 11,4 % et 8,6 %.

En analysant les données de manière désagrégée par quartier, on constate que les quartiers Sans Fil et Tshangu enregistrent une prédominance de « Malewa » bâtis en matériaux durables (71,4% chacun). Cette solidité des constructions favorise la sédentarisation des tenancières et offre aux consommateurs un cadre plus ou moins confortable et sécurisé. A l'opposé, les « Malewa » en plein air se démarquent principalement dans les quartiers Lubamba, Mapela et Mfumu Nsuka, où ils représentent chacun 42,9 % des

installations. Quant aux Malewa construits en bâches et en planches, ils sont principalement observés dans les quartiers de Mfumu Nsuka et Mapela. Ces types d'installations, de nature rudimentaire et facilement démontables, sont particulièrement vulnérables aux expulsions orchestrées par les autorités locales dans le cadre des politiques de lutte contre l'insalubrité et de promotion de l'assainissement de la ville-province de Kinshasa, et plus particulièrement de la commune de Masina.

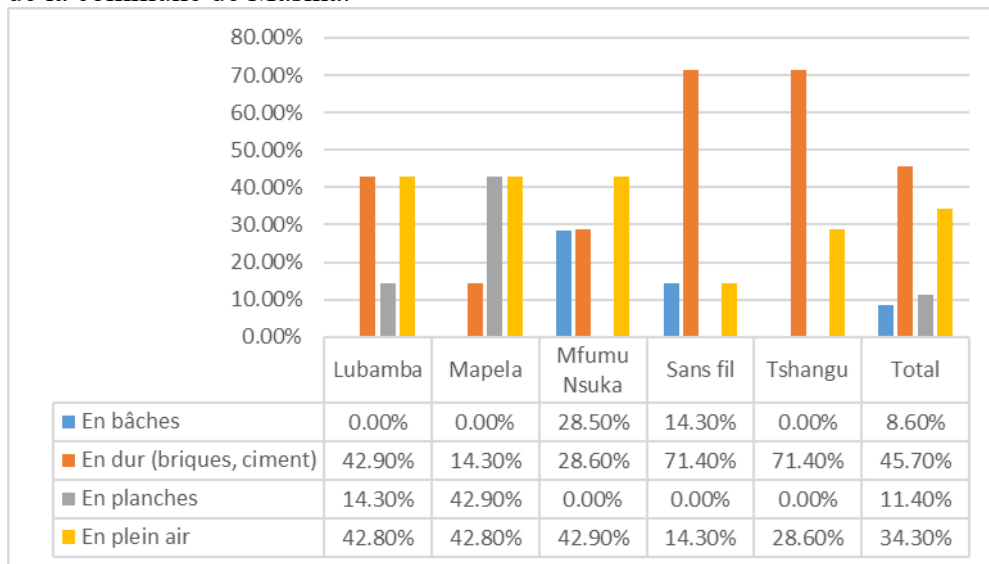


Figure 3 : Matériaux de construction des restaurants « Malewa » visités

Horaires de prestation de service des restaurants « Malewa »

Les heures d'ouverture et de fermeture peuvent exercer une influence positive sur la recette journalière de toute activité économique. Dans la commune de Masina, les horaires de service varient d'un restaurant à l'autre. En effet, un peu plus de la moitié des « Malewa » (51,4%) fonctionnent toute la journée ; c'est-à-dire du matin au soir (entre 6 heures et 18 heures). Cela traduit la volonté de maximiser les opportunités de vente en répondant aux besoins alimentaires des clients tout au long de la journée. Environ 40% des restaurants n'ouvrent que le soir (à partir de 16 heures). Cet horaire permet probablement de répondre à une forte demande de nourriture après les heures de travail ou en soirée, période de la fermeture de la majorité des activités urbaines. En revanche, seuls 8,6 % des « Malewa » sont ouverts uniquement le matin; ce qui peut s'expliquer par une demande plus faible pour les repas matinaux dans ce type de restauration informelle. C'est dans le quartier Sans Fil que l'on observe une prédominance des « Malewa » opérant toute la journée, tandis que ceux qui offrent leurs services uniquement le soir se trouvent majoritairement à Lubamba. Le service exclusif du matin reste marginal (8,6 %), concentré à Tshangu et Mapela.

Une restauration fondée sur une combinaison d'aliments locaux et importés

La diversité des plats proposés par les restaurants dans la ville de Kinshasa est vaste, allant des spécialités locales et régionales aux cuisines internationales. Les restaurants « Malewa » de la commune de Masina offrent une variété de plats, à base des produits locaux et importés, pour satisfaire leurs clients.

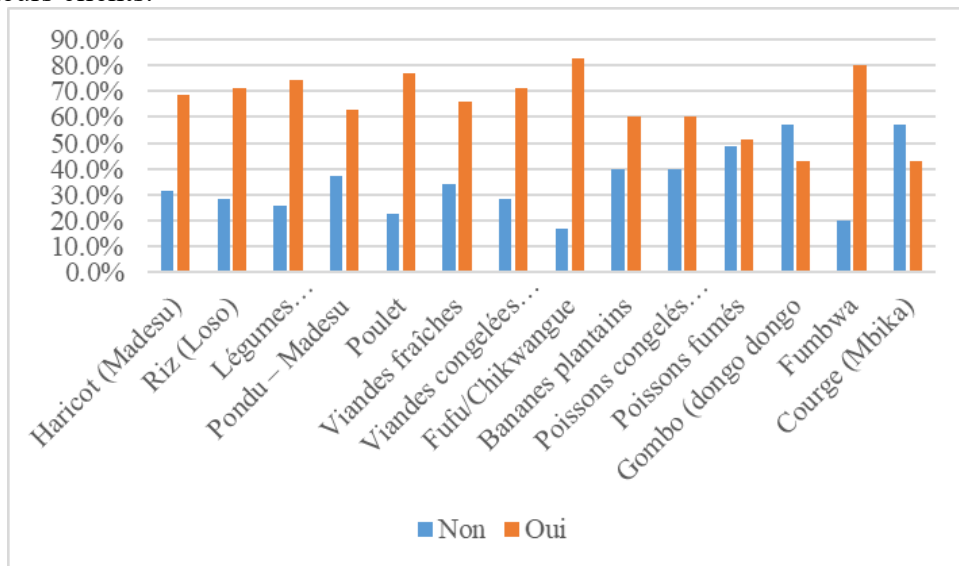


Figure 4 : Aliments proposés par les restaurants « Malewa » visités

Il se dégage de l'analyse des résultats de l'étude que les aliments proposés par les restaurants « Malewa » de la commune de Masina peuvent être répartis en trois (3) catégories : (i) les aliments les plus fréquemment servis ; (ii) les aliments modérément servis et (iii) les aliments les moins servis.

Les aliments les plus fréquemment servis sont le fufu/chikwangue (82,9%), le poulet (77,1%), les légumes - feuilles tels que les feuilles de patate douce (*Ipomoea batatas L.*) et l'épinard (*spinacia oleracea*) (74,3%), le riz (71,4 %), les viandes congelées (71,4%) et le haricot (Madesu) (68,6%). Il s'observe une prédominance de plats traditionnels, riches en féculent et protéine et culturellement appréciés par les consommateurs urbains de Kinshasa. Ces produits constituent la base de l'alimentation des Kinois en général et les menus des « Malewa » ne font que suivre. Ce sont des mets populaires, nutritifs et relativement accessibles, répondant ainsi à la demande quotidienne d'une clientèle variée.

Le deuxième groupe est constitué d'aliments proposés dans une fréquence modérée: les feuilles de manioc associées au haricot localement appelé « pondu – madesu » (62,9%), les viandes fraîches (65,7%), les poissons

grillés et les bananes plantains (60% chacun), ainsi que les poissons fumés (51,4%). Ces aliments, bien qu'également appréciés, sont plus coûteux et exigeants en termes de préparation.

Enfin, le dernier groupe comprend les aliments servis à une faible fréquence: le gombo (*Abelmoschus esculentus*) et la courge (*cucurbita pepo L.*) (42,9% chacun), ainsi que le fumbwa (*Gnetum Africanum*) (20%). Leur faible représentativité pourrait s'expliquer par leur prix élevé. Ce sont des produits souvent considérés comme plus spécifiques ou traditionnels, moins adaptés à une restauration rapide, ou nécessitant une clientèle plus ciblée.

Dans l'ensemble des quartiers étudiés, les marchés locaux constituent la principale source d'approvisionnement en matières premières (100%) pour les restaurants « Malewa ». Cette prédominance traduit une forte dépendance à l'économie locale, motivée par la facilité d'accès, la disponibilité immédiate ainsi que la fraîcheur perçue des produits issus de ces marchés locaux.



Photo 1 : Quelques plats proposés par les restaurants « Malewa » de la commune de Masina

Les pratiques d'hygiène dans les restaurants « Malewa »

Considérant les conditions dans lesquelles fonctionnent les restaurants « Malewa », les risques de contamination existent à plusieurs niveaux de la chaîne alimentaire, de la production à la consommation. Les mesures d'hygiène sont donc indispensables pour limiter ces risques. Dans le cadre de la présente étude, l'on s'intéresse à l'hygiène du personnel, au lavage des mains par les consommateurs, l'approvisionnement en eau et le lavage des équipements de travail, la conservation, la gestion et l'usage des aliments invendus, la gestion des déchets alimentaires, la sensibilisation et la formation des vendeuses et la situation globale de l'environnement de travail dans ces restaurants.

De l'hygiène du personnel dans les restaurants

La vendeuse d'aliments dans les restaurants « Malewa » est la première responsable de l'hygiène et de la qualité des aliments qu'elle propose aux consommateurs. A ce titre, elle doit respecter des normes strictes sur son hygiène personnelle et celui du restaurant. Or ce n'est pas toujours le cas. A en croire ces vendeuses, elles observent toutes la pratique de lavage des mains avant la manipulation des aliments. Cependant, 54,3% femmes vendeuses ne portent pas de tenue spéciale pour la préparation, contre 45,7% qui en portent. Pour ces dernières, les tenues utilisées sont généralement les blouses et les tabliers. L'état de ces tenues, déterminé par observation directe durant l'enquête, était moyennement propre. Cela indique les signes d'éveil de conscience autour des enjeux liés à l'hygiène de la part des tenancières de restaurants. L'examen par quartier montre que le quartier Mapela se distingue positivement, avec 85,7% des tenancières portant une tenue de travail. De même, le quartier Tshangu enregistre une majorité de restauratrices en tenue (57,1%). À l'inverse, cette pratique n'a pas été observée dans le quartier Sans Fil, traduisant un relâchement total des pratiques vestimentaires professionnelles. Enfin, les quartiers Lubamba et Mfumu Nsuka présentent un taux similaire, avec seulement 42,9% des tenancières qui portent de tenues de travail, ce qui reste en dessous de la moyenne observée dans l'ensemble.

Des dispositifs de lavage des mains moins équipés

De manière générale, les clients préfèrent consommer de la nourriture dans les restaurants rue « Malewa » sans couverts de table. Ces consommateurs estiment que manger avec la main faciliterait une consommation rapide de la nourriture. Cette pratique peut avoir des risques, particulièrement si les mains ne sont pas bien lavées avant de passer à table. En effet, les mains sales peuvent contaminer les aliments devenant ainsi un vecteur des microbes nuisibles pouvant provoquer des intoxications alimentaires. La présence d'un dispositif de lavage des mains dans les

restaurants est donc cruciale, car elle garantit non seulement la sécurité des consommateurs mais également la qualité du service.

Des observations de terrain, il en résulte que 68,6% des restaurants disposent d'un dispositif de lavage des mains, comprenant un seau (bidon) équipé d'un robinet, un petit bassin (qui sert à récupérer de l'eau sale) et du savon liquide (antibactérien). Toutefois, il y manquait des essuie-mains à usage unique (papier) qui permet de sécher les mains par tamponnement. En revanche, 14,3% des restaurants possèdent un dispositif de lavage des mains, mais sans savon (solide ou liquide), exposant ainsi les consommateurs à un risque sanitaire. Par ailleurs, 17,1% des Malewa déclarent ne pas disposer du tout de dispositif de lavage des mains, ce qui représente une faiblesse majeure en matière de sécurité alimentaire. L'analyse par quartier révèle que six restaurants Malewa répartis dans les quartiers Lubamba, Mapela et Mfumu Nsuka (deux par quartier) ne disposent pas de dispositif de lavage des mains. Dans ce cas, les clients se débrouillent seuls pour se laver les mains avant de consommer, ce qui est préoccupant du point de vue de l'hygiène.



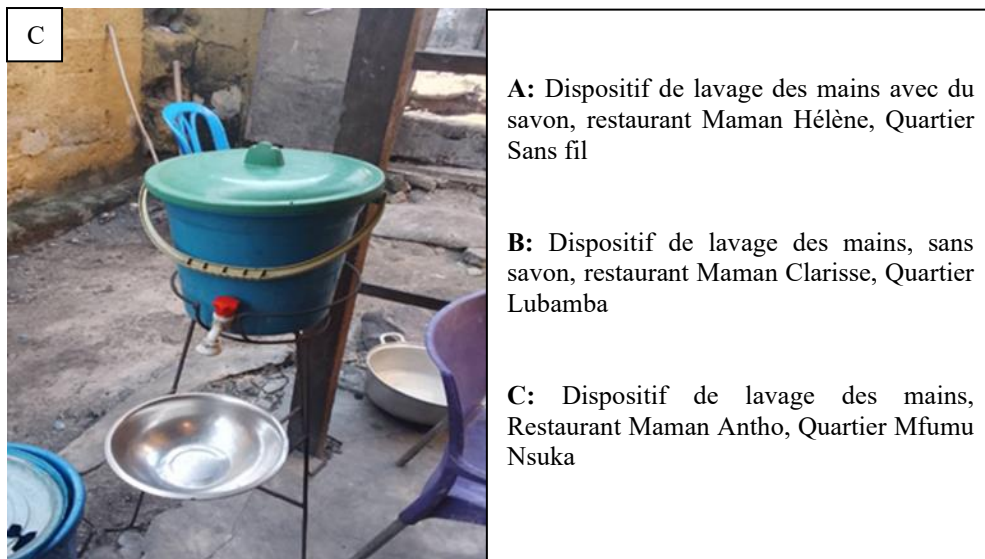


Photo 2: Dispositif de lavage dans les restaurants « Malewa » de la Commune de Masina

Approvisionnement en eau et nettoyage des équipements

La qualité de l'eau utilisée dans la restauration est primordiale, tant pour la sécurité sanitaire des aliments que pour la santé des consommateurs. Une eau de bonne qualité permet non seulement de prévenir les maladies hydriques, mais elle contribue également à garantir la sécurité alimentaire des clients. Concernant l'approvisionnement en eau pour les usages multiples (cuisson, vaisselle, lavage des mains), l'étude révèle que la totalité des restaurants « Malewa » visités utilisent l'eau fournie par la REGIDESO, société publique de distribution d'eau. Le recours à une source officielle garantit, en principe, la potabilité de l'eau utilisée. Ce résultat traduit une réduction significative des risques de contamination alimentaire et témoigne d'un niveau minimal de conformité aux normes d'hygiène.

Le nettoyage régulier des équipements de travail (plan de travail, ustensiles de cuisine, etc.) permet de prévenir les contaminations alimentaires, de respecter les normes sanitaires et de refléter le sérieux, l'organisation et le professionnalisme de l'établissement. À la question relative à la fréquence de nettoyage des ustensiles de cuisine dans les restaurants visités, les résultats de l'enquête révèlent que toutes les tenancières (100%) procèdent au nettoyage des ustensiles après chaque utilisation, notamment les assiettes, immédiatement après que les clients aient terminé leurs repas.

De la conservation et usage d'aliments invendus

L'hygiène du stockage (matières premières et produits finis) permet de limiter le risque de contamination physique, chimique et microbiologique. La figure 5 présente les modes de conservation/stockage des aliments dans les

restaurants « Malewa » de la commune de Masina. Il en ressort que 37,1 % des « Malewa » conservent les aliments au réfrigérateur ou au congélateur, ce qui constitue la méthode la plus sûre du point de vue sanitaire. Cela permet de ralentir la prolifération des bactéries et de prolonger la durée de conservation des plats. Le reste des restaurants, soit 22,9% d'entre eux conservent les aliments dans un récipient couvert à température ambiante après les avoir réchauffés. Cette technique est préférable à une exposition à l'air libre, mais reste insuffisante pour prévenir les risques de contamination si l'aliment n'est pas rapidement consommé. Une infime proportion des restauratrices (17,1%) conservent les aliments à température ambiante sans protection particulière, après les avoir chauffés. Cette technique favorise la multiplication des germes et présente un risque élevé pour la santé des consommateurs.

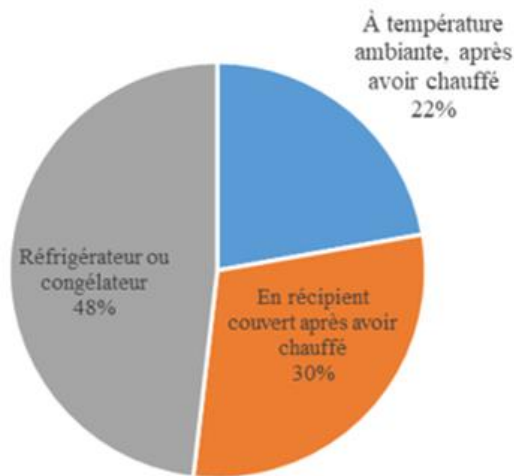


Figure 5 : Techniques de conservation des aliments dans les restaurants « Malewa » de la commune de Masina

Le phénomène des aliments invendus s'observe aussi bien dans les restaurants dits VIP que dans les restaurants populaires, communément appelés « Malewa ». La question essentielle qui se pose est celle de la gestion ou utilisation de ces aliments non vendus. A cette question, la majorité des tenancières de Malewa (65,7 %) déclarent « chauffer et revendre » ces aliments le lendemain. Cette pratique, bien que courante, peut avoir des conséquences néfastes sur la santé des consommateurs si les conditions de conservation et de réchauffage ne sont pas strictement respectées. Par ailleurs, 31,4 % des restauratrices affirment ramener les aliments non vendus à la maison pour une consommation immédiate. Cette pratique limite la réutilisation commerciale des aliments mais pose tout de même des questions sur la sécurité sanitaire au sein du foyer. Une minorité, soit 2,9 %, déclare donner les restes aux servantes ou servants pour une consommation immédiate, réduisant ainsi les risques liés à une conservation prolongée.

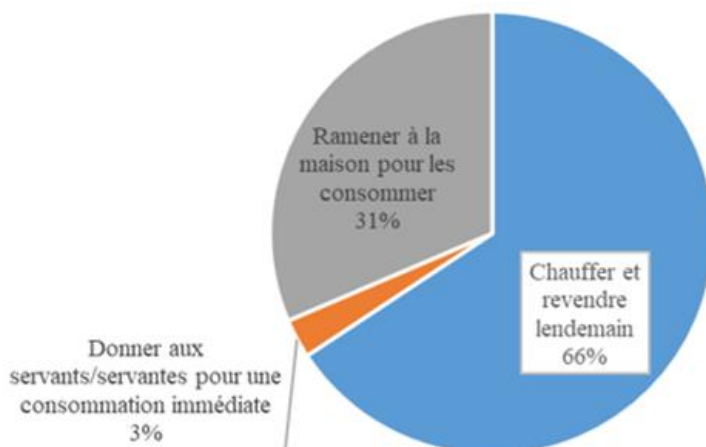


Figure 6 : Utilisation des aliments invendus dans les restaurants « Malewa » de la commune de Masina

Gestion des ordures et déchets alimentaires

Les déchets alimentaires sont les déchets biodégradables, solides ou pâteux provenant de la préparation ou des restes de repas. Leur composition, très variable, présente généralement des teneurs importantes en eau (> 70 %), lipides et glucides. Une gestion rigoureuse des déchets alimentaires au sein des restaurants garantit un environnement propre et sain pour les clients comme pour le personnel et les personnes vivant autour de ces restaurants. Par ailleurs, une gestion efficace reflète la conscience environnementale et la responsabilité sociale du restaurant.

Concernant la gestion des ordures et des déchets alimentaires, ce qui a des implications au niveau de la salubrité des lieux de vente et des aliments vendus, on note que 71 % des restaurants « Malewa » de la commune de Masina jettent leurs déchets alimentaires dans une poubelle avec couvercle. Ces poubelles sont ensuite ramassées pour être évacuées, ce qui témoigne d'une bonne pratique d'hygiène. Cependant, la question de la gestion des ordures et déchets demeure une préoccupation majeure car les décharges finales n'existent pas. Généralement, ces déchets se retrouvent dans les rues, les caniveaux ou encore les rivières de la ville qui sont de plus en plus polluées. À l'inverse, 29 % des restauratrices ne disposent pas de poubelles et jettent leurs déchets à même le sol ou dans un égout, une pratique préoccupante sur le plan sanitaire.

Ces résultats montrent que, malgré qu'une majorité de restaurants observent les bonnes pratiques, des efforts restent encore à fournir pour généraliser l'usage de dispositifs de collecte adaptés dans tous les établissements. Les quartiers Sans Fil, Mfumu Nsuka et Lubamba présentent les proportions les plus élevées de Malewa pratiquant cette forme de gestion,

avec respectivement 42,9 %, 42,9 % et 28,6 %. En comparaison, les quartiers Mapela et Tshangu ne comptent chacun qu'un seul restaurant ayant le dispositif de gestion de déchets.

Une faible sensibilisation des prestataires à l'hygiène alimentaire

Globalement, la majorité des tenancières de restaurants « Malewa » interrogées (68,6%) n'ont jamais été sensibilisées à l'hygiène alimentaire, contre seulement 31,4% qui en ont bénéficié. Cette situation révèle un déficit important en matière de renforcement des capacités dans le domaine de la sécurité sanitaire des aliments. Ce constat met en évidence la nécessité de mettre en place des programmes de formation ciblés afin de professionnaliser davantage le secteur de la restauration de rue et de garantir des conditions d'hygiène conformes aux normes, pour assurer la sécurité sanitaire des consommateurs.

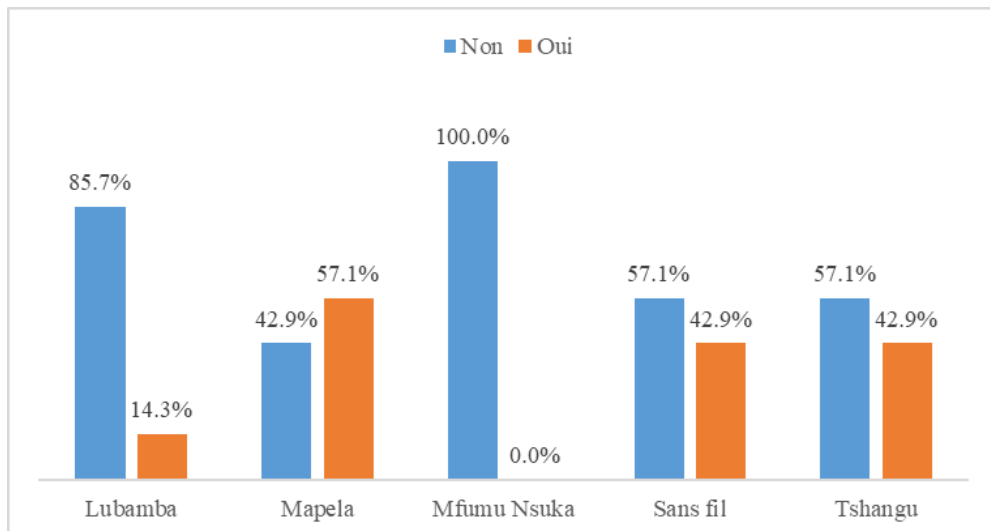


Figure 7 : Sensibilisation des tenancières de « Malewa » en matière d'hygiène alimentaire

L'analyse révèle, comme l'illustre la figure 7, qu'il existe des disparités importantes entre les quartiers en matière de sensibilisation sur l'hygiène alimentaire des tenancières de restaurants « Malewa ». Le quartier Mfumu Nsuka présente une situation alarmante, où toutes les tenancières n'ont jamais été sensibilisées. A Lubamba, 85,7 % des restauratrices n'ont jamais bénéficié des séances de sensibilisation, contre seulement 14,3 % qui en ont bénéficié. Les quartiers Sans Fil et Tshangu affichent chacun 57,1 % de tenancières non sensibilisées et 42,9 % de celles qui ont été sensibilisées, traduisant une situation intermédiaire. En revanche, le quartier Mapela se distingue positivement, avec 57,1 % des tenancières ayant été sensibilisées, ce qui en fait la zone la plus sensibilisée aux bonnes pratiques d'hygiène.

Environnement global du cadre de travail

Près de 65,7% des tenancières enquêtées jugent l'hygiène de leurs établissements très bon, tandis que 25,7 % la considèrent bon. Ces déclarations traduisent une perception globalement positive de la propreté dans ces restaurants. Toutefois, 8,6 % des répondantes estiment que l'hygiène est assez bon, révélant qu'une minorité perçoit encore certaines insuffisances à corriger. Ces déclarations des tenancières des restaurants « Malewa », teintées d'un sentiment d'autosatisfaction, doivent être considérées avec beaucoup de prudence. En effet, les observations de terrain montrent visiblement que ces établissements présentent des problèmes d'hygiène qui affectent la qualité de leurs services. La photo ci-après illustre la situation du cadre de travail et de vente d'aliments dans les restaurants « Malewa » dans la commune de Masina.



Photo 3: Environnement de travail des restaurants « Malewa » de la commune de Masina

Discussion

Les résultats de cette étude montrent que les restaurants « Malewa » à Masina sont exclusivement tenus par des femmes, confirmant les travaux de Delpeuch et al. (2012) qui insistent sur le rôle central des femmes dans les économies informelles urbaines en Afrique. Ces femmes cumulent à la fois la fonction de cheffe de ménage et celle d'actrice économique, dans une logique d'autonomisation souvent observée dans d'autres études sur l'économie de subsistance en milieu urbain (Poulain, 2002). En RDC en général et à Kinshasa en particulier, les femmes sont devenues des véritables maîtresse de maison et font face aux charges familiales, d'où leur engagement affirmé dans tous les secteurs économiques émergents comme la restauration « Malewa ».

La restauration « Malewa » dans la commune de Masina qui relève du secteur informel accueille toutes les tranches d'âge. Contrairement aux études qui attestent que cette activité est occupée par des personnes ayant un niveau d'instruction globalement faible (Canet, 1997; Carnet et Ndiaye, 1998), la situation de la ville de Kinshasa dans la commune de Masina prouve le contraire. En effet, la majorité de femmes impliquées dans cette activité ont au moins le niveau de secondaire, certaines de ces femmes ont une formation de niveau universitaire. Dans une ville comme Kinshasa où les opportunités d'emploi salarié sont limitées (Ba-Mweze, 2024), l'investissement des femmes « instruites » dans la restauration « Malewa » s'inscrit dans une logique de débrouillardise et d'auto-emploi (Ayimpam, 2013). La vente des aliments constitue une alternative de chômage qui sévit dans cette ville.

A Kinshasa, l'apparition de la restauration hors foyer n'est pas un phénomène récent (Bonkena et al., 2018), mais la dynamique du déploiement des restaurants « Malewa » dans la commune de Masina est récente et spectaculaire (35 « Malewa » installés en moins d'une année). Le déploiement rapide de ce type de restaurants a été observé aussi dans d'autres villes congolaises (Neema et Lebailly, 2020 ; Lituka et Ndahayo, 2023) où on assiste à une prolifération de différentes gammes de restaurants et de supermarchés. La dynamique actuelle de l'environnement économique, de plus en plus difficile, force incontestablement les congolais en général et les kinois en particulier à s'orienter vers le secteur informel de la restauration hors ménage.

Spatialement, ces restaurants s'épanouissent dans les endroits de forte activité économique et à forte concentration démographique (arrêts de bus, marchés, grandes artères, etc.). Ils sont installés dans des locaux présentant une diversité de matériaux de construction (planches, bâches, briques) en fonction du budget, de la durabilité souhaitée et de l'esthétique recherchée. Même si les horaires de service varient d'un restaurant à l'autre, les clients peuvent se restaurer durant toute la journée car certains restaurants se ferment lorsque d'autres ouvrent leurs portes. Cela obéit presque à la même

logique que celle décrite dans d'autres villes africaines, symbole de la vie animée de la rue en Afrique (Canet, 1997).

Les plats proposés par les restaurants « Malewa » de la commune de Masina sont composés aussi bien des produits locaux (fufu, chikwangu, banane plantain, feuilles de manioc, feuilles de patate douce, épinard, haricot, poisson fumé, etc.) que de produits importés (riz, viande, poulet, poisson chinchard, etc.). Ces plats sont adaptés aux habitudes alimentaires de la population de Kinshasa (Muteba, 2014 ; Bonkena, 2020) ; ils font donc partie de la « gastronomie populaire kinoise ». A travers les plats proposés, on peut se rendre compte que les restaurants « Malewa » de la ville de Kinshasa achètent des produits végétaux et animaux et valorisent les produits locaux. Ceci corrobore la réalité constatée dans d'autres villes de la RDC (Neema et Lebailly, 2020) et de la France (Ségolène et Christine, 2014 ; Agence Bio, 2017) où l'intégration des produits alimentaires locaux (d'origine végétale et animale) est remarquable dans la restauration hors domicile et occupe une place plus importante.

Malgré les gestes qui dénotent d'une prise de conscience progressive des enjeux liés à l'hygiène (lavage des mains et autres), le respect des normes requises en matière de préparation et d'hygiène des aliments n'est pas scrupuleusement observé dans les restaurants « Malewa » de la ville de Kinshasa (Muninga, 2022). Alors que les autorités sanitaires sont censées inspecter les « Malewa » une fois par semaine (Lituka et Ndahayo, 2023), la présente étude révèle que ces établissements de vente d'aliments ne sont presque pas inspectés. Cette situation révèle la défaillance des services publics à assurer l'encadrement du secteur de l'hôtellerie, de la restauration et des cafés (HORECA) afin de s'assurer que les plats servis dans les « Malewa » ne représentent de risques pour les consommateurs. Cette réalité demeure pareille dans de nombreuses parties du monde, notamment en Afrique (Canet et N'diaye, 1998 ; Hoteyi et al., 2014 ; Aholou et Monbgo, 2020). S'il est certain qu'un degré zéro de risque sanitaire ne pourrait être possible dans les restaurants du type « Malewa » à Kinshasa, Aholou et Monbgo (2020) estiment que la seule option qui s'offre aux acteurs est celle de développer des stratégies de limitation des risques. Ainsi, il est important, dans le contexte de la ville de Kinshasa, de faire respecter la loi et accompagner les acteurs de la restauration « Malewa » pour qu'ils améliorent leur standard.

Les restaurants « Malewa » de la ville de Kinshasa en général et de la commune de Masina en particulier sont confrontés à plusieurs défis liés à la pratique d'hygiène. Il s'agit notamment de la formation du personnel, la sensibilisation des vendeurs et des consommateurs, la qualité des équipements, la gestion des déchets et le respect des règles d'hygiène de base. Ces défis peuvent entraîner des maladies d'origine alimentaire, des problèmes

de santé publique, et une détérioration de la qualité de la restauration de rue, affectant la confiance des consommateurs.

Conclusion et perspectives

Le déploiement des restaurants de fortune « Malewa » dans la commune de Masina est spectaculaire mais aussi récent car plus de 80% des tenancières enquêtées ont une expérience dans le métier de moins d'une année. Ces établissements sont créés et gérés par les femmes mariées et célibataires, relativement jeunes (30 ans en moyenne) et ayant majoritairement un niveau d'étude acceptable (20% de niveau supérieur et 74,3% de niveau de secondaire).

La majorité de ces établissements (45,7%) sont construits en matériaux durables (brique et ciment), offrant ainsi un espace plus ou moins confortable aux consommateurs. Toutefois, une frange non négligeable de restaurants (34,3%) est installée en plein air (sans abri), tandis que d'autres laissent l'image des installations précaires car ils sont édifiés soit en planches, soit encore bâches. Situés dans des endroits de forte affluence des populations (grandes artères, arrêt de bus, marchés), les restaurants « Malewa » de la commune de Masina fonctionnent toute la journée avec des horaires de service différents. Ils offrent ainsi la possibilité aux consommateurs de se procurer la nourriture même après les heures de travail ou en soirée, période de la fermeture de la majorité des activités urbaines. Cette nourriture est constituée d'une diversité de plats avec une prédominance des produits locaux. Les plats les plus fréquemment servis sont le fufu/chikwangue (82,9%), le poulet (77,1%), les légumes - feuilles tels que les feuilles de patate douce et épinards (74,3%), le riz (71,4 %), les viandes congelées (71,4%) et le haricot (Madesu) (68,6%). Les autres plats sont modérément ou faiblement servis notamment les feuilles de manioc associées au haricot localement appelé pondou – madesu (62,9%), les viandes fraîches (65,7%), les poissons grillés et les bananes plantains (60% chacun), ainsi que les poissons fumés (51,4%). Les plats tels que le gombo (*Abelmoschus esculentus*) et la courge (*cucurbita pepo L.*) (42,9% chacun), ainsi que le fumbwa (*Gnetum Africanum*) (20%) sont servis à une faible fréquence dans les restaurants de Masina.

Le respect des normes requises en matière de préparation et d'hygiène des aliments n'est pas scrupuleusement observé dans les restaurants « Malewa ». L'hygiène et l'assainissement, nécessaires pour garantir la sécurité sanitaire des aliments, manquent obstinément dans ces établissements. Toutefois, les gestes observés tels que le dispositif de lavage des mains et les poubelles dans certains restaurants, dénotent d'une prise de conscience progressive des enjeux liés à l'hygiène et doivent être encouragés. En guise de perspectives, il serait important d'étendre cette étude dans d'autres communes dans le but d'appréhender le phénomène « Malewa » dans la mégapole

Kinshasa. Dans la perspective de réglementation, du respect des règles d'hygiène, des inspections, de sensibilisation et de formations, les interventions multisectorielles sont nécessaires pour améliorer l'hygiène, l'assainissement et la gestion des déchets dans ces établissements de vente des aliments.

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