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Editorial

Journal of Economics and Behavioral Studies (JEBS) provides a distinct avenue for quality research in the ever-changing fields of economics & behavioral studies and related disciplines. Research work submitted for publication consideration should not be limited to conceptualization of economics and behavioral developments but comprise interdisciplinary and multi-facet approaches to economics and behavioral theories and practices as well as general transformations in the fields. Scope of the JEBS includes: subjects of managerial economics, financial economics, development economics, finance, economics, financial psychology, strategic management, organizational behavior, human behavior, marketing, human resource management and behavioral finance. Author(s) should declare that work submitted to the journal is original, not under consideration for publication by another journal and that all listed authors approve its submission to JEBS. Author (s) can submit: Research Paper, Conceptual Paper, Case Studies and Book Review. Journal received research submissions related to all aspects of major themes and tracks. All submitted papers were first assessed by the editorial team for relevance and originality of the work and blindly peer-reviewed by the external reviewers, depending on the subject matter of the paper. After the rigorous peer-review process, the submitted papers were selected based on originality, significance and clarity of purpose. The current issue of JEBS comprises papers of scholars from Equatorial Guinea, Uganda, Nigeri, Ethiopia and Dem. Rep. of the Congo. Do Product Returns Distort Retail Profitability, Foreign Exchange Rate-Trade Balance Nexus, Foreign Direct Investment–Trade Balance Nexus, Environmental Uncertainty and Supply Chain Resilience among Manufacturing Firms, Determinants of Local Content Participation among Domestic Firms in Oil and Gas Sector, Trends and Development of Occupational Competency Assessment and Certification, Tax Enforcement and Tax Compliance in Southwestern Nigeria, Work Team Stability and Quality of Health Care, Job-Related Affective Wellbeing Differ Across Biocharacteristic Determinants and Moderating Role of Health Centre Characteristics in the Relationship between Psychosocial Work Environment and Quality of Health Care were some of the major practices and concepts examined in these studies. The current issue will therefore be a unique offer where scholars will be able to appreciate the latest results in their field of expertise and acquire additional knowledge in other relevant fields.

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PAPERS

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Do Product Returns Distort Retail Profitability? Evidence from Transaction Data

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Abstract: This study examines how product returns affect retail profitability using transaction-level data. While returns are often treated as a routine operational issue, their financial implications are not always fully captured in standard performance metrics. The analysis introduces a return-adjusted profitability framework and applies it to a multi-year retail dataset, allowing for a detailed examination of how returns influence margins across transactions and product categories. The results show that returns are generally associated with lower profitability, although the magnitude of the effect varies depending on product characteristics and over time. The study contributes to the literature by providing a practical and replicable approach to incorporating returns into profitability measurement at a granular level. It also highlights how conventional performance indicators may overestimate economic performance when transaction reversals are not explicitly considered. These findings are particularly relevant for retail environments where analytical systems are still developing and where reliance on aggregated indicators may limit the accuracy of decision-making.

Keywords: *Product returns; retail profitability; transaction data; performance measurement; emerging markets*

1. Introduction

Product returns have become an increasingly important feature of modern retail environments, yet their impact on profitability remains difficult to assess. While prior research has often focused on aggregate return rates, less attention has been given to how returns operate at the transaction level. This gap becomes more important in retail environments where operational constraints and market conditions differ from those typically observed in developed economies.

In many retail environments, particularly those characterized by the development of analytical systems and evolving operational practices, return management remains a challenging area. In such contexts, the financial implications of returns may be more difficult to anticipate and fully incorporate into routine performance measurement. Understanding these dynamics can therefore provide useful insights for both practitioners and researchers.

This study examines the relationship between product returns and retail profitability using detailed transaction data. By focusing on individual transactions, the analysis seeks to capture patterns that are not visible in aggregated data. In addition, the issues addressed in this study are particularly relevant in the context of developing retail systems, including those found in many African economies. In such environments, data limitations and reliance on simplified performance indicators may increase the risk of misinterpreting financial outcomes. As a result, improving the accuracy of profitability measurement can play an important role in supporting more efficient resource allocation and sector development.

The remainder of the paper is structured as follows. Section 2 reviews the relevant literature. Section 3 describes the methodology and data. Section 4 presents the results, followed by a discussion. Finally, Section 5 concludes the paper.

2. Literature Review

Product returns and retail performance dynamics

Product returns have become an increasingly relevant phenomenon in modern retail environments, particularly in sectors characterized by intense competition, promotional activity, and customer-oriented service policies. Flexible return policies are frequently used as a strategic instrument to reduce perceived purchase risk and stimulate demand. However, while such policies may enhance customer satisfaction and short-term sales performance, they simultaneously generate financial and operational consequences that are not always fully captured in traditional performance measurement systems.

The literature on product returns has traditionally focused on reverse logistics and operational efficiency. Studies emphasize the cost implications associated with inspection, restocking, refurbishment, transportation, and potential disposal of returned products (Rogers & Tibben-Lembke, 2001; Stock et al., 2002). These costs can significantly erode gross margins, especially in categories with low price points or thin contribution margins. Nevertheless, beyond direct operational costs, returns also influence revenue recognition, demand forecasting accuracy, inventory turnover, and working capital requirements.

From a managerial perspective, product returns create a structural tension between customer relationship management and profitability preservation. Retailers must balance the competitive advantage gained through lenient return policies with the financial risks arising from opportunistic behavior or excessive return rates. The financial impact of returns may therefore vary depending on product characteristics, price levels, and margin structures (Petersen & Kumar, 2009; Griffis et al., 2012) sever.

Moreover, recent developments in omnichannel retailing have further complicated return management. The integration of physical and online channels increases return flexibility but also amplifies logistical complexity. Empirical evidence suggests that return rates are often higher in online environments, where customers face greater uncertainty regarding product fit or quality. As a result, return management has evolved from an operational afterthought to a strategic concern with measurable implications for financial performance.

In addition, recent research highlights that the financial implications of return policies may differ across retail formats and customer segments, suggesting the need for empirical approaches that examine profitability impacts at a granular level (Zhang, Ren, & Li, 2024). Despite these advances, some aspects of return-related profitability remain less explored, particularly at a more disaggregated level.

Recent literature has increasingly examined the economic implications of product returns in modern retail environments, particularly in the context of omnichannel strategies and evolving consumer behavior. Several studies highlight that lenient return policies can enhance customer satisfaction and stimulate demand, thereby contributing positively to sales performance in the short term (Bower & Maxham, 2023; Petersen & Kumar, 2009). However, other contributions emphasize that high return rates may significantly erode margins and increase operational complexity, especially when reverse logistics costs are substantial (Hübner et al., 2023).

More recent empirical work suggests that the profitability impact of returns is not uniform but depends on factors such as product characteristics, customer segments, and channel structure (Zhang et al., 2024). In online retail environments, for example, higher uncertainty regarding product fit and quality has been associated with increased return rates, which may offset the revenue gains generated by more flexible return policies.

Despite these advances, existing research has largely focused on aggregate return rates, reverse logistics efficiency, or policy design. Comparatively less attention has been given to how returns affect profitability at the transaction level and how their impact may vary across product categories and over time. In particular, the integration of return-adjusted profitability measures into routine performance evaluation remains underexplored in the literature.

This gap is especially relevant in retail environments where analytical systems are still developing and where managerial decisions often rely on aggregated performance indicators. By focusing on transaction-level data, the present study contributes to the literature by providing a more granular perspective on how product returns influence profitability measurement.

Returns and profitability measurement systems

Traditional retail performance measurement relies heavily on accounting-based indicators such as gross margin, contribution margin, and sales growth. These metrics are typically derived from recorded transactions and assume that completed sales represent finalized economic exchanges. However, when transactions are subsequently reversed through returns, the underlying profitability calculations may become distorted.

Although accounting systems record returns as negative sales or adjustments, routine managerial dashboards and performance reports may not always incorporate return-adjusted metrics explicitly at the category or subcategory level. In practice, managers frequently rely on aggregated sales figures without systematically

distinguishing between completed and reversed transactions. This can lead to overestimation of effective margins and misinterpretation of category performance.

Performance measurement theory highlights the importance of aligning financial indicators with underlying economic reality. When measurement systems fail to incorporate relevant cost drivers or transaction reversals, managerial decision-making may become biased. For instance, categories with high nominal sales but elevated return rates may appear profitable in standard reports while generating lower effective margins once returns are accounted for.

Furthermore, pricing decisions, promotional strategies, and assortment planning often rely on historical margin indicators. If such indicators do not reflect the economic consequences of returns, retailers may inadvertently promote products or categories that are structurally vulnerable to profitability erosion. Integrating return-adjusted indicators into routine reporting systems may therefore improve transparency and support more informed decision-making.

Heterogeneity across product categories

Retail environments are inherently heterogeneous. Product categories differ in terms of price dispersion, margin structure, demand volatility, and return propensity. High-value technology products may exhibit different return dynamics compared to low-value office supplies or consumables. Similarly, bulky items such as furniture may entail distinct logistical and restocking implications relative to small, packaged goods.

Empirical studies indicate that return behavior is not uniformly distributed across product categories. Factors such as product complexity, degree of standardization, perceived quality uncertainty, and consumer involvement influence the likelihood of post-purchase dissatisfaction and subsequent returns. Consequently, identical return rates may have divergent financial implications depending on the economic characteristics of each category.

From a performance measurement perspective, this heterogeneity implies that aggregate return statistics may conceal category-specific vulnerabilities. A moderate overall return rate may mask substantial exposure in particular segments. Transaction-level analysis offers a more granular approach that enables the identification of subcategories where returns exert a disproportionate impact on profitability.

In addition, margin sensitivity to returns may depend on pricing structures and discount intensity. Categories characterized by aggressive promotional activity or narrow contribution margins are likely to be more sensitive to transaction reversals. Therefore, analyzing profitability at a disaggregated level provides deeper insight into structural performance differences within the retail assortment.

Dynamic adaptation and organizational learning

The impact of returns on profitability is not necessarily static. Retail organizations may adapt over time by refining pricing strategies, improving quality control, enhancing product descriptions, or optimizing return handling procedures. Organizational learning theory suggests that firms accumulate experience and gradually improve operational efficiency in response to recurring challenges.

Over time, retailers may implement preventive measures aimed at reducing avoidable returns, such as clearer product information, improved customer support, or more targeted promotions. They may also enhance reverse logistics processes to minimize handling costs and recovery losses. These adaptations can moderate the negative financial impact of returns.

Analyzing the temporal evolution of return-related profitability effects, therefore, provides additional insight into whether firms successfully mitigate the economic consequences of returns. A declining marginal effect of returns on profit may reflect improvements in operational processes, pricing adjustments, or more effective customer segmentation.

In this context, transaction-level data covering multiple years allows examination of both cross-sectional heterogeneity and dynamic patterns. Such analysis contributes to a more comprehensive understanding of how return behavior interacts with performance measurement systems in evolving retail environments.

Performance Measurement and Financial Accuracy in Retail Contexts

Performance measurement systems play a central role in managerial decision-making and organizational control. In retail environments, financial indicators such as sales growth, gross margin, and contribution margin are frequently used as benchmarks for evaluating category performance and managerial effectiveness. However, performance measurement literature emphasizes that indicators must accurately reflect underlying economic activity to support sound decision processes.

When measurement systems fail to incorporate relevant economic adjustments, distortions may arise. In the context of retail operations, product returns represent a form of transaction reversal that can affect both revenue recognition and margin calculation. Although accounting standards provide mechanisms for recording returns, internal managerial dashboards do not always adjust performance indicators in a manner that reflects effective realized profitability.

Theoretical perspectives on management control systems suggest that misalignment between reported indicators and economic reality may generate unintended behavioral consequences. Managers whose performance evaluations are based on unadjusted sales or margins may prioritize strategies that increase nominal sales without adequately considering return risk. For example, aggressive discounting or liberal return policies may temporarily inflate sales figures while simultaneously increasing the probability of subsequent reversals.

Accurate performance measurement, therefore, requires integration of risk-related components into profitability indicators. In financial management theory, expected value frameworks account for potential reversals or losses when evaluating economic outcomes. Applying a similar logic to retail performance measurement implies that margins should be assessed net of return exposure rather than on the basis of gross transaction records alone.

Furthermore, as retail environments become increasingly data-driven, the availability of transaction-level information enables more precise indicator construction. Advances in business analytics allow organizations to move beyond aggregated reporting and towards refined measurement systems that capture operational realities. Incorporating return-adjusted profitability metrics aligns financial reporting more closely with realized economic performance.

In this regard, the present study contributes to performance measurement discussions by demonstrating a practical and implementable approach to integrating return considerations into routine margin analysis. By highlighting the measurable difference between theoretical and adjusted profitability indicators, the study reinforces the importance of aligning managerial metrics with transactional realities.

Theoretical Framework

The relationship between product returns and profitability can be better understood when considered through established theoretical perspectives in accounting and management research. From an accounting perspective, performance indicators are expected to reflect the underlying economic reality of transactions. However, when completed sales are later reversed through returns, standard profitability measures may not fully capture realized outcomes. This creates a potential discrepancy between reported margins and effective financial performance.

In addition, agency theory provides a useful lens to interpret the managerial implications of such discrepancies. When performance evaluation is based on unadjusted sales or margin indicators, managers may have incentives to prioritize short-term revenue generation without fully accounting for the risk of returns. This may lead to decisions that improve reported performance while weakening actual profitability.

Contingency theory further suggests that the relevance and accuracy of performance measurement systems depend on the specific characteristics of the operating environment. In retail settings, where product categories, pricing structures, and return behavior vary considerably, a single, standardized approach to profitability measurement may not adequately reflect these differences.

Finally, the study is also related to the literature on management control systems, which emphasizes the importance of aligning performance metrics with operational realities. When key elements such as transaction reversals are not explicitly incorporated into measurement systems, the resulting indicators may provide an incomplete basis for decision-making.

Taken together, these perspectives support the argument that product returns should be considered an integral component of profitability measurement rather than a purely operational issue. The empirical analysis that follows is therefore aimed at assessing how the inclusion of return-related adjustments influences the interpretation of financial performance at the transaction level.

3. Data and Method

Data description

The analysis is based on a multi-year retail transaction dataset covering the period 2014–2017. The dataset contains order-line level information, including sales value, profit, discounts, quantity sold, product subcategory, and a return indicator specifying whether a transaction was subsequently reversed.

The data represent a multi-category retail environment including office supplies, furniture, and technology products across different customer segments. Such datasets are commonly used in retail analytics research and provide a suitable context for demonstrating practical profitability measurement frameworks. It corresponds to a publicly available retail transaction dataset widely used in empirical analytics research.

After data cleaning and removal of incomplete observations, the final sample consists of 29,911 transactions distributed across multiple product subcategories. The presence of detailed transaction-level variables allows for the construction of return-adjusted profitability measures and the estimation of regression models controlling for observable commercial characteristics.

Importantly, the objective of this study is not to generalize the findings to a specific geographic context but to demonstrate how return-adjusted profitability metrics can be constructed and applied using standard transactional retail data. While the dataset does not correspond to a particular regional setting, the analytical framework developed in this study may apply to a wide range of retail environments, including those where analytical capabilities and return management practices are still evolving.

Research design and analytical approach

This study adopts a quantitative research design based on transaction-level retail data. The analytical approach combines descriptive analysis with regression modelling to evaluate the financial implications of product returns. The empirical analysis focuses on identifying statistical associations between product returns and transaction-level profitability rather than establishing causal relationships. While this approach does not allow for causal inference, it provides meaningful insights into how returns are systematically related to financial performance within the observed dataset.

Transaction-level analysis is particularly appropriate in this context because it enables direct observation of individual sales outcomes, including revenue, profit, discount intensity, quantity sold, and return status. Unlike aggregate accounting reports, transaction-level data allows more precise adjustment of profitability measures and provides a granular view of financial performance across product subcategories.

The methodological framework is deliberately designed to be replicable using standard retail datasets. Rather than relying on complex econometric techniques, the study employs linear regression models that are commonly used in applied business research. This approach enhances transparency and ensures that the analytical procedure can be implemented by practitioners using widely available statistical tools.

Variable definition and measurement

The dependent variable in the regression analysis is transaction-level profit. Profit is measured as the monetary contribution generated by each transaction after accounting for discounts and cost adjustments recorded in the dataset. This variable captures the immediate financial outcome associated with each sale.

The key independent variable is a binary return indicator. This variable takes the value of 1 if a transaction was subsequently reversed through a product return and 0 otherwise. The inclusion of this variable allows estimation of the marginal effect of returned transactions on profitability.

Several control variables are incorporated to account for observable commercial characteristics that may influence profit:
Sales value: Measured as the monetary amount associated with each transaction. Higher sales values are generally expected to correlate positively with profit.
Discount level: Measured as the monetary or percentage discount applied to the transaction. Greater discount intensity may reduce contribution margins.
Quantity sold: Measured as the number of units sold in each transaction. Larger quantities may influence profitability through scale effects.

Including these control variables reduces omitted variable bias and improves the robustness of the estimated relationship between returns and profitability.

Regression specification and assumptions
The baseline regression model is specified as:
$\text{Profit}_i = \beta_0 + \beta_1 \text{Return}_i + \beta_2 \text{Sales}_i + \beta_3 \text{Discount}_i + \beta_4 \text{Quantity}_i + \varepsilon_i$
where ε_i represents the error term.

Linear regression is chosen due to its interpretability and suitability for estimating marginal effects in applied management research. The coefficient β_1 represents the average change in transaction-level profit associated with returned transactions, holding other observable characteristics constant.

Although the study does not focus on advanced econometric modelling, standard regression assumptions are considered. These include linearity of relationships, independence of observations, and absence of perfect multicollinearity among explanatory variables. Given the transaction-level structure of the dataset, individual observations represent separate sales events, reducing concerns regarding serial dependence. However, the analysis does not explicitly model potential heteroscedasticity or hierarchical clustering effects, which is acknowledged as a limitation. In addition, although the model is intentionally kept simple to ensure interpretability, potential econometric issues such as heteroscedasticity and within-group correlation are considered in supplementary analyses. Addressing these aspects helps ensure that the estimated relationships are not sensitive to standard violations of classical regression assumptions.

Subcategory and temporal analysis
To explore heterogeneity, separate regressions are estimated for selected product subcategories. This approach allows identification of category-specific sensitivity to returns and provides insight into structural differences within the retail assortment.

In addition, year-specific regressions are conducted to evaluate whether the profitability impact of returns changes over time. Temporal analysis enables examination of dynamic adaptation processes and potential organizational learning effects. Comparing coefficients across years offers an indication of whether the financial consequences of returns are stable or evolving.

Construction of return-adjusted profitability measures
Beyond regression modelling, return-adjusted sales and margin indicators are constructed by excluding transactions flagged as returned. The adjusted margin is calculated as adjusted profit divided by adjusted sales. Comparing theoretical and return-adjusted margins provides a descriptive estimate of potential overestimation when returns are ignored.

This framework is intentionally simple and does not require additional cost allocations beyond the recorded transactional data. Its practical relevance lies in its feasibility for implementation within standard accounting or enterprise resource planning systems.

It is important to note that the adjusted profitability measures do not incorporate additional costs associated with reverse logistics processes, such as handling, transportation, inspection, or refurbishment of returned products. As a result, the estimated impact of returns on profitability may be conservative, as the full economic cost of returns is likely to be higher than what is captured by transaction-level profit data alone. Despite this limitation, the simplified framework remains useful for illustrating how return-related adjustments can improve the accuracy of performance measurement in practical settings.

Robustness checks

To assess the reliability of the regression results, several robustness checks are conducted.
First, potential heteroscedasticity is considered, given the cross-sectional nature of transaction-level data. Although the baseline models are estimated using ordinary least squares, additional estimations using heteroscedasticity-robust standard errors yield qualitatively similar results, suggesting that the main findings are not driven by unequal variance in the error terms.

Second, to account for potential correlation within product categories, standard errors are clustered at the subcategory level. This adjustment allows for more conservative inference by relaxing the assumption of independent error terms across observations within the same category. The results remain consistent in terms of sign and statistical significance.

Third, alternative model specifications are estimated by excluding extreme observations and testing different functional forms of the dependent variable. These variations do not materially affect the direction or magnitude of the estimated coefficients, reinforcing the robustness of the main conclusions.
Overall, these checks provide additional confidence that the observed relationship between product returns and profitability is not driven by model specification or statistical artefacts.

4. Results and Discussion

While the overall patterns are relatively clear, some results require more careful interpretation and may reflect underlying differences that are not directly observable in the dataset. This section presents the main empirical results obtained from the data. The focus is on straightforwardly describing the observed patterns, before turning to their interpretation in the next section.

Descriptive evidence and return-adjusted margins

This subsection compares standard profitability indicators with return-adjusted measures to see whether ignoring returns leads to noticeable differences in performance evaluation.

Table 1 reports summary statistics for sales, profit, return rates, and margin measures. The overall return rate in the sample is 3.26%, which does not seem particularly high at first glance. However, when comparing the theoretical margin (based on all transactions) with the adjusted margin (excluding returned transactions), a small but consistent difference appears.

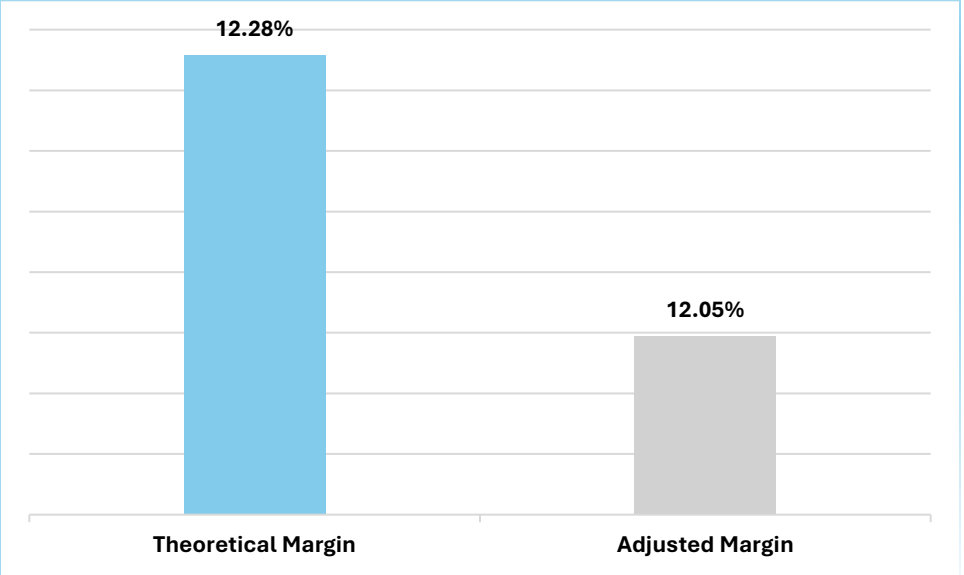
Table 1: Descriptive statistics and return-related metrics

Variable	Value
Nº transacciones	29.911
Ventas totales	7.116.072
Beneficio total	853.608
Nº devoluciones	976
% devoluciones	3,26%
Margen teórico (%)	12,28%
Margen ajustado (%)	12,05%

Note: Adjusted margin excludes transactions corresponding to returned orders.

Figure 1 shows this gap visually. Although the difference is not large in absolute terms, it points in the same direction: conventional margin indicators tend to slightly overstate profitability when returns are not taken into account.

Figure 1: Comparison between theoretical and adjusted margins



Subcategory heterogeneity

Looking only at aggregate figures can hide important differences across product types. Table 2, therefore, breaks down return rates and margin differences by subcategory.

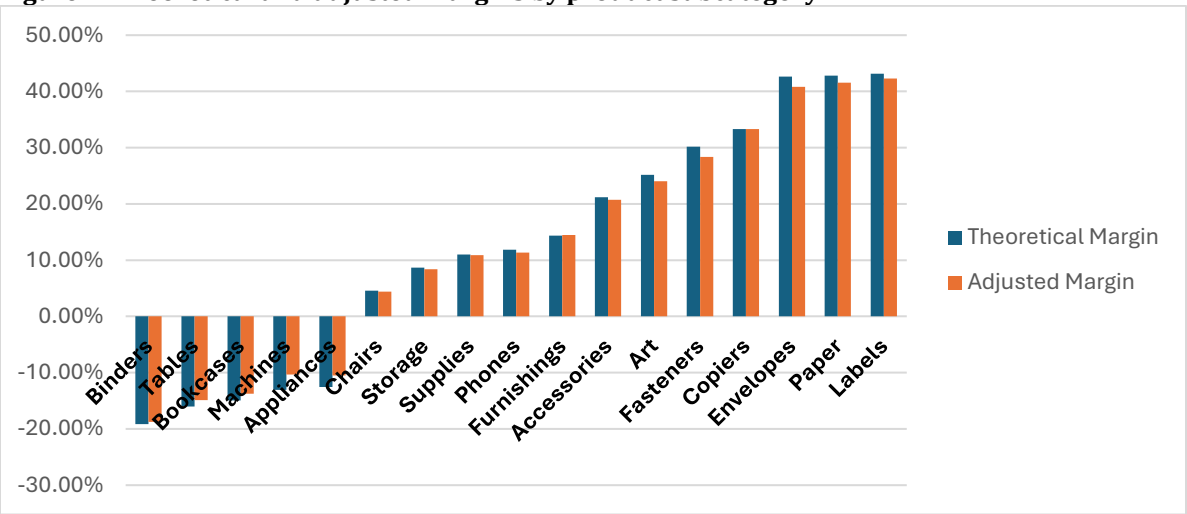
Table 2: Impact of product returns on profitability by subcategory.

Subcategory	% Returns	Theoretical Margin	Adjusted Margin	Δ Margin
Accessories	2,74%	21,20%	20,71%	-0,49%
Appliances	2,80%	-12,53%	-10,51%	2,02%
Art	4,29%	25,16%	24,03%	-1,12%
Binders	2,65%	-19,15%	-18,72%	0,43%
Bookcases	4,39%	-14,94%	-13,76%	1,18%
Chairs	2,94%	4,56%	4,40%	-0,16%
Copiers	0,00%	33,30%	33,30%	0,00%
Envelopes	4,77%	42,62%	40,81%	-1,81%
Fasteners	5,06%	30,19%	28,37%	-1,82%
Furnishings	3,60%	14,34%	14,47%	0,13%
Labels	2,16%	43,14%	42,28%	-0,86%
Machines	5,74%	-13,07%	-10,33%	2,74%
Paper	2,93%	42,82%	41,57%	-1,26%
Phones	3,65%	11,87%	11,33%	-0,54%
Storage	3,32%	8,66%	8,41%	-0,25%
Supplies	2,10%	11,01%	10,87%	-0,15%
Tables	3,89%	-16,02%	-14,87%	1,15%
Total general	3,26%	12,28%	12,05%	-0,23%

Note: Margin difference expressed in percentage points (pp).

Figure 2 provides a visual comparison across categories. What stands out is that the impact of returns is far from uniform. Some subcategories—such as Envelopes, Fasteners, and Art—show more noticeable reductions in adjusted margins. In contrast, categories like Chairs, Storage, and Supplies display only minor differences. These patterns suggest that the financial effect of returns depends, at least to some extent, on the characteristics of each product category.

Figure 2: Theoretical and adjusted margins by product subcategory



Regression results

To go beyond descriptive comparisons, transaction-level regression models are estimated. These models examine how returns relate to profit while controlling for sales value, discounts, and quantities sold.

Table 3: Impact of product returns on profit by subcategory.

Subcategory	β_return	Standard error	p-value	n	R^2
Accessories	−26,82	6,01	0,0000085	2.296	0,801
Appliances	−59,09	12,19	0,0000014	1.394	0,757
Art	−2,60	0,57	0,000006	2.308	0,806
Binders	12,42	22,4	0,579	4.484	0,377
Chairs	9,57	11,11	0,389	1.838	0,668

Note: Coefficients represent the marginal effect of a return on profit per transaction. Linear regressions are estimated controlling for sales, discount, and quantity sold.

In several sub-categories, the return indicator is negative and statistically significant, indicating that returned transactions are associated with lower profitability. However, this is not the case everywhere. In some categories, such as Binders and Chairs, the effect is not statistically significant once other factors are taken into account.

Interaction model

To explore differences across product types more formally, a pooled regression model with interaction terms between returns and product subcategories is estimated.

Table 4: Interaction model between returns and product subcategory.

Variables	Coefficient	Standard error	p-value
Return (Base category: Art)	−54,96	—	< 0,001
Return × Accessories	37,9	—	0,189
Return × Appliances	28,13	—	0,435
Return × Binders	53,61	—	0,014
Return × Chairs	68,34	—	0,027

Note: The base category is Art. The total effect of a return for each subcategory is obtained as the sum of the base Return coefficient and the corresponding interaction term.

The results show that the effect of returns varies across subcategories. The total effect for each category depends on both the base coefficient and the corresponding interaction term.

Temporal analysis

Finally, the analysis looks at how the impact of returns evolves using year-specific regressions.

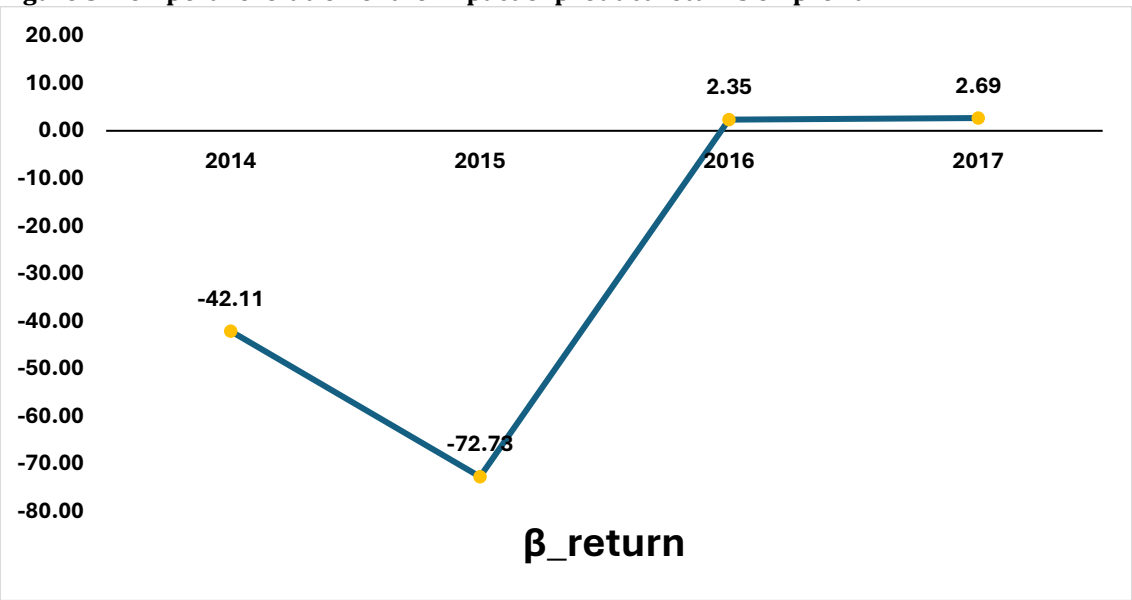
Table 5: Impact of product returns on profit by year.

Year	β_return	Standard error	p-value	n	R^2
2014	−42,11	15,66	0,007	6.009	0,073
2015	−72,73	9,62	< 0,001	6.372	0,27
2016	2,35	12,73	0,854	7.709	0,487
2017	2,69	15,51	0,862	9.820	0,331

Note: Coefficients represent the marginal effect of a return on profit per transaction. Regressions are estimated separately for each year, controlling for sales, discount, and quantity sold.

The results differ across years. In earlier periods, returns are associated with a negative effect on profit, while in later years the estimated effect becomes smaller and, in some cases, statistically insignificant.
Figure 3 illustrates this change over time.

Figure 3: Temporal evolution of the impact of product returns on profit.



Together, the evidence from Table 5 and Figure 3 indicates that the financial impact of returns is dynamic rather than constant. Taken together, the results suggest that product returns do affect retail profitability, although not always in the same way or to the same extent. One of the clearest findings is that even relatively modest return rates can lead to small but consistent differences in measured margins. While these differences may seem minor at first, they can become relevant when aggregated across large volumes of transactions.

At the same time, the results make it clear that the impact of returns is not uniform. Some product categories appear to be more sensitive than others, which likely reflects differences in pricing, margins, and product characteristics. This also helps explain why aggregate indicators can sometimes hide underlying issues.
The regression analysis adds another layer of evidence by showing that returns are linked to lower profitability even after accounting for basic transaction characteristics. Still, not all the variation is explained by the model, which suggests that other factors—such as product quality, customer behavior, or operational processes—may also be influencing the results.

Looking at the time dimension, the impact of returns seems to weaken in later years. One possible explanation is that firms gradually adjust their practices, either by improving return management or by adapting pricing and product strategies. However, this cannot be confirmed directly with the available data. From a practical point of view, the results highlight a simple issue: standard performance indicators do not always tell the full story. This may be particularly relevant in emerging retail environments, including many African contexts, where analytical systems are still developing and may rely heavily on aggregated metrics.

Beyond the descriptive interpretation of the results, several broader analytical implications emerge.
From a performance measurement perspective, the findings highlight a systematic misalignment between reported financial indicators and realized economic outcomes. This interpretation aligns with accounting theory, which emphasizes that performance metrics should accurately reflect underlying transactions. When returns are not fully incorporated into profitability measures, managers may rely on indicators that overstate effective margins, potentially leading to suboptimal decision-making.

From a behavioral standpoint, the results also support insights from agency theory. If managerial performance is evaluated based on unadjusted sales or margin indicators, there may be incentives to prioritize strategies that increase nominal sales while disregarding return risk. This may help explain why categories with relatively high return sensitivity can still appear attractive in standard performance reports.

In addition, the observed heterogeneity across product subcategories is consistent with contingency theory, suggesting that the impact of returns depends on contextual factors such as product characteristics, pricing structures, and demand uncertainty. This reinforces the idea that uniform performance metrics may not adequately capture category-specific risks.

The temporal variation observed in the results may also reflect processes of organizational adaptation. Over time, firms may adjust pricing strategies, improve product information, or refine return management practices, thereby reducing the negative financial impact of returns. Although this mechanism cannot be directly tested within the present study, it provides a plausible explanation for the diminishing effect observed in later periods. Overall, these interpretations suggest that product returns should be understood not only as operational events but as economically relevant factors that influence both measurement accuracy and managerial behavior within retail organizations.

These considerations may be particularly relevant in developing retail environments, where analytical capabilities and access to detailed data are often more limited. In such contexts, the use of simplified performance indicators without appropriate adjustments may lead to greater distortions in profitability assessment.

5. Conclusion, Recommendations and Policy Implications

This study examined the impact of product returns on profitability measurement in retail environments and proposed a return-adjusted analytical framework based on transaction-level data. The findings demonstrate

that ignoring returned transactions leads to systematic overestimation of profitability, even when overall return rates appear relatively moderate. This suggests that conventional accounting-based indicators may not fully reflect realized economic performance when transaction reversals are not explicitly incorporated.

The empirical results further show that the financial impact of product returns is heterogeneous across product subcategories and evolves. In several categories, returns significantly reduce transaction-level profitability even after controlling for key commercial variables such as sales value, discount intensity, and quantity sold. The temporal analysis indicates that the negative effect of returns may decline over time, potentially reflecting organizational learning and operational adaptation.

These findings highlight the importance of aligning performance measurement systems with underlying transactional realities. In retail environments characterized by high transaction volumes and competitive pricing structures, even small distortions in margin indicators may translate into substantial financial implications. This is particularly relevant in retail environments where performance measurement practices are still evolving and may rely on simplified reporting structures.

At the same time, the results should be interpreted with some caution. The magnitude of the observed effects is not uniform, and in some cases, relatively modest, which suggests that the economic relevance of returns may depend on specific operational contexts. From a practical perspective, the study provides a simple and implementable framework for improving profitability assessment. By incorporating return-adjusted indicators into routine financial reporting, retail managers can obtain a more accurate representation of economic performance and reduce measurement bias. This, in turn, supports more informed decision-making regarding pricing strategies, promotional policies, and assortment planning.

Recommendations

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

First, retail organizations should integrate return-adjusted profitability indicators into their standard performance measurement systems. Managers should complement conventional sales and margin metrics with adjusted measures that explicitly exclude or account for returned transactions.

Second, category-level analysis should be prioritized. Given the heterogeneity observed across product subcategories, retailers should monitor return-adjusted margins at a disaggregated level to identify segments that are particularly vulnerable to return-related profit erosion.

Third, pricing and promotional strategies should be aligned with return behavior. In categories with high return sensitivity, retailers may consider adjusting pricing structures, limiting excessive discounting, or improving product information to reduce avoidable returns.

Fourth, retail firms should invest in improving data systems and analytical capabilities. Even in resource-constrained environments, the use of transaction-level data and basic analytical tools can significantly enhance the accuracy of financial reporting and managerial decision-making.

Fifth, policymakers and stakeholders in emerging retail markets, particularly in African economies, should support the adoption of data-driven performance measurement practices. Strengthening analytical capabilities within retail sectors can contribute to improved financial transparency, more efficient resource allocation, and overall sector development.

In conclusion, product returns should not be treated merely as operational events but as measurable determinants of financial performance. Incorporating return-adjusted indicators into routine performance evaluation systems represents a practical and effective step towards improving profitability measurement and strengthening managerial decision-making in modern retail environments.

Finally, continuous monitoring is essential. Return behavior and profitability dynamics may evolve due to changes in consumer preferences, competitive conditions, or operational improvements. Periodic recalculation

of return-adjusted metrics ensures that performance measurement systems remain aligned with economic realities.

Importantly, the proposed framework does not require sophisticated analytical infrastructure. The necessary data elements—sales value, profit, quantity, discount, and return status—are typically available in standard retail databases. Implementation can therefore be achieved using commonly available business intelligence tools or spreadsheet-based reporting systems.

By embedding return-aware metrics into routine financial monitoring, retail organizations can enhance transparency, reduce measurement bias, and support more informed managerial decision-making. The framework presented here demonstrates that improving profitability assessment does not necessarily require complex modelling, but rather systematic utilization of existing transactional information.

Although the empirical analysis is based on a generic retail dataset, the proposed framework is especially relevant for developing retail systems, including those in African economies, where improving the accuracy of performance measurement can contribute to more effective decision-making and sector development.

Policy Implications

The findings of this study have several implications for policymakers and stakeholders involved in the development of retail sectors, particularly in environments where analytical capabilities are still evolving.

First, promoting the adoption of data-driven performance measurement systems can improve financial transparency and resource allocation within retail markets. Encouraging firms to integrate return-adjusted indicators into standard reporting practices may lead to more accurate assessments of economic performance. Second, supporting the development of logistics infrastructure and return management systems can help reduce the operational costs associated with product returns. Investments in supply chain efficiency and reverse logistics capabilities may therefore contribute to improved profitability and sector competitiveness.

Third, policymakers may consider fostering better consumer information standards and product quality regulations. Reducing uncertainty in purchasing decisions can lower return rates and improve overall market efficiency.

Overall, integrating return-aware performance metrics into both managerial and policy frameworks can support more sustainable development of retail systems.

Limitations and Future Research

Despite the practical contributions of this study, several limitations should be acknowledged.

First, the empirical analysis is based on a single retail transaction dataset covering a specific period and a particular retail context. Although the dataset includes multiple product categories and a substantial number of transactions, the findings may not be directly generalizable to all retail environments. Retail sectors differ significantly in terms of product characteristics, return policies, cost structures, and customer behavior. Future research could apply the return-adjusted profitability framework to alternative retail settings, including online-only retailers, omnichannel systems, or industries with structurally higher return rates, such as fashion or electronics.

Second, the profitability measures employed in this study rely on recorded transaction-level profit and exclude additional indirect costs associated with reverse logistics. The analysis focuses primarily on revenue reversals and reported profit adjustments. However, returns may generate further economic consequences, including inspection costs, repackaging, transportation, inventory holding, depreciation, or disposal expenses. Incorporating detailed reverse logistics cost data could provide a more comprehensive assessment of the total financial impact of returns. Future studies may extend the proposed framework by integrating such cost components into profitability calculations.

This limitation also implies that the empirical results presented in this study may underestimate the total financial impact of product returns. Consequently, the observed effects should be interpreted as a lower bound

of the true economic impact, reinforcing the importance of incorporating more comprehensive cost structures in future research.

Third, the regression analysis identifies statistical associations between returns and profitability while controlling for observable transaction characteristics. However, the design does not establish causal relationships. Returns may be influenced by unobserved variables such as product quality variations, customer characteristics, or marketing strategies that are not fully captured in the dataset. Future research could employ quasi-experimental designs, natural experiments, or policy changes to explore causal mechanisms more rigorously.

Fourth, the temporal analysis suggests a decline in the marginal profitability impact of returns over time, which may indicate organizational adaptation. Nevertheless, the present study does not directly examine the managerial actions or operational changes responsible for this trend. Qualitative research or mixed-method approaches could provide deeper insight into how retailers modify processes, pricing strategies, or return policies in response to return behavior.

Fifth, the study focuses on transaction-level profitability rather than customer-level profitability. Returns may affect customer lifetime value, retention rates, and long-term purchasing behavior. Some customers who frequently return products may still generate substantial lifetime revenue, while others may erode profitability. Future research could integrate customer-level analytics to explore the interaction between return behavior and long-term financial performance.

Finally, the proposed framework is deliberately simple and designed for practical implementation. While this simplicity enhances managerial applicability, more advanced modelling approaches may uncover additional nuances. For example, machine learning techniques or predictive analytics could be employed to forecast return likelihood and incorporate expected return-adjusted margins into forward-looking performance dashboards.

Overall, these limitations provide opportunities for further research aimed at deepening the understanding of the financial implications of product returns. Expanding the analytical scope across sectors, incorporating richer cost data, and exploring dynamic and customer-level effects would contribute to a more comprehensive assessment of return-related profitability in retail environments.

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Foreign Exchange Rate-Trade Balance Nexus in Sub-Saharan Africa

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Abstract: We examine the nexus between foreign exchange rate (FER) and trade balance in Sub-Saharan Africa (SSA). We utilize balanced annual panel data for 20 SSA countries spanning 2005–2024, sourced from the World Bank. To address endogeneity, unobserved country-specific effects, and dynamic panel bias, we apply the Generalized Method of Moments (GMM) estimator. Results reveal significant persistence in trade balance, with the lagged coefficient (0.215576) indicating that about 21.6% of past trade balance conditions persist into the current period, reflecting partial adjustment and structural inertia. Crucially, FER exhibits a negative and statistically significant effect (−0.899849), implying that a 10% depreciation leads to an approximate 9% deterioration in the trade balance, ceteris paribus. This contradicts the Marshall–Lerner condition and underscores the dominance of import dependence, weak export diversification, and structural rigidities in SSA economies. We conclude that currency depreciation is counterproductive to external balance in SSA. We therefore advocate for strong and stable currencies, alongside policies promoting export diversification, domestic production, and structural transformation to achieve sustainable trade balance outcomes.

Keywords: *GMM, Foreign exchange rate, Trade Balance, SSA*

1. Introduction

Sub-Saharan Africa (SSA) has experienced persistent deterioration in its trade balance since the mid-1970s, despite abundant natural resources and a historically vibrant role in global trade. Pre-colonial Africa was a major hub of commerce and food production, sustaining extensive trade networks such as the Trans-Saharan trade, the Trans-Atlantic trade, the Cape route, and long-distance trade along the East African coast. Commodities, including slaves, gold, ivory, spices, textiles, and agricultural produce, dominated exchange, positioning Africa as a critical supplier in the global economy (Austen, 1987; Hopkins, 1973). Historical narratives, even in biblical accounts, depict Africa as a destination for food and resources, underscoring its former productive strength and global relevance (Curtin, 1984). Early mercantilist views further recognized Africa's strategic importance as a source of wealth and raw materials for global accumulation.

However, the post-independence period, particularly from the 1970s onward, marked a structural reversal. The deterioration of trade balances coincided with the adoption of externally driven macroeconomic reforms, notably the International Monetary Fund (IMF) and World Bank-supported Structural Adjustment Programs (SAPs). Central to these reforms was currency devaluation, justified under conventional trade theories such as the Marshall–Lerner condition, which posits that depreciation should improve trade balances by boosting exports and reducing imports (Krugman & Obstfeld, 2009). Yet, in SSA, these policies often produced the opposite effect. Devaluation made imports significantly more expensive for domestic populations while simultaneously rendering local assets and goods disproportionately cheap to foreign actors, effectively enabling external purchasing power to dominate domestic economies. In extreme cases, foreigners could acquire goods and services at a fraction of their real value, reflecting deep distortions in exchange rate regimes and economic sovereignty (Stiglitz, 2002).

Classical trade theories, rooted in the works of Adam Smith and David Ricardo, advocated specialization and comparative advantage as pathways to mutual gains from trade (Smith, 1776; Ricardo, 1817). However, their application in SSA has been constrained by structural rigidities, weak industrial bases, and persistent dependence on primary commodity exports. Rather than fostering competitive export sectors, exchange rate devaluation has often entrenched import dependence and undermined domestic production capacity. Consequently, the expected gains from trade liberalization and currency adjustments have remained elusive.

Despite extensive empirical literature on exchange rates and trade balance, a critical gap persists regarding the dynamic and structural implications of exchange rate movements in SSA. Many studies assume the validity of conventional theoretical frameworks without adequately accounting for Africa's unique economic structure, characterized by low export diversification, high import elasticity, and limited value addition. Furthermore, limited attention has been paid to the persistence effects and dynamic adjustments inherent in trade balance behavior.

We address these gaps by re-examining the foreign exchange rate–trade balance nexus in SSA using a dynamic panel framework. By employing the Generalized Method of Moments (GMM) and recent panel data (2005–2024), our study provides robust insights into the extent to which exchange rate movements influence trade outcomes in the region. The rationale is to challenge orthodox policy prescriptions and offer evidence-based alternatives that prioritize structural transformation, currency stability, and economic sovereignty. In doing so, we contribute to a growing body of literature advocating for a rethinking of exchange rate policy in Africa, not merely as a tool for price adjustment, but as a central pillar of sustainable development and external sector resilience.

2. Literature Review

Empirical evidence at the global level presents mixed findings on the exchange rate–trade balance relationship. Studies such as Rose (1991) and Bahmani-Oskooee & Niroomand (1998) find limited support for the Marshall–Lerner condition in the short run but stronger effects in the long run. Similarly, the J-curve effect has been widely observed in developed and emerging economies, though its magnitude and timing vary significantly across countries (Bahmani-Oskooee & Ratha, 2004). Conversely, some studies report that exchange rate depreciation may worsen trade balances, particularly in economies with high import dependence and inelastic demand structures (Arize et al., 2000). These findings suggest that structural factors, rather than price effects alone, play a critical role in determining trade outcomes.

In SSA, empirical literature largely challenges conventional theory. Studies by Edwards (1988) and Elbadawi (1994) highlight that exchange rate devaluation under Structural Adjustment Programs often failed to generate sustained improvements in trade balances. Instead, many SSA economies experienced worsening external positions due to their heavy reliance on imports and limited export diversification.

More recent studies, such as Bahmani-Oskooee & Gelan (2012) and Onafowora (2003), provide evidence that the Marshall–Lerner condition rarely holds in SSA, especially in the short to medium term. Depreciation tends to increase the import bill, particularly for essential goods such as machinery, fuel, and intermediate inputs, thereby offsetting any gains from export competitiveness. Furthermore, weak supply-side responses, infrastructural constraints, and low value addition limit the capacity of SSA countries to expand exports following depreciation.

Country-level studies within SSA reinforce the regional narrative. For instance, studies on countries such as Nigeria, Kenya, and Uganda show that exchange rate depreciation often leads to trade balance deterioration rather than improvement (Agenor, 1991; Musila & Newark, 2003). In Uganda, empirical evidence suggests that the import elasticity is relatively high, while export responsiveness to exchange rate changes remains weak due to structural bottlenecks and limited industrial capacity.

Additionally, IMF and World Bank-driven devaluation policies have been criticized for exacerbating external vulnerabilities. While intended to restore competitiveness, these policies often reduced the real purchasing power of domestic agents while making local assets cheaper for foreign investors, thereby deepening economic dependency (Stiglitz, 2002).

The foreign exchange rate–trade balance nexus is grounded in several competing theoretical perspectives. The elasticity approach, anchored in the Marshall–Lerner condition, posits that currency depreciation improves the trade balance if the sum of export and import demand elasticities exceeds unity (Krugman & Obstfeld, 2009). Closely related is the J-curve hypothesis, which suggests that trade balance initially deteriorates following depreciation before improving over time due to delayed quantity adjustments (Bahmani-Oskooee & Ratha, 2004).

The absorption approach (Alexander, 1952) emphasizes that trade balance outcomes depend on the relationship between national income and domestic absorption (consumption + investment + government expenditure). Under this framework, depreciation only improves the trade balance if it reduces domestic absorption relative to output. Meanwhile, the monetary approach links trade imbalances to disequilibrium in money supply and demand, viewing exchange rate movements as reflections of broader macroeconomic imbalances (Frenkel & Johnson, 1976).

Classical trade theories also provide foundational insights. Adam Smith's theory of absolute advantage and David Ricardo's theory of comparative advantage argue that countries benefit from specialization and trade (Smith, 1776; Ricardo, 1817). However, in SSA, structural rigidities, commodity dependence, and limited industrialization constrain the realization of these theoretical gains. The Structuralist and Dependency theories further challenge orthodox views by arguing that developing economies remain locked into unfavorable trade patterns, exporting primary commodities while importing high-value manufactured goods (Prebisch, 1950; Singer, 1975).

Our study conceptualizes trade balance as a function of mainly the foreign exchange rate, where currency movements influence export competitiveness and import demand. While exchange rate depreciation is generally expected to improve the trade balance, the effect may vary due to structural rigidities and adjustment lags in Sub-Saharan Africa (Bahmani-Oskooee & Ratha, 2004; Onafowora, 2003). To address potential endogeneity arising from reverse causality and omitted variables, the study employs the Generalized Method of Moments (GMM), which provides more reliable and consistent estimates (Arellano & Bond, 1991).

3. Data and Method

We adopt a quantitative, explanatory research design to empirically examine the relationship between foreign exchange rate and trade balance in Sub-Saharan Africa (SSA). The design is appropriate as it enables rigorous testing of theoretical propositions using econometric techniques and facilitates causal inference based on observed macroeconomic relationships. A panel data framework is employed, combining both cross-sectional (countries) and time-series (years) dimensions, which enhances variability, reduces collinearity among variables, and improves estimation efficiency.

We utilize balanced annual panel data for 20 Sub-Saharan African countries over the period 2005–2024. The selection of countries is guided by data availability and consistency across all variables to ensure robustness of estimation. All data are sourced from the World Development Indicators (WDI) database of the World Bank, which provides reliable and internationally comparable macroeconomic data. The key variables are:

The dependent variable is trade balance (TB), measured as exports minus imports in absolute terms (TB = |X - M|), reflects the difference between a country's exports (X) and imports (M) and is a key indicator of a nation's economic health and external sector performance (Krugman et al., 2018; Salvatore, 2016; Nahabwe et al., 2025). The independent variable is Foreign Exchange Rate (FER), Official exchange rate (local currency units per US dollar), capturing currency valuation. (World Bank 2024).

The use of a balanced panel ensures that each country has complete observations across the study period, thereby avoiding biases associated with missing data and enhancing the consistency of results. To capture the dynamic nature of trade balance adjustment, the study specifies a dynamic panel model as follows:

$$TB_{it-1} = \alpha_0 + \alpha_1 TB_{it-1} + \beta_1 FER_{it} + \varepsilon_{it} \quad \ldots\ldots(1)$$

Where:
TB_{it} : Trade balance in country *i* at time *t*
TB_{it-1} : Lagged dependent variable capturing trade balance persistence
FER_{it} : Foreign exchange rate in country *i* at time *t*
ε_{it} : Error term.

TB and FER are first transformed using natural logarithms to enhance econometric reliability and interpretability. Logarithmic transformation compresses large numerical scales and reduces the influence of extreme values, which are common in cross-country macroeconomic data. For instance, while the absolute distance between 10 and 10^{10} is enormous, their logarithmic values differ modestly (from 1 to 10), making relationships more stable and comparable. This transformation also helps linearize potentially nonlinear relationships, mitigate heteroskedasticity, and allows estimated coefficients to be interpreted as elasticities, which is particularly useful for policy analysis in international trade and investment studies (Wooldridge, 2010; Baltagi, 2021).

We employ the Generalized Method of Moments (GMM), specifically the Arellano–Bond difference GMM estimator, to estimate the dynamic panel model. This approach is appropriate for addressing endogeneity arising from reverse causality and simultaneity between trade balance and foreign exchange rate movements (Arellano & Bond, 1991; Roodman, 2009). By utilizing internal instruments based on lagged values of endogenous variables, GMM yields consistent and efficient estimates in the presence of unobserved country-specific effects and measurement errors (Blundell & Bond, 1998). The baseline specification incorporates a lagged dependent variable to capture persistence in trade balance dynamics, alongside the foreign exchange rate as the key explanatory variable.

The empirical analysis proceeds by presenting descriptive statistics, followed by estimation of the dynamic GMM model to identify the effect of exchange rate movements on trade balance. Lagged values of the foreign exchange rate are used as instruments under the assumption of no correlation with the contemporaneous error term, satisfying the orthogonality condition required for identification (Arellano & Bover, 1995; Bowsher, 2002). Estimation is conducted using a two-step GMM framework with robust standard errors to correct for heteroskedasticity and autocorrelation (Wooldridge, 2010). Instrument validity is assessed using the Hansen J-test of over-identifying restrictions, while Arellano–Bond serial correlation tests are applied to confirm model consistency, with careful control of instrument count to avoid proliferation (Roodman, 2009).

GMM estimator is expressed as:

$$\hat{\theta}_{GMM} = \underset{\theta}{\operatorname{argmin}}\left[\frac{1}{n}\sum_{i=1}^{n} g(X_i,\theta)\right]' W_n \left[\frac{1}{n}\sum_{i=1}^{n} g(X_i,\theta)\right] \quad \ldots\ldots (2)$$

Where:

$g(X_i,\theta) = \frac{1}{n}\sum_{i=1}^{n} Z_i' \, \varepsilon_i(\theta)$ is the vector of moment conditions,

W_n : A consistent estimate of the weighting matrix,

θ: Vector of structural parameters (Arellano & Bond 1991; Blundell & Bond 1998).

To ensure the validity and reliability of the estimates, several diagnostic tests are conducted. The Arellano–Bond serial correlation tests (AR(1) and AR(2)) are applied to detect autocorrelation in the differenced residuals (Arellano & Bond, 1991), while the Sargan/Hansen test of over-identifying restrictions assesses the validity of the instruments (Hansen, 1982). Instrument proliferation is carefully controlled to avoid overfitting bias (Roodman, 2009) and robust standard errors are employed to correct for heteroskedasticity (Wooldridge, 2010).

The choice of a dynamic panel GMM framework is motivated by both theoretical and empirical considerations. Theoretically, trade balance adjustment is inherently dynamic, with past outcomes influencing current performance. Empirically, Sub-Saharan African economies exhibit structural rigidities, policy endogeneity, and cross-country heterogeneity, necessitating an estimation technique capable of addressing these complexities. Compared to static panel models, GMM provides more reliable and policy-relevant estimates in the presence of endogenous regressors and persistence effects (Blundell & Bond, 1998), making it well-suited for analyzing the foreign exchange rate–trade balance nexus in the region.

4. Results and Discussion

Descriptive statistics (Appendix 1) reveal important distributional characteristics of the variables. The mean value of the foreign exchange rate (LNFER) is 5.003 with a standard deviation of 2.025, indicating substantial

variability across countries and over time. The trade balance (LNTB) has a mean of 22.787 and a lower standard deviation of 1.315, suggesting relatively moderate dispersion.

Skewness values show that LNFER is slightly negatively skewed (−0.251), while LNTB is positively skewed (0.559), indicating asymmetry in the data. Kurtosis results reveal that LNFER is platykurtic (1.795), whereas LNTB is mildly leptokurtic (3.542), suggesting the presence of extreme values in trade balance observations. The Jarque–Bera statistics for both variables are statistically significant ($p < 0.01$), confirming non-normality. Such deviations from normality are common in macroeconomic panel data, particularly in developing economies characterized by volatility and structural breaks (Baltagi, 2021).

Stationarity properties of trade balance (LNTB) and foreign exchange rate (LNFER) are examined using the Augmented Dickey–Fuller (ADF) unit root test (Appendices 2–6). Results indicate that LNTB and LNFER are non-stationary in levels, as the null hypothesis of a unit root cannot be rejected at conventional significance levels ($p > 0.05$). Upon first differencing, the null hypothesis of a unit root is rejected for both LNTB and LNFER ($p < 0.05$), indicating that they become stationary. Accordingly, both trade balance and foreign exchange rate are found to be integrated of order one, I(1). This common order of integration supports the adoption of a dynamic panel GMM estimator, which is well-suited for handling non-stationary panel data in levels, addressing endogeneity, and capturing dynamic adjustments in macroeconomic relationships (Dickey & Fuller, 1979; Arellano & Bond, 1991; Baltagi, 2021).

Generalized Method of Moments (GMM) model results (Appendix 7)

$\widehat{\text{DLNTB}} = 0.215576 DLNTB_{it-1}$ - 0.8998491DLNFER …….. (3)

Hence,

$$\hat{\theta}_{GMM} = \begin{bmatrix} 0.215576 \\ -0.899849 \end{bmatrix}$$

The dynamic GMM estimation shows that the lagged trade balance is positive and statistically significant, with a coefficient of 0.215576, implying that approximately 21.6% of past trade balance conditions persist into the current period. This confirms the presence of partial adjustment dynamics and inertia in external sector performance, consistent with dynamic trade models (Arellano & Bond, 1991; Roodman, 2009).

The key finding is that the foreign exchange rate (LNFER) has a negative and statistically significant coefficient of −0.899849. This implies that a 10% increase in the exchange rate (currency depreciation) leads to approximately a 9% deterioration in the trade balance, ceteris paribus. This result contradicts the Marshall–Lerner condition, which predicts an improvement in trade balance following depreciation (Krugman & Obstfeld, 2009).

Robustness checks confirm the reliability of the model. Residual diagnostics indicate non-normality, with leptokurtic behavior and a Jarque–Bera probability of 0.00, leading to rejection of the null hypothesis of normality. However, this does not invalidate GMM estimates, as the estimator relies on moment conditions rather than distributional assumptions (Baltagi, 2021; Arellano & Bond, 1991).

The Hansen J-statistic yields a probability value of 0.48, indicating failure to reject the null hypothesis of instrument validity. This confirms that the instruments are exogenous and appropriately specified, mitigating concerns of over-identification (Roodman, 2009).

The Arellano–Bond serial correlation tests show statistically significant first-order autocorrelation (AR(1): $p < 0.05$), which is expected in first-differenced models, and no second-order autocorrelation (AR(2): $p > 0.05$), confirming the consistency of the GMM estimator and the validity of moment conditions (Arellano & Bond, 1991).

The findings provide strong evidence that challenges conventional exchange rate theory. The persistence of trade balance, as indicated by the significant lagged coefficient, is consistent with prior studies emphasizing gradual adjustment and path dependency in trade dynamics (Bahmani-Oskooee & Ratha, 2004).

However, the most novel and striking finding is the negative impact of exchange rate depreciation on trade balance in SSA, which directly contradicts the Marshall–Lerner condition. While standard theory predicts that depreciation enhances export competitiveness and improves trade balance, this study finds that depreciation instead worsens external balances. This aligns with earlier regional evidence suggesting that devaluation policies in Africa have often been ineffective or counterproductive (Edwards, 1988; Elbadawi, 1994).

This outcome can be attributed to structural constraints in SSA economies. First, high import dependence, particularly for essential goods such as fuel, capital equipment, and intermediate inputs, implies that depreciation significantly raises import costs. Second, limited export diversification and weak industrial capacity constrain the ability of these economies to expand exports in response to favorable price changes. Third, inelastic demand structures reduce the responsiveness of both imports and exports to exchange rate movements (Onafowora, 2003; Bahmani-Oskooee & Gelan, 2012).

Unlike many previous studies that focus on short-run dynamics, this study employs a dynamic panel framework over an extended period (2005–2024), demonstrating that the adverse effects of depreciation persist beyond the short run. This supports structuralist and dependency perspectives, which argue that developing economies are constrained by unequal trade structures and external vulnerabilities (Prebisch, 1950; Singer, 1975).

Furthermore, the findings raise critical concerns about the effectiveness of exchange rate policies promoted under Structural Adjustment Programs. While currency devaluation was intended to restore external balance, the evidence suggests that it may have instead exacerbated trade deficits and reinforced economic dependency, particularly in economies with weak productive bases (Stiglitz, 2002).

5. Conclusion and Recommendations

Limitations

Despite the methodological rigor employed, this study is subject to several limitations relating to research design, sample selection, data, and analytical procedures.

First, the study adopts a quantitative panel design, which, while suitable for identifying empirical relationships, limits deeper institutional and country-specific insights. The heterogeneity of Sub-Saharan African (SSA) economies arising from differences in policy regimes, resource endowments, and structural conditions may not be fully captured within a generalized panel framework (Baltagi, 2021). Consequently, important contextual nuances could be overlooked.

Secondly, the sample is restricted to 20 SSA countries due to data availability and consistency requirements. Although the use of a balanced panel enhances estimation reliability, it potentially introduces sample selection bias, as countries with incomplete data, often fragile or conflict-affected economies, are excluded. This may limit the generalizability of the findings across the entire SSA region.

Thirdly, the study relies on secondary data from the World Development Indicators, which, despite being widely and standardized, may suffer from measurement errors, data revisions, and reporting inconsistencies across countries. Additionally, the use of aggregate macroeconomic indicators may mask sectoral dynamics, particularly differences between commodity and non-commodity trade.

Fourthly, while the Generalized Method of Moments (GMM) estimator effectively addresses endogeneity and dynamic panel bias, it is not without limitations. Results can be sensitive to instrument selection and proliferation, potentially weakening the power of over-identification tests such as the Hansen test (Roodman, 2009). Although efforts were made to control instrument count, some degree of finite-sample bias may persist.

Fifthly, the model specification, though theoretically grounded, may be subject to omitted variable bias. Factors such as institutional quality, trade policies, and global shocks such as commodity price fluctuations or financial crises were not explicitly modeled, yet they may significantly influence trade balance outcomes (Arellano & Bond, 1991).

Finally, the assumption of homogeneous slope coefficients across countries may be restrictive, given the structural diversity of SSA economies. The impact of exchange rate movements on trade balance may vary across countries depending on their level of development, export structure, and policy frameworks.

Conclusion

We re-examine the foreign exchange rate–trade balance nexus in Sub-Saharan Africa (SSA) within a dynamic and structurally grounded framework. Moving beyond conventional theoretical assumptions, we demonstrate that exchange rate movements in SSA operate within a context shaped by deep structural constraints, including persistent import dependence, weak productive capacity, and limited export diversification (Edwards, 1988; Elbadawi, 1994; Onafowora, 2003). As such, the effectiveness of exchange rate adjustments cannot be understood in isolation from these underlying economic realities.

The overarching conclusion is that exchange rate policy, as traditionally prescribed, has not functioned as a reliable instrument for correcting external imbalances in SSA. Instead, the interaction between currency dynamics and structural vulnerabilities has often reinforced existing trade deficits rather than alleviating them (Stiglitz, 2002; Bahmani-Oskooee & Gelan, 2012). This underscores the inadequacy of relying solely on price-based adjustment mechanisms in economies where supply-side rigidities and external dependencies dominate.

Accordingly, our study highlights the need for a paradigm shift in policy orientation from exchange rate-centered adjustment strategies toward a broader development approach anchored in structural transformation (Prebisch, 1950; Singer, 1975). Sustainable improvement in trade balance requires strengthening domestic production systems, enhancing value addition, and fostering export competitiveness within diversified sectors. In this regard, exchange rate stability rather than persistent depreciation emerges as a more supportive macroeconomic condition for long-term external sector resilience (Krugman & Obstfeld, 2009; Baltagi, 2021).

Ultimately, our study contributes to the ongoing debate by emphasizing that the trade balance challenge in SSA is fundamentally structural rather than merely monetary. Addressing it demands coordinated policy efforts that integrate exchange rate management with industrial, trade, and institutional reforms aimed at restoring Africa's productive capacity and repositioning it within the global economy (Elbadawi, 1994; Stiglitz, 2002).

Recommendations

Based on the findings of our study, several recommendations are proposed to guide policy, programmatic interventions, and future research in Sub-Saharan Africa (SSA):

Given that depreciation worsens trade balances in SSA, policymakers should focus on maintaining a stable and credible exchange rate regime. Stability reduces external vulnerability, mitigates inflationary pressures, and fosters investor confidence (Edwards, 1988; Stiglitz, 2002).

Governments should implement strategies to diversify exports beyond primary commodities, including incentives for manufacturing, agro-processing, and value-added industries. Diversification enhances resilience against external shocks and reduces over-reliance on volatile global markets (Prebisch, 1950; Onafowora, 2003).

Strategic import substitution policies and development of domestic production capabilities should be encouraged to reduce reliance on imported essential goods, which amplifies trade balance vulnerability during currency depreciation (Elbadawi, 1994).

Exchange rate management should be complemented by reforms targeting industrialization, infrastructure, and institutional capacity. A holistic approach strengthens competitiveness, mitigates structural rigidities, and enhances long-term trade performance (Singer, 1975; Krugman & Obstfeld, 2009).

Governments and development agencies should promote programs that add value to raw exports locally, thereby increasing foreign exchange earnings and improving trade balance sustainability.

Encouraging intra-regional trade through frameworks like the African Continental Free Trade Area (AfCFTA) can reduce external dependency, expand markets for locally produced goods, and buffer the impact of exchange rate fluctuations.

Programs targeting small and medium enterprises with technical assistance, financing, and market access support can foster export competitiveness and reduce reliance on imported goods.

Future research could conduct in-depth, country-level studies to account for heterogeneity in economic structures, policy frameworks, and institutional quality across SSA. Investigating how exchange rate fluctuations affect specific sectors and commodity exports will provide granular insights for targeted policy interventions. Research assessing the long-term impact of industrial, trade, and institutional reforms on the trade balance and exchange rate dynamics could guide sustainable policy design.

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APPENDICES

Appendix 1: Descriptive statistics

	LNFER	LNTB
Mean	5.003224	22.78683
Median	6.100319	22.72746
Maximum	8.452155	26.52293
Minimum	1.061114	20.05782
Std. Dev.	2.025074	1.315174
Skewness	-0.250653	0.558564
Kurtosis	1.795181	3.541903
Jarque-Bera	28.3816	25.69394
Probability	0.000001	0.000003
Sum	2001.29	9114.733
Sum Sq. Dev.	1636.269	690.1437
Observations	400	400

Appendix 2: Unit root test, LNTB (in Level)

Panel unit root test: Summary
Series: LNTB
Date: 04/07/26 Time: 14:46
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.36325	0.0004	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.78989	0.2148	20	360
ADF - Fisher Chi-square	50.4277	0.1249	20	360
PP - Fisher Chi-square	58.0121	0.0326	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Unit root test, LNTB (in first difference)

Panel unit root test: Summary
Series: D(LNTB)
Date: 04/07/26 Time: 14:47
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.17086	0.0000	20	340
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.35184	0.0000	20	340
ADF - Fisher Chi-square	112.028	0.0000	20	340
PP - Fisher Chi-square	146.681	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 4: Unit root test, LNFER (in Level)

Panel unit root test: Summary
Series: LNFER
Date: 04/07/26 Time: 14:48
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	1.56496	0.9412	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	5.34094	1.0000	20	360
ADF - Fisher Chi-square	14.7314	0.9999	20	360
PP - Fisher Chi-square	8.31841	1.0000	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 5: Unit root test, LNFER (in first difference)

Panel unit root test: Summary
Series: D(LNFER)
Date: 04/07/26 Time: 14:48
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.56359	0.0000	20	340
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.43966	0.0000	20	340
ADF - Fisher Chi-square	113.624	0.0000	20	340
PP - Fisher Chi-square	130.304	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 6: Generalized Method of Moments (GMM) model results

Dependent Variable: D(LNTB)
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 04/07/26 Time: 15:00
Sample (adjusted): 2008 2024
Periods included: 17
Cross-sections included: 20
Total panel (balanced) observations: 340
White period (period correlation) instrument weighting matrix
White period (cross-section cluster) standard errors & covariance (d.f. corrected)
Standard error and t-statistic probabilities adjusted for clustering
Instrument specification: @DYN(D(LNTB),-2) (-1)
Constant added to instrument list.

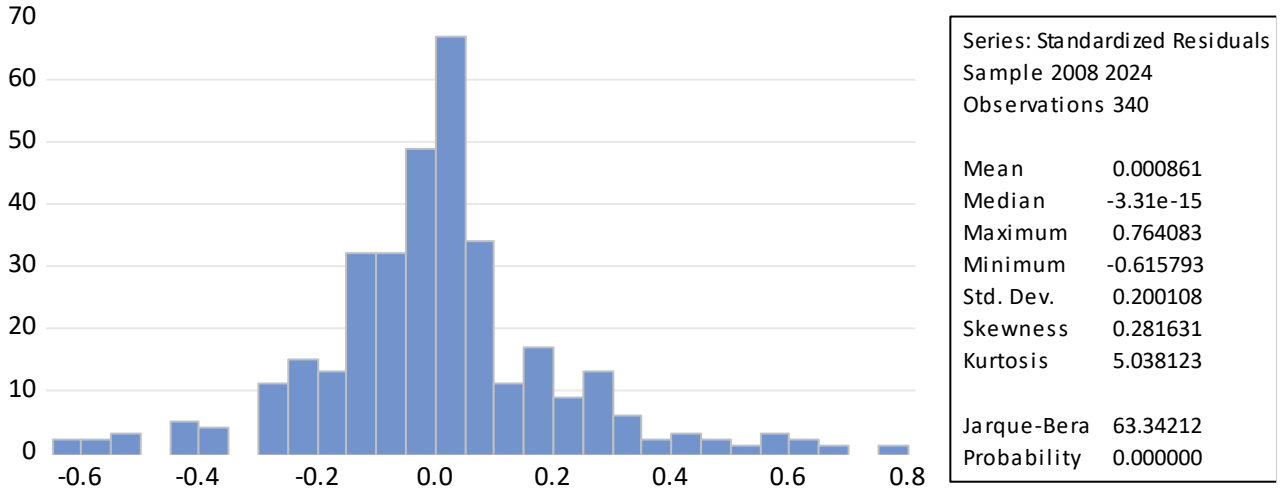
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNTB(-1))	0.215576	0.016977	12.69836	0.0000
D(LNFER)	-0.899849	0.085609	-10.51115	0.0000

Effects Specification

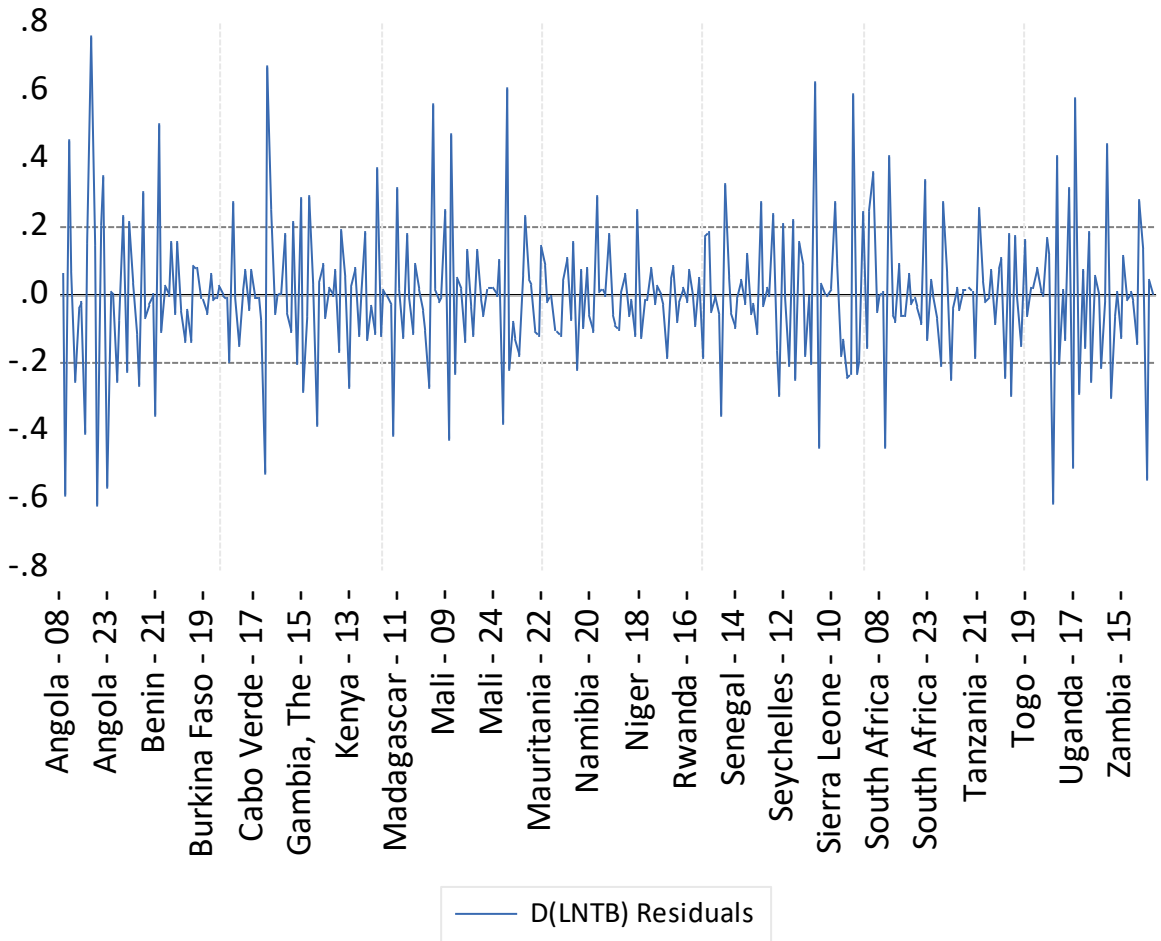
Cross-section fixed (first differences)

Mean dependent var	-0.003348	S.D. dependent var	0.206568
S.E. of regression	0.200405	Sum squared resid	13.57486
J-statistic	17.63408	Instrument rank	20
Prob(J-statistic)	0.479992		

Appendix 7: Normality test



Appendix 8: Graph of residuals



Appendix 9: Serial Correlation Test

Arellano-Bond Serial Correlation Test
Equation: EQ01
Date: 04/07/26 Time: 15:02
Sample: 2005 2024
Included observations: 340

Test order	m-Statistic	rho	SE(rho)	Prob.
AR(1)	-3.331784	-5.580599	1.674958	0.0009
AR(2)	-0.958727	-1.396052	1.456151	0.3377

Appendix 10: List of Sub-Saharan Africa countries in the study

Angola	Gambia, The	Mauritania	Senegal	Tanzania
Benin	Kenya	Namibia	Seychelles	Togo
Burkina Faso	Madagascar	Niger	Sierra Leone	Uganda
Cabo Verde	Mali	Rwanda	South Africa	Zambia

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Foreign Direct Investment–Trade Balance Nexus in Sub-Saharan Africa

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Abstract: We investigate the nexus between foreign direct investment (FDI) and trade balance in Sub-Saharan Africa (SSA). We employ balanced annual panel data for 20 SSA countries spanning the period 2005–2024, sourced from the World Development Bank. To address potential endogeneity, unobserved heterogeneity, and dynamic panel bias, we utilize the Generalized Method of Moments (GMM) estimator. Empirical results reveal that both lagged trade balance and FDI exert a positive and statistically significant influence on the current trade balance. The coefficient of the lagged trade balance (0.2617) indicates partial adjustment dynamics, suggesting that approximately 26.2% of past trade balance conditions persist into the current period. Furthermore, the FDI coefficient (0.1035) implies that a 10% increase in FDI inflows leads to an estimated 1.03% improvement in the trade balance, ceteris paribus. The findings underscore the critical role of FDI in strengthening external sector performance in SSA by enhancing export capacity, improving productive efficiency, and alleviating foreign exchange constraints. We conclude that FDI is a significant driver of trade balance sustainability in the region. We recommend policies aimed at attracting export-oriented FDI, enhancing domestic absorptive capacity through strategic investments in human capital and infrastructure, and implementing complementary trade and industrial policies to maximize FDI spillovers.

Keywords: *Generalized Method of Moments, Foreign direct investment, Trade Balance*, *Sub-Saharan Africa*

1. Introduction

Sub-Saharan Africa (SSA) has historically occupied a central position in global production and trade, often characterized as a region of abundance and resource richness. Early historical and religious accounts portray parts of SSA, particularly Ancient Egypt, Ethiopia, and Sudan, as vital food baskets that sustained surrounding regions. Biblical narratives frequently reference the migration of peoples, including the Jews, to these areas in search of food during periods of famine (Genesis 41–47). Beyond religious texts, Africa's prominence in global commerce was reinforced through major historical trade systems such as the Trans-Saharan Trade and the Trans-Atlantic Trade, through which commodities, including slaves, gold, ivory, spices, textiles, and agricultural products, flowed to Europe, the Middle East, and the Americas (Austen, 2010; Hopkins, 2019).

Early economic thought further reinforced the perception of Africa as a region of immense wealth and opportunity. Mercantilism viewed Africa as a critical source of raw materials necessary for European industrial expansion. Similarly, Adam Smith, in his book The Wealth of Nations, acknowledged the natural endowments of Africa, emphasizing the importance of trade, specialization, and openness in harnessing such abundance (Smith, 1776). Collectively, these perspectives framed SSA as a region with strong potential for sustained trade surpluses and global competitiveness.

However, this historical narrative sharply contrasts with contemporary realities. Since the mid-1970s, most SSA economies have experienced a persistent deterioration in their trade balances, characterized by rising import dependence, limited export diversification, and vulnerability to external shocks (UNCTAD, 2019; World Bank, 2024). This paradox of a resource-rich region facing chronic external imbalances raises critical questions about the structural drivers of trade performance in SSA.

Foreign direct investment (FDI) has emerged as a key factor in shaping external sector outcomes, given its potential to enhance productive capacity, facilitate technology transfer, and promote export-oriented industrialization. While existing empirical studies have examined the relationship between FDI and trade, the evidence for SSA remains inconclusive and fragmented, with limited focus on dynamic interactions and endogeneity concerns. Moreover, few studies comprehensively analyze the FDI–trade balance nexus using recent data and robust econometric techniques across a broad sample of SSA countries.

We address these gaps by examining the dynamic relationship between FDI and trade balance in SSA using a panel of 20 countries over the period 2005–2024. By employing the Generalized Method of Moments (GMM) framework, we provide more reliable estimates that account for endogeneity and country-specific effects. Our findings are expected to offer important policy insights on how SSA economies can leverage FDI to restore external balance, enhance export performance, and achieve sustainable economic development.

2. Literature Review

The relationship between FDI and trade balance has attracted extensive debate in international economics. Traditional theory suggests that FDI can either complement or substitute trade flows. On one hand, export-oriented FDI enhances production capacity and promotes exports, thereby improving trade balance (Markusen & Venables, 1999). On the other hand, market-seeking FDI may increase imports through intermediate inputs and profit repatriation, potentially worsening the trade balance (Blonigen, 2001).

Empirical evidence remains mixed. Studies such as those by Borensztein et al. (1998) find that FDI contributes positively to growth and export performance when host countries possess sufficient human capital. Conversely, Aizenman & Noy (2006) highlight a bidirectional relationship between FDI and trade, suggesting that the net effect on trade balance depends on the structure and orientation of FDI. More recent studies emphasize the role of absorptive capacity, institutional quality, and sectoral allocation of FDI in determining its trade effects (Alfaro et al., 2010). These findings indicate that the FDI–trade balance nexus is context-specific and influenced by structural characteristics of host economies.

In SSA, the literature points to structural constraints that limit the effectiveness of FDI in improving trade outcomes. FDI inflows into SSA have historically been concentrated in extractive industries, particularly oil and minerals, which generate limited export diversification and weak linkages with domestic economies (UNCTAD, 2019). As a result, the potential of FDI to improve trade balance remains underutilized.

Empirical studies in SSA provide inconclusive results. For instance, Asiedu (2002) finds that while FDI inflows to Africa are influenced by market size and natural resources, their impact on trade performance is limited. Ndikumana & Verick (2008) argue that FDI in SSA often leads to enclave economies with minimal spillover effects. However, recent evidence suggests that FDI directed toward manufacturing and services can positively influence export performance and reduce trade deficits (Abbes et al., 2015). These divergent findings highlight the importance of sectoral composition and policy environment in shaping the FDI–trade balance relationship in SSA.

Country-level studies within SSA further underscore the heterogeneity of the FDI–trade balance nexus. In Uganda, studies indicate that FDI has contributed to export growth in sectors such as telecommunications and agro-processing, although its impact on the overall trade balance remains limited due to high import dependence (Ssemanda, 2025). Similarly, research in Nigeria shows that FDI inflows into the oil sector have not significantly improved the trade balance due to volatility in global oil prices and import-intensive production structures (Akinlo, 2004).

In Kenya, findings suggest that FDI in manufacturing has modestly enhanced export diversification, yet persistent trade deficits remain due to structural inefficiencies (Saddimbah, 2014). These country-specific studies reveal that while FDI has the potential to improve trade outcomes, its effectiveness is often constrained by weak industrial bases, limited value addition, and inadequate infrastructure.

Our study is anchored in three key theoretical perspectives: Firstly, the Eclectic Paradigm (OLI Framework) developed by John Dunning explains FDI flows based on Ownership, Location, and Internalization advantages (Dunning, 1991). This theory suggests that countries with abundant natural resources and favorable investment climates attract FDI, which can influence trade patterns.

Secondly, the Dependency Theory posits that developing countries, including those in SSA, are integrated into the global economy in a manner that perpetuates dependence on primary commodity exports and foreign capital, limiting their ability to achieve favorable trade balances (Prebisch, 1962; Frank, 1967).

Thirdly, the Export-Led Growth Theory argues that increased investment, including FDI, can stimulate export expansion, enhance productivity, and improve trade balance (Balassa, 1978). This theory is particularly relevant in assessing whether FDI contributes to export-oriented industrialization in SSA.

The conceptual framework of this study posits that trade balance is mainly influenced by foreign direct investment. FDI is expected to affect the trade balance through multiple channels, including increased production capacity, technology transfer, export promotion, and import substitution. The framework, therefore, assumes a dynamic relationship, where past trade balance also influences current outcomes, justifying the inclusion of lagged dependent variables in the empirical model.

Despite extensive literature, significant gaps remain. Firstly, many studies focus on either trade or FDI independently, with limited emphasis on their dynamic interaction. Secondly, existing studies on SSA often rely on static estimation techniques that fail to address endogeneity. Thirdly, there is limited cross-country evidence incorporating recent trends and structural changes in SSA economies.

Our study contributes to the literature by employing recent panel data (2005–2024) and a dynamic GMM approach to provide robust evidence on the FDI–trade balance nexus in SSA. It further integrates theoretical insights with empirical analysis to offer policy-relevant conclusions for improving external sector performance.

3. Data and Method

We employ a quantitative, longitudinal research design based on panel data econometrics to investigate the dynamic relationship between FDI and trade balance in SSA. A panel design is appropriate because it captures both cross-country heterogeneity and temporal dynamics, thereby improving efficiency and reducing omitted variable bias (Baltagi, 2021).

We utilize balanced annual panel data for 20 SSA countries covering the period 2005–2024. Data are sourced from the World Bank's World Development Indicators (WDI), which ensures consistency, comparability, and reliability across countries. The selection of this period is motivated by the need to capture recent trends in FDI inflows, globalization, and trade performance in SSA.

The sample consists of 20 SSA countries (Appendix 9) selected using purposive sampling based on data availability and completeness for all variables over the study period. This approach ensures a balanced panel structure, which enhances the reliability of dynamic panel estimators and avoids biases associated with missing data (Wooldridge, 2010; Nahabwe & Kagarura, 2026). Although purposive sampling limits generalizability to all SSA countries, it is justified by the need for consistent time-series observations across countries.

Data for all variables are obtained from the World Development Indicators (WDI) of the World Bank, a widely used and credible source for cross-country macroeconomic analysis (World Bank, 2023). The dependent variable is trade balance (TB), measured as exports minus imports in absolute terms (TB = |X - M|), reflects the difference between a country's exports (X) and imports (M) and is a key indicator of a nation's economic health and external sector performance (Krugman et al., 2018; Salvatore, 2016; Nahabwe et al., 2025). The independent variable is net inflows of foreign direct investment (BoP, current US$) (World Bank 2024).

To account for the persistence of the trade balance and potential dynamic adjustments, the study specifies the following dynamic panel model:

The core equation for trade balance is specified as:

$$TB_{it} = \alpha_0 + \alpha_1 TB_{it-1} + \beta_1 FDI_{it} + \varepsilon_{it} \quad \text{.....(1)}$$

Where:

TB_{it} : Trade balance in country *i* at time *t*

TB_{it-1} : Lagged dependent variable capturing trade balance persistence

FDI_{it} : Foreign direct investment in country *i* at time *t*

ε_{it} : Error term. (Nahabwe & Kagarura, 2026)

TB and FDI are first transformed using natural logarithms to enhance econometric reliability and interpretability. Logarithmic transformation compresses large numerical scales and reduces the influence of extreme values, which are common in cross-country macroeconomic data. For instance, while the absolute distance between 10 and 10^{10} is enormous, their logarithmic values differ modestly (from 1 to 10), making relationships more stable and comparable. This transformation also helps linearize potentially nonlinear relationships, mitigate heteroskedasticity, and allows estimated coefficients to be interpreted as elasticities, which is particularly useful for policy analysis in international trade and investment studies (Wooldridge, 2010; Baltagi, 2021; Nahabwe & Kagarura, 2026).

We employ the System Generalized Method of Moments (System GMM) estimator, developed by Arellano & Bover (1995) and Blundell & Bond (1998), to estimate the dynamic panel model. System GMM is preferred to the conventional Difference GMM estimator of Arellano & Bond (1991) because it combines equations in first differences with equations in levels, thereby improving instrument strength and estimation efficiency, particularly when the variables exhibit persistence over time. The estimator is particularly suitable for this analysis for several reasons. Firstly, it effectively addresses potential endogeneity arising from reverse causality between trade balance and foreign direct investment. Secondly, it controls for unobserved country-specific heterogeneity and dynamic panel bias associated with the inclusion of a lagged dependent variable. Thirdly, System GMM produces more reliable and efficient estimates than Difference GMM when lagged levels are weak instruments for differenced variables. Finally, it is well-suited for panel datasets characterized by a relatively small number of cross-sectional units and a longer time dimension, a common feature of macroeconomic studies in Sub-Saharan Africa (Roodman, 2009).

GMM estimator is expressed as:

$$\hat{\theta}_{GMM} = \underset{\theta}{\operatorname{argmin}}[\tfrac{1}{n}\textstyle\sum_{i=1}^{n} g(X_i,\theta)]' W_n [\tfrac{1}{n}\textstyle\sum_{i=1}^{n} g(X_i,\theta)] \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where:

$g(X_i,\theta) = \frac{1}{n}\sum_{i=1}^{n} Z_i' \varepsilon_i(\theta)$ is the vector of moment conditions,

W_n : A consistent estimate of the weighting matrix,

θ: Vector of structural parameters (Arellano & Bond 1991; Blundell & Bond 1998; Nahabwe & Kagarura, 2026).

Empirical analysis proceeds in several stages. Firstly, descriptive statistics are computed to summarize the distribution and trends of the variables. Secondly, panel unit root tests using Levin-Lin-Chu and Im-Pesaran-Shin are applied to assess stationarity properties of the variables (Levin et al., 2002; Im et al., 2003). Thirdly, the dynamic panel model is estimated using system GMM.

Lagged levels of the endogenous variables are used as internal instruments, consistent with standard practice in dynamic panel estimation. The validity of the instruments is assessed using the Hansen test of over-identifying restrictions, while the Arellano–Bond test for serial correlation is employed to ensure the absence of second-order autocorrelation in the differenced residuals (Nahabwe & Kagarura, 2026).

To ensure the validity of the results, diagnostic tests are conducted. The Arellano-Bond test for serial correlation is used to verify the absence of second-order autocorrelation in the differenced residuals, while the Hansen test of over-identifying restrictions is employed to assess the validity of the instruments. Additionally, robustness checks, including alternative model specifications and sensitivity analyses, are performed to confirm the stability of the findings.

By integrating dynamic panel modeling with robust instrumentation, this study provides a methodologically rigorous framework for analyzing the FDI–trade balance nexus in SSA. The use of System GMM not only addresses key econometric challenges but also enhances the credibility and policy relevance of the empirical results.

4. Results and Discussion

The summary statistics for the key variables, log of trade balance (LNTB) and log of foreign direct investment (LNFDI) are presented in Appendix 1. The mean values of LNTB (22.78683) and LNFDI (19.74268) indicate

relatively stable average levels across the sampled countries over the study period. The proximity between the mean and median values for both variables suggests a fairly symmetric distribution.

The standard deviations (1.315174 for LNTB and 1.427882 for LNFDI) indicate moderate variability, implying that while there are fluctuations in trade balance and FDI inflows, these variations are not excessively dispersed. The skewness values reveal that LNTB is moderately positively skewed (0.558564), indicating a longer right tail, whereas LNFDI is slightly negatively skewed (-0.138906), suggesting a near-symmetric distribution.

Kurtosis values exceeding 3 (3.541903 for LNTB and 3.826509 for LNFDI) indicate leptokurtic distributions, implying the presence of heavier tails and potential outliers. This is further confirmed by the Jarque–Bera statistics, which are statistically significant ($p < 0.01$) for both variables, leading to the rejection of the null hypothesis of normality. Such non-normality is common in macroeconomic panel data, particularly in developing regions characterized by structural changes and external shocks (Baltagi, 2021).

We examine stationarity of trade balance (LNTB), government expenditure (LNFDI), using Im, Pesaran, and Shin unit root test (Appendices 2–5). Results indicate that all variables are non-stationary in levels, as the null hypothesis of a unit root cannot be rejected at conventional significance levels ($p > 0.05$). This confirms the presence of unit roots in the series. However, after first differencing, the null hypothesis of a unit root is rejected for each variable ($p < 0.05$), implying that all variables become stationary at first difference, that is, integrated of order one, I(1). These findings justify the adoption of a dynamic panel modeling approach and the use of the GMM, which is well-suited for handling non-stationary macroeconomic variables in panel settings (Arellano & Bover, 1995; Blundell & Bond, 1998; Nahabwe & Kagarura, 2026).

Generalized Method of Moments (GMM) model results (Appendix: 6)

$$\widehat{\mathrm{DLNTB}} = 0.261720\mathrm{DLNTB}_{\mathrm{it}-1} + 0.103497\mathrm{DLNFDI} \quad \ldots\ldots (3)$$

Hence,

$$\hat{\theta}_{GMM} = \begin{bmatrix} 0.261720 \\ 0.103497 \end{bmatrix}$$

The dynamic panel estimation results provide strong evidence in support of a positive relationship between FDI and trade balance in SSA. The lagged dependent variable, $\mathrm{LNTB}_{(\mathrm{it}-1)}$, is positive and statistically significant with a coefficient of 0.261720. This finding indicates partial adjustment dynamics, implying that approximately 26.2% of past trade balance conditions persist into the current period. In other words, the trade balance in SSA exhibits moderate inertia, reflecting structural rigidities and slow adjustment to external shocks.

The coefficient of FDI ($\beta_1 = 0.103497$) is positive and highly statistically significant ($p = 0.0000$), indicating a robust effect of FDI on trade balance. Specifically, a 10% increase in FDI inflows is associated with an approximate 1.03% improvement in trade balance, ceteris paribus. This result suggests that FDI contributes to enhancing export capacity, improving production efficiency, and easing foreign exchange constraints in SSA economies.

Diagnostic tests confirm the reliability of the estimated model. Although the residuals deviate from normality as evidenced by a kurtosis value of 4.8 and a Jarque–Bera probability of 0.00, this does not invalidate the results. In panel data contexts, particularly for developing economies, non-normality often arises due to structural breaks, commodity price volatility, and policy shifts (Baltagi, 2021). Importantly, the Generalized Method of Moments (GMM) estimator does not rely on the assumption of normally distributed errors but instead depends on valid moment conditions (Arellano & Bond, 1991).

Furthermore, the Hansen J-statistic yields a probability value of 0.394788, indicating failure to reject the null hypothesis of instrument validity. This confirms that the instruments used in the GMM estimation are appropriate, exogenous, and free from over-identification bias. The result also suggests the absence of instrument proliferation, thereby reinforcing the robustness of the estimates (Roodman, 2009).

The Arellano–Bond serial correlation tests (Appendix 10) show statistically significant first-order autocorrelation (AR(1): $p < 0.05$), which is expected in first-differenced models, and no second-order autocorrelation (AR(2): $p > 0.05$), confirming the consistency of the GMM estimator and the validity of moment conditions (Arellano & Bond, 1991).

The positive and statistically significant effect of FDI on trade balance supports the export-enhancing hypothesis of FDI, which argues that foreign investment improves productive efficiency, facilitates technology transfer, and strengthens integration into global value chains (Markusen & Venables, 1999). This finding is consistent with Borensztein et al. (1998) and Abbes et al. (2015), who emphasize the export-boosting potential of FDI in developing economies.

However, despite statistical significance, the magnitude of the effect remains relatively modest. This limited economic impact can be explained by structural constraints in Sub-Saharan Africa, including low levels of industrialization, weak forward and backward linkages between foreign firms and domestic enterprises, limited absorptive capacity, and high dependence on imported intermediate and capital goods. As a result, a substantial portion of FDI inflows does not fully translate into sustained improvements in the trade balance.
The persistence of the trade balance, as indicated by the significant lagged dependent variable, further reinforces the presence of structural rigidities such as narrow export bases, inadequate infrastructure, and import dependency, which dampen the overall impact of FDI. These findings therefore suggest that while FDI contributes positively to trade balance improvement, its effectiveness is conditional on structural transformation and complementary domestic policies that enhance productive capacity and export diversification in Sub-Saharan Africa.

5. Conclusion and Recommendations

Limitations

Despite the methodological rigor and robustness of the empirical strategy, this study is subject to several limitations relating to research design, sample selection, data, and analytical procedures, which should be considered when interpreting the findings.

Firstly, the study adopts a quantitative panel data design, which, while suitable for capturing macro-level relationships, inherently abstracts from country-specific institutional, political, and structural nuances that may influence the FDI–trade balance nexus. Such aggregation may mask heterogeneity across countries, particularly in SSA, where economies differ significantly in terms of resource endowments, policy regimes, and stages of development (Baltagi, 2021). Consequently, the findings may not fully capture micro-level dynamics or sector-specific effects of FDI.

Secondly, the use of purposive sampling to select 20 SSA countries based on data availability introduces potential sample selection bias. Countries with incomplete or inconsistent data are excluded, which may systematically omit fragile or conflict-affected economies where the FDI–trade relationship could differ markedly. This limits the generalizability of the results to the entire SSA region (Wooldridge, 2010).

Thirdly, the study relies on secondary data obtained from the World Bank's World Development Indicators. While widely and standardized, such data may be subject to measurement errors, reporting inconsistencies, and revisions over time, particularly in developing economies with weaker statistical systems (Jerven, 2013). In addition, key variables such as trade balance and FDI are measured in aggregate terms, which constrains the ability to distinguish between different types of FDI (e.g., greenfield vs. mergers and acquisitions) and their potentially divergent effects on trade outcomes.

Fourthly, although the GMM estimator effectively addresses endogeneity and dynamic panel bias, it is not without limitations. The validity of GMM estimates depends critically on the strength and appropriateness of the instruments used. While the Hansen test suggests that the instruments are valid, there remains a risk of weak instruments or instrument proliferation, which can bias estimates and reduce efficiency (Roodman, 2009). Moreover, GMM estimators can be sensitive to model specification and lag structure choices.

Fifthly, the study does not explicitly account for structural breaks, policy regime shifts, or global shocks such as commodity price fluctuations or financial crises that may have influenced both FDI inflows and trade balance during the study period. Ignoring such factors may lead to omitted variable bias and affect the stability of the estimated relationships (Perron, 1989).

Lastly, the analysis focuses primarily on the direct relationship between FDI and trade balance, with limited exploration of transmission channels such as technology spillovers, export diversification, and value chain integration. As a result, the study may not fully capture the mechanisms through which FDI influences external sector performance.

Conclusion

We set out to examine the relationship between FDI and trade balance in SSA within a dynamic panel framework. Drawing on contemporary data and robust econometric techniques, we provide important insights into how external capital inflows interact with the region's external sector performance.

Overall, we establish that FDI constitutes a meaningful, though not singular, driver of trade balance outcomes in SSA. Our findings underscore that the effectiveness of FDI in improving external balances is fundamentally conditioned by the structural characteristics of host economies, including the degree of export diversification, the strength of domestic productive capacity, and the quality of supporting infrastructure. In this regard, FDI should not be viewed merely as a source of capital inflows, but as a strategic instrument whose developmental impact depends on its alignment with broader economic transformation objectives (Borensztein et al., 1998; UNCTAD, 2019).

Our study further highlights the dynamic nature of trade balance adjustment in SSA, reflecting persistent structural rigidities and gradual responses to policy and external shocks. This persistence points to the need for sustained and coordinated policy interventions rather than short-term measures. It also reinforces the argument that improving trade balance is a cumulative process shaped by both historical conditions and current economic policies (Baltagi, 2021).

Importantly, our study contributes to the ongoing debate by demonstrating that while FDI can support external sector improvement, its impact is neither automatic nor uniform across countries. Instead, it is influenced by absorptive capacity, institutional quality, and the sectoral composition of investment. This finding aligns with the broader development literature, which emphasizes the complementary role of domestic policies in maximizing the benefits of globalization (Alfaro et al., 2010).

In sum, the study advances the understanding of the FDI–trade balance nexus in SSA by integrating theory, empirics, and policy considerations. It calls for a strategic reorientation of investment policies toward productivity-enhancing and export-oriented activities, alongside efforts to strengthen domestic capabilities. Such an approach is essential for translating FDI inflows into sustainable improvements in trade balance and long-term economic development.

Recommendations

Drawing from the study's findings on the FDI–trade balance nexus in SSA, this section presents policy, programmatic, and research recommendations aimed at enhancing the contribution of FDI to external sector performance and sustainable development.

Firstly, governments in SSA should prioritize attracting export-oriented and productivity-enhancing FDI rather than purely market-seeking or extractive investments. This can be achieved through targeted investment policies, fiscal incentives, and the establishment of special economic zones that promote manufacturing and value addition. Evidence suggests that export-oriented FDI is more likely to improve trade balance by expanding domestic production and exports (Markusen & Venables, 1999; UNCTAD, 2019).

Secondly, policymakers should strengthen domestic absorptive capacity by investing in human capital, infrastructure, and technological capabilities. The effectiveness of FDI in improving trade outcomes depends critically on the host country's ability to absorb and utilize foreign technologies and managerial skills

(Borensztein et al., 1998). Improved infrastructure, particularly in transport, energy, and digital systems, can reduce production costs and enhance export competitiveness.

Thirdly, SSA countries should implement complementary trade and industrial policies that promote export diversification and reduce import dependence. This includes supporting local industries, encouraging backward and forward linkages between foreign and domestic firms, and fostering participation in global value chains. Such measures enhance the spillover effects of FDI and strengthen the structural transformation of economies (Alfaro et al., 2010).

Fourthly, maintaining macroeconomic stability, including stable exchange rates, low inflation, and prudent fiscal management, is essential for sustaining the positive effects of FDI on the trade balance. Macroeconomic instability can undermine investor confidence and distort trade dynamics, thereby weakening the potential benefits of FDI (Aizenman & Noy, 2006).

At the program level, governments and regional bodies should design and implement investment facilitation programs that streamline regulatory procedures, reduce bureaucratic barriers, and improve the ease of doing business. Transparent and predictable regulatory frameworks are critical in attracting high-quality FDI.

Additionally, there is a need to promote sector-specific investment programs, particularly in agro-processing, manufacturing, and services, where SSA has comparative advantages. These programs should focus on enhancing value addition, improving supply chain efficiency, and increasing export capacity.

Regional integration initiatives, such as the African Continental Free Trade Area (AfCFTA), should be leveraged to create larger and more integrated markets, thereby attracting FDI that targets regional value chains rather than fragmented national markets. This can significantly enhance trade competitiveness and reduce structural trade imbalances.

Future research could extend the current study by incorporating disaggregated sectoral data to distinguish between different types of FDI (e.g., manufacturing vs. extractive industries) and their differential impacts on trade balance. Such analysis would provide deeper insights into the channels through which FDI influences external sector performance.

Further studies could also explore country-specific case studies or adopt mixed-method approaches to capture institutional, political, and structural factors that are not easily quantified in macro-panel models. This would complement the findings of this study and provide more nuanced policy guidance.

More still, future research could consider the role of emerging factors, such as digital trade, green investment, and global value chain reconfigurations, in shaping the FDI–trade balance relationship. These factors are increasingly relevant in the evolving global economic landscape.

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Appendices

Appendix 1: Descriptive statistics

	LNTB	LNFDI
Mean	22.78683	19.74268
Median	22.72746	19.73548
Maximum	26.52293	24.42848
Minimum	20.05782	14.39035
Std. Dev.	1.315174	1.427882
Skewness	0.558564	-0.138906
Kurtosis	3.541903	3.826509
Jarque-Bera	25.69394	12.67161
Probability	0.000003	0.001772
Sum	9114.733	7897.07
Sum Sq. Dev.	690.1437	813.5001
Observations	400	400

Appendix 2: Unit root test, LNTB (in Level)

Panel unit root test: Summary
Series: LNTB
Date: 04/06/26 Time: 08:36
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-3.36325	0.0004	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.78989	0.2148	20	360
ADF - Fisher Chi-square	50.4277	0.1249	20	360
PP - Fisher Chi-square	58.0121	0.0326	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 3: Unit root test, LNTB (in First Difference)

Panel unit root test: Summary
Series: D(LNTB)
Date: 04/06/26 Time: 08:38
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.17086	0.0000	20	340
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-6.35184	0.0000	20	340
ADF - Fisher Chi-square	112.028	0.0000	20	340
PP - Fisher Chi-square	146.681	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 4: Unit root test, LNFDI (in Level)

Panel unit root test: Summary
Series: LNFDI
Date: 04/06/26 Time: 08:39
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.21843	0.5865	20	360
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.30251	0.0964	20	360
ADF - Fisher Chi-square	67.1179	0.0046	20	360
PP - Fisher Chi-square	86.3939	0.0000	20	380

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 5: Unit root test, LNFDI (in First Difference)

Panel unit root test: Summary
Series: D(LNFDI)
Date: 04/06/26 Time: 08:42
Sample: 2005 2024
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.97847	0.0000	20	340

Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-7.91604	0.0000	20	340
ADF - Fisher Chi-square	143.440	0.0000	20	340
PP - Fisher Chi-square	378.024	0.0000	20	360

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 6: Generalized Method of Moments regression results

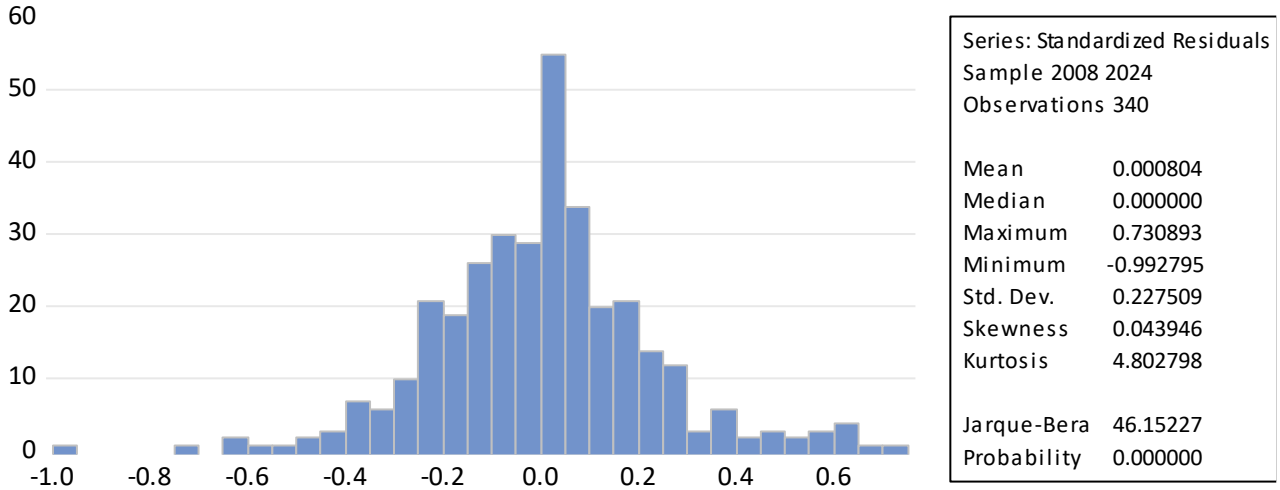
Dependent Variable: D(LNTB)
Method: Panel Generalized Method of Moments
Transformation: First Differences
Date: 04/06/26 Time: 09:05
Sample (adjusted): 2008 2024
Periods included: 17
Cross-sections included: 20
Total panel (balanced) observations: 340
White period (period correlation) instrument weighting matrix
White period (cross-section cluster) standard errors & covariance (d.f. corrected)
Standard error and t-statistic probabilities adjusted for clustering
Instrument specification: @DYN(D(LNTB),-2) (-1)
Constant added to instrument list.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNTB(-1))	0.261720	0.011367	23.02365	0.0000
D(LNFDI)	0.103497	0.011011	9.399820	0.0000

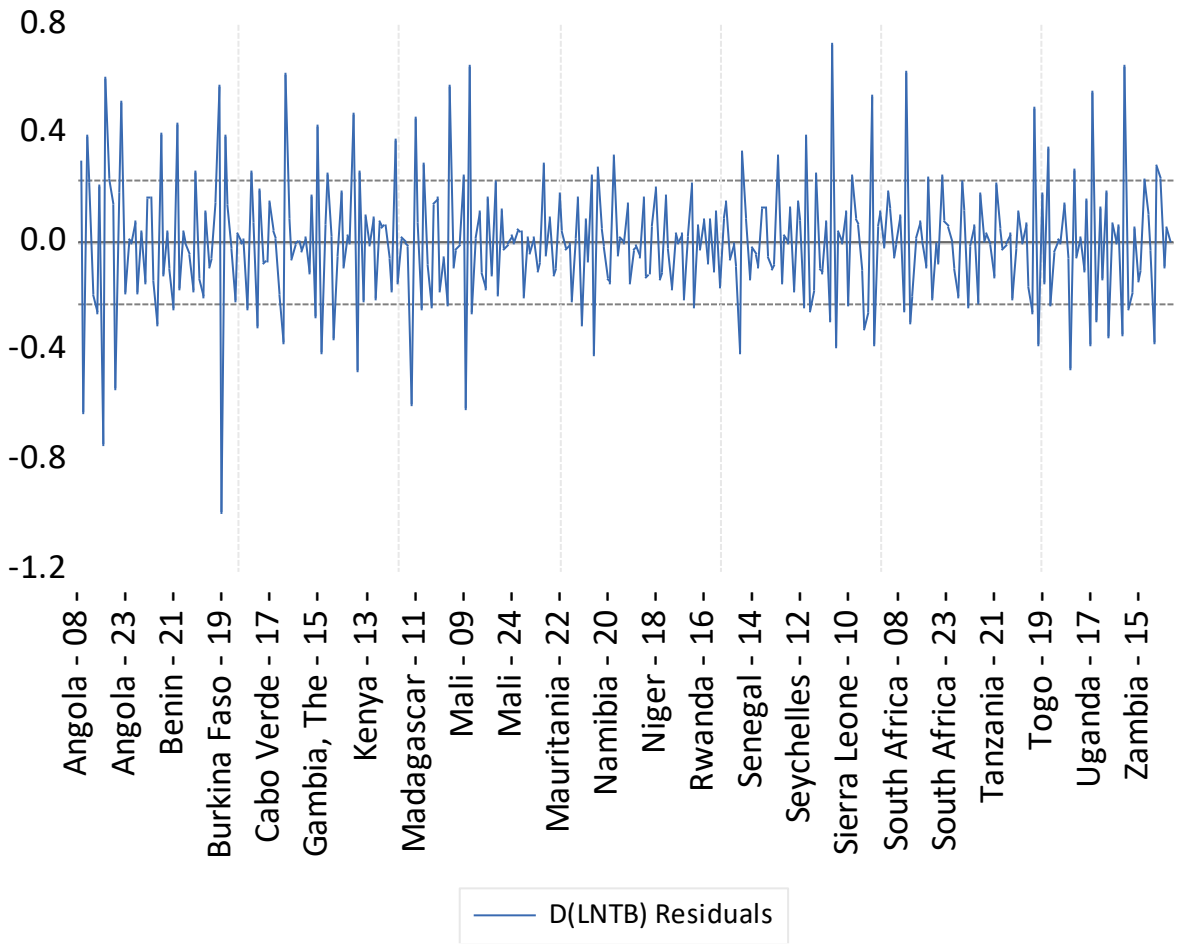
Effects Specification
Cross-section fixed (first differences)

Mean dependent var	-0.003348	S.D. dependent var	0.206568
S.E. of regression	0.227847	Sum squared resid	17.54695
J-statistic	18.95195	Instrument rank	20
Prob(J-statistic)	0.394788		

Appendix 7: Normality test



Appendix 8: Graph of residuals



Appendix 9: List of Sub-Saharan Africa countries in the study

Angola	Gambia, The	Mauritania	Senegal	Tanzania
Benin	Kenya	Namibia	Seychelles	Togo
Burkina Faso	Madagascar	Niger	Sierra Leone	Uganda
Cabo Verde	Mali	Rwanda	South Africa	Zambia

Appendix 10: Serial Correlation Test

Arellano-Bond Serial Correlation Test
Equation: Untitled
Date: 06/08/26 Time: 14:03
Sample: 2005 2024
Included observations: 340

Test order	m-Statistic	rho	SE(rho)	Prob.
AR(1)	-3.657367	-8.833164	2.415170	0.0003
AR(2)	-0.332117	-0.342711	1.031901	0.7398

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Environmental Uncertainty and Supply Chain Resilience among Manufacturing Firms in Uganda: The Mediating Role of Supply Chain Innovativeness

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Abstract: This study examines the relationships between environmental uncertainty (EU), supply chain innovativeness (SCI), and supply chain resilience (SCRE) among manufacturing small and medium-sized enterprises (SMEs) in Uganda. Specifically, it investigates the mediating role of supply chain innovativeness in the relationship between environmental uncertainty and supply chain resilience. A cross-sectional quantitative survey was conducted using structured questionnaires administered to 400 manufacturing SMEs located in Kampala, Wakiso, Mukono, and Jinja districts. The data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS 4. The results reveal that environmental uncertainty positively influences both supply chain resilience and supply chain innovativeness. Supply chain innovativeness also exerts a significant positive effect on supply chain resilience and partially mediates the relationship between environmental uncertainty and supply chain resilience. These findings suggest that manufacturing SMEs enhance resilience by developing innovative capabilities that enable them to anticipate, adapt to, and recover from environmental disruptions. The cross-sectional design limits causal inference and the ability to capture resilience development over time. Future studies should employ longitudinal or mixed-methods approaches to examine the dynamic processes through which firms build resilience under environmental uncertainty. Manufacturing SMEs should strengthen innovation capabilities by investing in flexible production systems, digital technologies, collaborative relationships, and continuous product and process innovation to improve resilience against supply chain disruptions. This study contributes to the supply chain resilience literature by integrating Resource-Based Theory and Dynamic Capability Theory to explain how supply chain innovativeness transforms environmental uncertainty into resilience.

Keywords: *Environmental uncertainty; Supply chain innovativeness; Supply chain resilience; Manufacturing SMEs; Resource-Based Theory; Dynamic Capability Theory.*

1. Introduction

Contemporary firms operate in increasingly dynamic, complex and uncertain business environments characterized by rapid technological change, evolving customer expectations, geopolitical tensions and frequent supply chain disruptions. Consequently, environmental uncertainty has become an inherent feature of modern supply chains, compelling firms to continuously adapt their operations to sustain competitiveness (Munir et al., 2020; Tukamuhabwa et al., 2017). Moreover, the growing globalization and interdependence of supply chains have increased firms' reliance on geographically dispersed suppliers, customers and strategic partners. While such interconnectedness enhances operational efficiency and market access, it also exposes firms to endogenous and exogenous risks that can rapidly propagate across global supply networks (Munir et al., 2020; Wieland & Durach, 2021).

To improve efficiency and reduce costs, many firms have adopted lean manufacturing, just-in-time production and global sourcing strategies (Tukamuhabwa et al., 2017). Although these practices enhance operational

performance, they also reduce redundancy and increase firms' vulnerability to supply chain disruptions (Ali & Gölgeci, 2019; Chowdhury & Quaddus, 2016). The COVID-19 pandemic vividly illustrated this vulnerability by disrupting global production, transportation and distribution networks, exposing the fragility of highly interconnected supply chains (Guan et al., 2020). More recently, geopolitical conflicts and climate-related events have further reinforced the need for resilient supply chains capable of withstanding and recovering from unexpected disruptions.

Accordingly, firms with globally integrated operations are particularly susceptible to supply chain disruptions (United Nations Trade and Development, 2020). These challenges underscore the strategic importance of supply chain resilience (SCRE), defined as a firm's ability to anticipate, absorb, respond to, recover from and adapt to disruptions while maintaining operational continuity (Hosseini et al., 2019; Ivanov, 2023). Given that supply chain disruptions are inevitable and increasingly frequent, developing resilient supply chains has become a strategic imperative for sustaining organizational performance and competitiveness (Chowdhury & Quaddus, 2017; Wieland & Durach, 2021).

Supply chain resilience (SCRE) has become a major research priority due to the increasing frequency and severity of supply chain disruptions. Although substantial progress has been made, important theoretical and empirical gaps remain regarding the antecedents and mechanisms through which resilience is developed (Gölgeci & Kuivalainen, 2020; Negri et al., 2021). Existing studies have linked SCRE to sustainability practices (Negri et al., 2021), blockchain technology (Min, 2019), big data analytics and organizational flexibility (Dubey et al., 2021), supply chain risk management (Kumar & Anbanandam, 2020), social capital and absorptive capacity (Gölgeci & Kuivalainen, 2020), relational capabilities (Chowdhury et al., 2019), network characteristics (Li et al., 2020), and disruption risk management (Vanpoucke & Ellis, 2020; Xu et al., 2020). However, relatively little attention has been devoted to understanding how environmental uncertainty (EU) influences SCRE through supply chain innovativeness (SCI), despite theoretical arguments that innovation enables firms to adapt and respond proactively to environmental turbulence (Xu et al., 2020).

Furthermore, the existing evidence is derived predominantly from developed economies (Li & Zobel, 2020; Min, 2019; Xu et al., 2020), limiting its applicability to developing countries, where manufacturing firms operate under distinct institutional, infrastructural and resource constraints. Given the interconnected nature of global supply chains, disruptions originating in one region can rapidly cascade across international supply networks, exposing firms in developing economies to significant operational risks (Li & Zobel, 2020). This vulnerability is particularly pronounced among manufacturing SMEs, whose limited financial, technological and organizational resources constrain their ability to anticipate, absorb and recover from supply chain disruptions (Muhwezi et al., 2023; World Trade Organization, 2021). The COVID-19 pandemic exemplified this challenge by severely disrupting global and Ugandan supply chains, disproportionately affecting manufacturing SMEs through shortages of raw materials, production interruptions and logistics constraints (Guan et al., 2020). Consequently, there is a need for empirical evidence on how manufacturing SMEs in developing economies build supply chain resilience under conditions of environmental uncertainty and whether supply chain innovativeness serves as the mechanism through which such resilience is achieved.

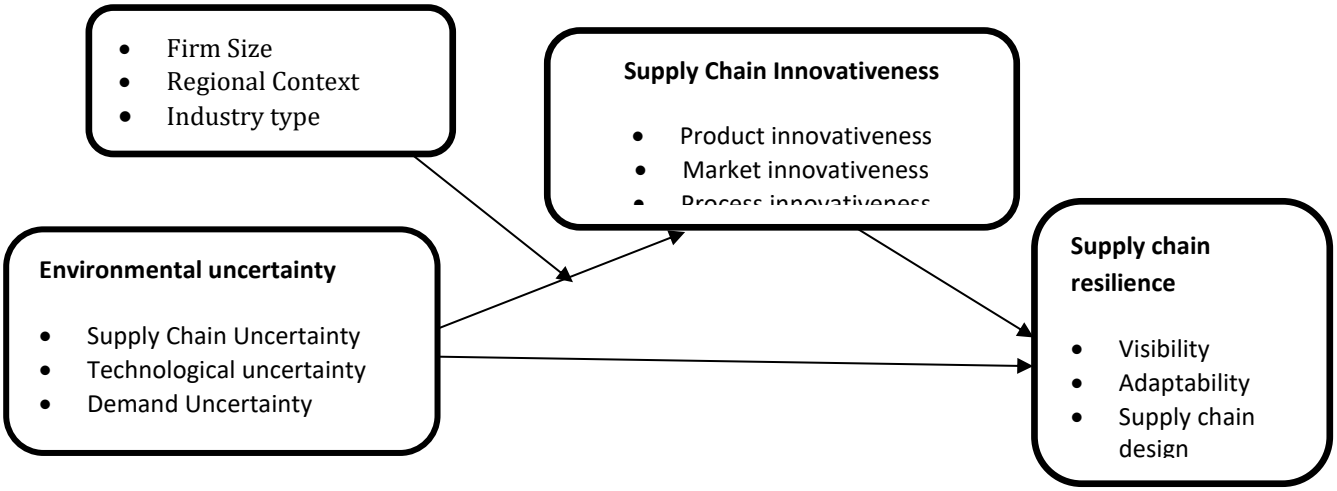
Emerging economies experience supply chain disruptions that are often more severe than those encountered in developed countries because of weaker institutional environments, inadequate infrastructure, political instability and resource constraints (Tukamuhabwa et al., 2015; Muhwezi et al., 2023). In Uganda, these contextual conditions expose manufacturing firms to persistent disruptions arising from political instability, regulatory inefficiencies, corruption, unreliable suppliers, demand volatility and logistics constraints, thereby undermining supply chain resilience (SCRE) (Tukamuhabwa et al., 2017). For example, the 2020 election-related unrest in Uganda and the 2011 Kenyan post-election crisis disrupted the movement of fuel, raw materials and finished goods, illustrating the vulnerability of Ugandan manufacturing supply chains to both domestic and cross-border disruptions (Ksoll et al., 2023; Tukamuhabwa et al., 2017). Consequently, many manufacturing firms experience production interruptions, delivery failures and quality deficiencies, contributing to poor business survival, particularly among SMEs (Tukamuhabwa et al., 2017).

Manufacturing firms are inherently more susceptible to supply chain disruptions because of their dependence on interconnected supply networks and their limited capacity to anticipate, absorb and recover from unexpected shocks (Ali & Gölgeci, 2019; International Trade Centre, 2020). Consequently, developing SCRE has

become a strategic imperative for ensuring operational continuity and sustaining competitive performance under conditions of environmental uncertainty (Shafi et al., 2020; World Trade Organization, 2021). However, despite extensive research, the mechanisms through which SCRE is developed remain inconclusive. While several studies report positive relationships between organizational capabilities and SCRE (Gölgeci & Kuivalainen, 2020; Mandal et al., 2016; Scholten & Schilder, 2015), others suggest that these relationships are contingent on contextual conditions and may exhibit nonlinear or counterproductive effects (Fan & Stevenson, 2019; Tukamuhabwa et al., 2017). Moreover, SCRE research has been dominated by studies conducted in developed economies and has largely relied on single-theory explanations, limiting its applicability to manufacturing firms operating in developing countries.

Accordingly, three important gaps remain. First, empirical evidence explaining how environmental uncertainty (EU) influences SCRE through supply chain innovativeness (SCI) remains limited despite growing recognition of innovation as a critical capability for responding to environmental turbulence. Second, manufacturing SMEs in developing economies remain underrepresented in SCRE research despite their strategic importance and disproportionate exposure to supply chain disruptions. Third, limited research has integrated Resource-Based Theory (RBT) and Dynamic Capability Theory (DCT) to explain how firms transform innovative resources into resilient supply chains. To address these gaps, this study examines the effect of environmental uncertainty on SCRE and the mediating role of SCI among Ugandan manufacturing SMEs using the complementary perspectives of RBT and DCT. By doing so, it responds to recent calls for theory-driven, context-specific and capability-based research on supply chain resilience in manufacturing SMEs operating in developing economies (Rha, 2020; Shafi et al., 2020; Tukamuhabwa et al., 2015).

Figure 1: Hypothesized model developed by the authors



2. Literature Review

Theoretical underpinning

The study is anchored in the complementary perspectives of Resource-Based Theory (RBT) and Dynamic Capability Theory (DCT), which together explain how firms develop supply chain resilience under conditions of environmental uncertainty. Resource-Based Theory posits that sustained competitive advantage stems from the possession and effective deployment of valuable, rare, inimitable, and non-substitutable (VRIN) resources that competitors cannot easily replicate (Barney, 1991; Koch & Windsperger, 2017). Within supply chain management, RBT has been widely applied to explain variations in organizational performance by arguing that firms possessing superior strategic resources are better equipped to cope with environmental uncertainty and achieve superior supply chain outcomes (Kumar & Anbanandam, 2020; Siagian et al., 2021). In this study, supply chain innovativeness (SCI) is conceptualized as a strategic organizational resource that enables firms to develop and implement innovative products, processes, and managerial practices, thereby enhancing their ability to anticipate disruptions, exploit emerging opportunities, and sustain competitive advantage (Ateş et al., 2022; Siagian et al., 2021).

While RBT explains the strategic value of organizational resources, it offers limited insight into how these resources are continuously renewed and deployed in rapidly changing environments. Dynamic Capability Theory complements RBT by emphasizing that sustained competitiveness depends on a firm's ability to integrate, build, and reconfigure internal and external resources in response to environmental change (Teece et al., 1997; Teece, 2007). Rather than focusing solely on resource ownership, DCT highlights organizational capabilities for sensing environmental changes, seizing emerging opportunities, and transforming existing resources to maintain competitiveness under uncertainty.

Drawing on these complementary perspectives, this study conceptualizes supply chain innovativeness as the mechanism through which strategic resources are transformed into dynamic capabilities that strengthen supply chain resilience. From the RBT perspective, SCI represents a valuable strategic resource, whereas DCT explains how firms continuously leverage, recombine, and reconfigure this resource to adapt to environmental uncertainty. Through innovation, firms redesign supply chain processes, integrate emerging technologies, strengthen collaboration with supply chain partners, and reconfigure operational routines, thereby enhancing their capacity to anticipate, absorb, adapt to, and recover from supply chain disruptions.

The application of Dynamic Capability Theory is particularly relevant because supply chain resilience is increasingly viewed as a dynamic capability that enables firms to maintain operational continuity despite environmental turbulence (Ponomarov & Holcomb, 2009; Kwak et al., 2018). Consistent with this perspective, prior studies argue that innovative capabilities facilitate organizational adaptation by enabling firms to integrate knowledge, reconfigure resources, and implement innovative responses to environmental uncertainty, thereby strengthening supply chain resilience (Gligor & Holcomb, 2012; Mikalef et al., 2020; Singh et al., 2019; Zavala-Alcívar et al., 2020).

Accordingly, this study argues that environmental uncertainty motivates firms to exploit and continuously reconfigure their strategic resource base through supply chain innovativeness. Resource-Based Theory explains why innovative resources contribute to resilience, whereas Dynamic Capability Theory explains how these resources are continually transformed into adaptive capabilities that enable firms to respond effectively to environmental turbulence. The integration of RBT and DCT, therefore, provides a robust theoretical foundation for explaining the mediating role of supply chain innovativeness in the relationship between environmental uncertainty and supply chain resilience among Ugandan manufacturing SMEs.

Supply chain resilience (SCRE)

SCRE refers to the ability of a supply chain to prepare for, respond effectively to, and recover from disruptions, thereby restoring operations to their pre-disruption state or, ideally, achieving an even higher level of performance (Tukamuhabwa et al., 2015). Although research on strategies for enhancing SCRE has expanded considerably (Chowdhury & Quaddus, 2017; Gölgeci & Kuivalainen, 2020; Mandal et al., 2016), comparatively limited attention has been devoted to understanding the antecedents that enable organizations to develop resilience capabilities (Tukamuhabwa et al., 2017). Existing studies identify numerous resilience-enhancing strategies; however, the relationships among these strategies remain complex and insufficiently understood. Some strategies reinforce one another, whereas others may conflict, overlap conceptually, or even subsume each other. Moreover, the implementation of certain resilience strategies may generate unintended consequences that ultimately undermine rather than strengthen supply chain resilience (Tukamuhabwa et al., 2017). For instance, Fan and Stevenson (2019) found that excessive relational capital can reduce SCRE by limiting organizational flexibility and adaptive decision-making during disruptions. Furthermore, the conceptual distinction between SCRE and its antecedents remains unresolved. While several studies identify capabilities such as redundancy, supply chain visibility, flexibility, collaborative capability, and agility as antecedents of resilience, Chowdhury and Quaddus (2016, 2017) conceptualize these capabilities as dimensions of SCRE itself. Such inconsistencies highlight the absence of consensus regarding the conceptual boundaries between SCRE and its antecedents, underscoring the need for further theoretical refinement and empirical investigation.

Supply Chain Innovativeness (SCI)

SCI refers to the continuous capability of firms to leverage the collective resources, knowledge, and capabilities of supply chain partners to generate innovations that create and sustain value across the supply chain (Iddris,

2016). As an inter-organizational capability, SCI extends beyond firm boundaries and is achieved through strategic collaboration with suppliers, customers, and other key stakeholders, enabling firms to respond proactively to changing market conditions and evolving customer needs.

The innovation literature conceptualizes SCI as a multidimensional construct comprising product innovativeness, market innovativeness, and process innovativeness (Saunila & Ukko, 2012). Product innovativeness refers to the development of novel or significantly improved products and services that enhance competitive advantage and market positioning (Danneels & Kleinschmidt, 2001; Henard & Szymanski, 2001). Market innovativeness reflects a firm's capability to identify and exploit new market opportunities through innovative marketing strategies, customer intelligence, and value propositions (Ali et al., 1995; Andrews & Smith, 1996; Wang & Ahmed, 2004). Process innovativeness involves the adoption and implementation of improved production, operational, and managerial processes that enhance efficiency, flexibility, quality, and responsiveness through the application of new technologies and operational practices (Kitchell, 1997; Wang & Ahmed, 2004). Collectively, these dimensions strengthen firms' adaptive capacity, improve responsiveness to environmental changes, and enhance overall supply chain competitiveness.

Environmental uncertainty (EU)

EU refers to the unpredictability and instability of external business conditions that affect supply chain operations and limit firms' ability to anticipate, interpret, and respond effectively to environmental changes (Jangga et al., 2015). Such uncertainty stems from rapid changes in markets, technologies, customer preferences, regulations, and supply networks, making strategic planning and operational decision-making increasingly challenging. Consequently, firms must develop capabilities that enable them to sense environmental changes, adapt their operations, and maintain competitiveness.

In the supply chain literature, EU is commonly conceptualized as a multidimensional construct comprising supply uncertainty, demand uncertainty, and technological uncertainty (Wang, Chen, et al., 2025). Supply uncertainty relates to the unpredictability of the availability, quality, quantity, and delivery of production inputs, which can disrupt procurement and operational activities (Davis, 1993; Scholten et al., 2014). Demand uncertainty reflects fluctuations in customer demand regarding quantity, timing, and product mix, resulting in forecasting inaccuracies, inventory imbalances, and the bullwhip effect across supply chain tiers (Eckstein et al., 2015). Technological uncertainty refers to the rapid pace of technological change that requires firms to continuously acquire new knowledge, adopt emerging technologies, and reconfigure operational processes to remain competitive (Wang, Chen, et al., 2025). Collectively, these dimensions create operational challenges while motivating firms to develop adaptive capabilities, strengthen collaboration, and enhance supply chain resilience.

EU and SCRE

Existing literature identifies environmental uncertainty (EU) as a key contextual factor influencing supply chain resilience (SCRE) (Chowdhury et al., 2019; Singh, 2020; Wang et al., 2021). Environmental uncertainty arises from unpredictable changes in customer demand, supply conditions, technological developments, and competitive environments, thereby increasing firms' exposure to disruptions and necessitating the development of adaptive capabilities. While earlier studies primarily examined the direct influence of the EU on SCRE, recent studies increasingly conceptualize the EU as a contextual factor that shapes the effectiveness of organizational capabilities in enhancing resilience (Wang, Chen, et al., 2025; Wang, Zeng, et al., 2025; Yu et al., 2025).

Empirical evidence suggests that firms operating in uncertain environments strengthen resilience by investing in capabilities such as technological integration, supply chain flexibility, collaborative relationships, and reserve capacity. For example, Wang et al. (2021) found that environmental uncertainty encouraged pharmaceutical firms to enhance technological integration and sourcing capabilities, thereby improving supply chain resilience. Similarly, Chowdhury et al. (2019) argued that resilience capabilities enable firms to anticipate, absorb, and recover from disruptions, while Jangga et al. (2015) and Singh (2020) contend that environmental uncertainty compels firms to develop greater flexibility, responsiveness, and adaptive capabilities to cope with rapidly changing market conditions.

These findings are consistent with Resource-Based Theory, which posits that firms achieve superior performance by effectively deploying valuable and difficult-to-imitate resources under changing environmental conditions (Koch & Windsperger, 2017). Accordingly, strategic resources such as supply chain flexibility, digital technologies, information sharing, and collaborative relationships become increasingly valuable in uncertain environments because they enhance visibility, facilitate coordinated responses, and strengthen resilience (Galetsi et al., 2020; Katsaliaki et al., 2022; Mashiloane et al., 2018).

Despite growing evidence linking environmental uncertainty and supply chain resilience, existing findings remain inconclusive regarding whether environmental uncertainty directly enhances resilience or merely conditions the effectiveness of resilience-building capabilities. Furthermore, empirical evidence from manufacturing firms in developing economies remains limited. Addressing this gap, the present study examines the relationship between environmental uncertainty and supply chain resilience among Ugandan manufacturing firms.
H1: *Environmental uncertainty is significantly associated with supply chain resilience.*

EU and SCI
Environmental uncertainty (EU) is widely recognized as a key driver of supply chain innovativeness (SCI). Increasing unpredictability in customer demand, technological change, and market conditions compels firms to adopt innovative strategies that enhance competitiveness and long-term survival (Jangga et al., 2015; Kalyar et al., 2020). Under uncertain conditions, firms are more likely to introduce innovative products, redesign operational processes, and develop adaptive managerial practices that improve flexibility, responsiveness, and customer satisfaction (Barney, 1991; Lv et al., 2018). Such innovations enable firms to respond effectively to environmental turbulence while sustaining competitive advantage.

From the perspective of Dynamic Capability Theory, environmental uncertainty stimulates firms to continuously reconfigure resources, redesign supply chain processes, and align organizational structures with changing environmental conditions to maintain strategic fit (Bae, 2017; Jabnoun et al., 2003). This adaptive orientation fosters an innovative culture characterized by flexible policies, collaborative practices, and continuous process improvement, enabling firms to optimize resource utilization and respond rapidly to changing customer needs (Tamayo-Torres et al., 2016; Whiteside & Dani, 2020).

Empirical evidence generally supports a positive relationship between environmental uncertainty and innovation. For example, Lin et al. (2025) reported that market uncertainty significantly promoted product innovation among Chinese technology-based SMEs. Likewise, Kalyar et al. (2020) and Jangga et al. (2015) found that firms operating in turbulent environments exhibit higher levels of innovativeness to enhance adaptability and competitiveness. However, contrary evidence exists. Li et al. (2025) observed a negative relationship between perceived technological and market uncertainty and ecosystem innovation among Chinese SMEs, suggesting that the influence of environmental uncertainty on innovation remains context-dependent. Furthermore, empirical evidence from manufacturing firms in developing economies remains limited. This study, therefore, examines the relationship between environmental uncertainty and supply chain innovativeness among Ugandan manufacturing firms.
H2: *EU is significantly associated with SCI.*

Supply chain innovativeness and SCRE
Previous studies consistently identify supply chain innovativeness (SCI) as a key capability that enhances supply chain resilience (SCRE) by enabling firms to anticipate, respond to, and recover from supply chain disruptions (Al-Hakimi & Borade, 2020; Al-Hakimi et al., 2022; Ateş et al., 2022). Firms with higher levels of innovativeness are better positioned to develop innovative products, redesign operational processes, and implement adaptive managerial practices that improve flexibility, agility, and operational continuity under uncertain conditions (Parast, 2020; Sabahi & Parast, 2020). Through continuous innovation, firms strengthen their ability to respond proactively to changing customer demands, production challenges, and supply chain disruptions, thereby enhancing resilience (Siagian et al., 2021; Sunil, 2019).

Innovation also contributes to resilience by fostering organizational learning and continuous improvement. Firms that encourage employees and supply chain partners to generate and implement innovative ideas are

better able to accumulate knowledge, improve operational practices, and strengthen their adaptive capacity during periods of environmental turbulence (Wziątek-Kubiak & Pęczkowski, 2021; Zavala-Alcívar et al., 2020). Likewise, product and process innovations enhance collaboration, information sharing, and operational flexibility, which ultimately improve supply chain resilience (Ateş et al., 2022; Dickens et al., 2024; Lv et al., 2018).

Despite the growing consensus that innovativeness enhances resilience, the direction of this relationship remains subject to debate. While most studies conceptualize innovativeness as an antecedent of resilience, Akgün and Keskin (2014) found that organizational resilience promotes product innovativeness, suggesting a potential reverse relationship. Moreover, empirical evidence examining the relationship between supply chain innovativeness and supply chain resilience in manufacturing firms operating in developing economies remains limited. Accordingly, this study proposes that supply chain innovativeness serves as an important antecedent of supply chain resilience among Ugandan manufacturing firms.
H3: *SCI is significantly associated with SCRE.*

Relationship between the EU and SCRE mediated by SCI
Previous literature, utilizing the RBT lens, has shown that innovativeness, as an internal resource of firms (Cho and Linderman, 2020; Ramon-Jeronimo *et al.*, 2019) enables firms operating in an uncertain environment to possess SCRE. Based on this perspective, SCI assists in developing proactive strategies to deal with new product lagged demands. SCI facilitates SCRE by promoting agility to customer demands and operational continuity (Sunil, 2019). A firm's level of innovation in its policies, procedures and implementation process can strain its adaptive ability to respond to sudden internal and external changes. (Wziątek-Kubiak and Pęczkowski, 2021). This demonstrates that in the ever-changing operating market environment in terms of competition, demand, supply and technology, supply chains have to continuously reconfigure their resources to be flexible, robust and proactive and react to such environmental disruptions. (Aslam and Azhar, 2018). In a turbulent environment, SCI qualifies supply chains to acquire dynamic capabilities (like resilience) in facing the EU. (Bag and Rahman, 2023). In fact, innovative supply chains are more resilient in the face of environmental changes than other firms. (Al-hakimi *et al.*, 2022; Zavala-Alcívar *et al.*, 2020). Amidst the EU, with turbulent technological changes, firms tend to respond by cooperating via the sharing of information and predicting supply chain innovations, which helps them to withstand supply chain disruptions. (Wang, Chen, *et al.*, 2025). We contribute to the SCRE literature and DCT by examining the mediating role of SCI in the relationship between EU and SCRE. Therefore, we propose;
H_4: *SCI significantly mediates the relationship between EU and SCRE.*

3. Research methodology

Research Design
To address the research objectives, this study adopted a cross-sectional research design employing both descriptive and explanatory approaches to examine the relationships among environmental uncertainty, supply chain innovativeness, and supply chain resilience among manufacturing firms in Uganda. A quantitative research approach was adopted, and data were analyzed using descriptive statistics and Partial Least Squares Structural Equation Modeling (PLS-SEM). Descriptive statistics summarized the respondents' demographic characteristics and the distribution of the study variables, while PLS-SEM was used to assess the measurement model and test the hypothesized relationships by estimating the structural paths, explanatory power (R^2), effect sizes (f^2), and predictive relevance (Q^2) of the proposed model.

Population, sample size determination
Uganda Bureau of Statistics (2025) show that approximately 22,990 manufacturing firms operate within the Buganda, Kampala, and Busoga sub-regions, including the districts of Kampala, Wakiso, Mukono, and Jinja. Since the exact population of manufacturing firms in these districts could not be established, the sample size was determined using Cochran's (1977) formula for large or unknown populations. The calculation assumed a 95% confidence level, a 5% margin of error, and a population proportion of 50%, as recommended by Israel (1992), yielding a minimum sample size of 384 firms. To account for potential non-response, an additional 10% was included, resulting in a target sample of 416 firms (Israel, 1992). Of these, 400 valid questionnaires were returned and used for analysis, representing a response rate of 96.2%.

The unit of analysis was manufacturing SMEs because supply chain resilience is conceptualized and measured at the organizational level. The units of inquiry comprised firm owners, operations managers, procurement managers, and supply chain managers, who were considered knowledgeable about their firms' supply chain operations and strategic decision-making.

Unit of analysis characteristics

The unit of analysis was the manufacturing firm. To enhance the reliability of organizational measures and minimize single-informant bias, two knowledgeable respondents were surveyed from each of the 400 sampled firms, consistent with recommendations for organizational survey research that advocate the use of multiple informants to improve the accuracy and validity of organizational-level constructs (Bliese, 2000; Podsakoff et al., 2003; Hair et al., 2022).

Before analysis, all returned questionnaires were screened for completeness, consistency, and missing data. Since the firm constituted the unit of analysis, individual responses were aggregated to the organizational level. The appropriateness of aggregation was assessed using the intraclass correlation coefficients, ICC(1) and ICC(2), and the within-group agreement index (rwg), which are widely recommended for evaluating inter-rater agreement in organizational research (Bliese, 2000; Hair et al., 2022). The obtained values of ICC(1) = 0.58, ICC(2) = 0.92, and rwg = 0.94 exceeded the recommended thresholds of 0.20, 0.70, and 0.70, respectively, indicating strong inter-rater agreement and justifying aggregation of the individual responses. Accordingly, the responses from the two informants were averaged to generate a single composite score for each construct at the firm level. Following data screening and aggregation, complete and usable data were obtained for all 400 manufacturing firms, which constituted the final sample for subsequent analyses.

As presented in Table 1, most manufacturing firms had been in operation for 6–10 years, followed by those operating for 21–50 years and 2–5 years, indicating that the sample comprised firms with varying levels of operational experience. The firms represented diverse manufacturing subsectors, with agro-processing, chemicals, and cement and ceramic products accounting for the largest proportion of the sample, while paper and printing, and textile, apparel, and footwear (TAF) constituted the smallest proportion. In terms of firm size, most firms employed between 5 and 100 employees, although medium- and large-sized firms were also represented. Furthermore, the majority of firms reported annual turnovers exceeding UGX 10 million, followed by those with turnovers between UGX 5 million and UGX 10 million, suggesting that the sample captured firms with varying operational scales and financial capacities.

Table 1: Unit of analysis characteristics

Organizational Age in years	**F**	**%**	**Manufacturing sector**	**F**	**%**
2-5	94	23.5	Agro processing	89	22.3
6-10	110	27.5	TAF	50	12.5
11-20	80	20	Paper & Print	20	5
21-50	96	24	Chemical sector	83	20.7
Above 50	20	5	Ceramic & Cement products	85	21.3
Total	400	100	Metal fabrication	73	18.2
Business ownership	F	%	Total	400	100
Indigenous owned	287	71.8	Number employed	F	%
Internationally owned	113	28.2	5-100	224	56
Total	400	100	101-500	50	12.5
Annual sales turnover	F	%	501-1000	64	16
Less than 5,000,000	64	16	1001-2000	26	6.5
5,000,000 - 10,000,000	119	29.8	Over 2000	35	9
Over 10,000,000	217	54.2	Total	400	100
Total	400	100			

Source: Author's own work

Unit of inquiry characteristics

The units of inquiry comprised two employees involved in supply chain operations from each of the sampled manufacturing firms. As shown in Table 1, the largest proportion of respondents worked in the production department (25.6%), followed by sales and marketing (23.1%), purchasing (18.5%), logistics (12.9%), and finance (9.4%), indicating broad representation of key functional areas involved in supply chain management. Most respondents (45.2%) had served in their respective organizations for between two and five years, suggesting adequate familiarity with their firms' operations. In terms of age, the majority were between 31 and 40 years, while most respondents held a bachelor's degree, with only 13.8% possessing certificate qualifications. These characteristics indicate that the respondents were drawn from a relatively experienced and educated workforce capable of providing informed responses on the study constructs. Male respondents constituted the majority of the sample, reflecting the gender composition of the participating manufacturing firms.

Table 2: Unit of inquiry characteristics

Department	**F**	**%**	**Qualification level**	**F**	**%**
Owner managers	83	10.4	Certificate	111	13.8
Logistics/ supply chain management	104	13	Diploma	164	20.5
Purchasing	148	18.5	Degree	459	57.4
Production	205	25.6	Masters	42	5.3
Sales/ marketing	185	23.1	PhD	2	0.3
Finance	75	9.4	Professional	22	2.7
Total	**800**	**100**	**Total**	**800**	**100**
Tenure in years	**F**	**%**	**Age of respondent**	**F**	**%**
0< 2	130	16.3	21-30	333	41.6
2-5	362	45.2	31-40	387	48.4
6-10	212	26.5	41-50	73	9.1
Above 10	96	12	Above 50	7	0.9
Total	**809**	**100**	**Total**	**806**	**100**
Management grade	**F**	**%**	**Gender**	**F**	**%**
Operational level	142	17.8	Male	405	50.6
Middle level	441	55.1	Female	395	49.4
Strategic level	217	27.1	**Total**	**800**	**100**
Total	**800**	**100**			

Source: Author's own work

Sampling design and procedure

To ensure representative selection, a proportionate stratified random sampling technique was adopted. Manufacturing SMEs were first stratified into six manufacturing subsectors: agro-processing; chemicals and pharmaceuticals; cement and ceramic products; paper and printing; metal and fabricated products; and textile, apparel, and footwear (TAF). The required sample was then proportionately allocated to each stratum based on its population size. Thereafter, simple random sampling without replacement was employed to select firms from each stratum, ensuring that each eligible firm had an equal probability of selection while preventing duplicate selection. A sampling frame of all eligible manufacturing firms was compiled from the Uganda Bureau of Statistics (UBOS) register, and the selected firms constituted the final sample for the study.

Data collection

Primary data were collected using a self-administered structured questionnaire comprising only closed-ended items, an approach widely recommended for quantitative survey research because it facilitates standardized data collection and statistical analysis (Saunders et al., 2019; Hair et al., 2022). Respondents were given one to two weeks to complete and return the questionnaires, providing adequate time to furnish complete and accurate responses.

Measurement of variables

Supply chain resilience (SCRE) was operationalized as a higher-order construct comprising proactiveness, reactiveness, and supply chain design, following the scale developed by Chowdhury, M. M. H., and Quaddus, M. A. (2016). Supply chain innovativeness (SCI) was measured as a multidimensional construct comprising market innovativeness (2 items), process innovativeness (3 items), and product innovativeness (3 items), adapted from Iddris, Faisal (2016). Consistent with prior literature, environmental uncertainty (EU) was conceptualized as a higher-order construct comprising supply uncertainty, demand uncertainty, and technological uncertainty, each measured using three items. To minimize potential confounding effects, firm size, firm age, and industry type were included as control variables. Firm size was measured by the number of employees (Gligor et al., 2015), firm age by the number of years since the firm's establishment (Srinivasan & Swink, 2018), and industry type by categorizing firms according to their manufacturing subsector using numerical codes to account for sectoral differences in supply chain characteristics and innovation practices. The control variables were specified with direct paths to supply chain resilience in the structural model. All study constructs were measured using a seven-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), indicating respondents' level of agreement with the measurement items.

Reliability and validity of the measurement instrument

The reliability and validity of the measurement instrument were assessed following the guidelines of Hair et al. (2022). Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability, with all constructs exceeding the recommended threshold of 0.70, indicating satisfactory reliability. Content validity was established by adapting measurement items from previously validated scales and subjecting the questionnaire to expert review by academics and practitioners in supply chain management to ensure the relevance, clarity, and adequacy of the items. Construct validity was assessed through convergent validity using the average variance extracted (AVE), with all constructs recording AVE values above the recommended threshold of 0.50, thereby demonstrating adequate convergent validity (Hair et al., 2022).

Measurement model assessment

The measurement model was evaluated using SmartPLS 4 following the guidelines of Hair et al. (2022). Specifically, indicator reliability, internal consistency reliability, convergent validity, and discriminant validity were assessed. As shown in Table 3, all indicator loadings exceeded the recommended threshold of 0.708, confirming satisfactory indicator reliability. Internal consistency reliability was evaluated using Cronbach's alpha, rho_A, and composite reliability (CR), with all constructs recording values above the recommended threshold of 0.70, thereby demonstrating satisfactory reliability. Convergent validity was assessed using the average variance extracted (AVE), and all constructs exceeded the recommended minimum threshold of 0.50, with the lowest AVE value being 0.528 for supply chain innovativeness (SCI). Discriminant validity was assessed using the heterotrait-monotrait ratio (HTMT), and all HTMT values were below the recommended threshold of 0.85, confirming that the constructs were empirically distinct (Table 4). Having satisfied all the measurement model assessment criteria, the structural model was subsequently evaluated.

Table 3: Results for reliability and validity of the measurement model

Constructs/ Variables	Item Codes	λ	α	CR (rho_a)	CR (rho_c)	AVE
Demand Uncertainty	EUDU1_mean	0.747	0.784	0.81	0.873	0.698
	EUDU2_mean	0.872				
	EUDU3_mean	0.88				
Supply Chain Uncertainty	EUSCU2_mean	0.923	0.845	0.851	0.928	0.865
	EUSCU3_mean	0.937				
Technology Uncertainty	EUTU1_mean	0.863	0.789	0.795	0.876	0.702
	EUTU2_mean	0.816				
	EUTU3_mean	0.835				
Environmental Uncertainty			0.844	0.853	0.881	0.755
Process Innovation	ICPI1_mean	0.86	0.85	0.854	0.91	0.771
	ICPI2_mean	0.924				
	ICPI3_mean	0.847				

Product Innovation	ICPR1_mean	0.865	0.801	0.808	0.872	0.633
	ICPR2_mean	0.889				
	ICPR3_mean	0.715				
Supply Chain Innovativeness			0.82	0.828	0.869	0.528
Supply Chain Resilience	RMRSRE1_mean	0.794	0.88	0.893	0.909	0.624
	RMRSRE2_mean	0.817				
	RMRSRE3_mean	0.772				
	RMRSRE4_mean	0.76				
	RMRSRE5_mean	0.752				
	RMRSRE6_mean	0.843				
SME Size	EUFS1_mean	0.933	0.922	0.928	0.951	0.865
	EUFS2_mean	0.959				
	EUFS3_mean	0.898				

Legend: Factor loadings (λ); Cronbach's alpha (α); average variance extracted (AVE); composite reliability (CR). **Source:** Author's own work

Table 4: Discriminant Validity Using the Heterotrait-monotrait ratio of correlations (HTMT) results

Study Variables	1	2	3	4	5	6	7	8	9	10
EU (1)										
Industry (2)	0.249									
Regional Context (3)	0.263	0.353								
SME Size (4)	0.687	0.11	0.165							
SCI (5)	0.467	0.171	0.209	0.372						
SCRE (6)	0.407	0.108	0.16	0.516	0.448					
Industry x EU (7)	0.21	0.117	0.105	0.067	0.163	0.074	0.479			
SME Size x EU (8)	0.424	0.061	0.112	0.482	0.123	0.265	0.295	0.165		
Industry x SCI (9)	0.163	0.148	0.133	0.017	0.252	0.087	0.324	0.421	0.102	

Legend: Environmental Uncertainty (EU); Supply Chain Innovativeness (SCI); Supply Chain Resilience (SCRE). **Source:** Author's own work

Data processing, analysis and presentation

The collected data were coded, cleaned, and analyzed using IBM SPSS Statistics version 27 and SmartPLS 4. IBM SPSS was used to generate descriptive statistics and Pearson's bivariate correlation coefficients to summarize the data and examine the relationships among the study variables. The hypothesized relationships were subsequently tested using Partial Least Squares Structural Equation Modeling (PLS-SEM) in SmartPLS 4. The structural model was evaluated by estimating the path coefficients and their significance using the bootstrapping procedure with 5,000 resamples, as recommended by Hair et al. (2022). To examine the mediating role of supply chain innovativeness (SCI) in the relationship between environmental uncertainty (EU) and supply chain resilience (SCRE), the significance of the indirect effects was assessed using the bias-corrected and accelerated 95% confidence intervals (BCa CI), following the recommendations of Zhao et al. (2010) and Cepeda-Carrion et al. (2019). Mediation was considered significant when the confidence interval for the indirect effect did not include zero.

4. Results

Bivariate analyses

Table 3 presents the Pearson's bivariate correlation coefficients among the study variables. The results indicate significant positive associations between environmental uncertainty (EU) and supply chain resilience (SCRE) ($r = 0.356$, $p < .01$), supply chain innovativeness (SCI) and SCRE ($r = 0.387$, $p < .01$), and EU and SCI ($r = 0.392$, $p < .01$). Among the control variables, firm size ($r = 0.469$, $p < .05$) and industry type ($r = 0.158$, $p < .05$) were

also positively associated with SCRE. Overall, the correlation coefficients were positive and of low to moderate magnitude, indicating meaningful associations among the study variables without suggesting problematic multicollinearity. These preliminary findings were subsequently validated through Partial Least Squares Structural Equation Modeling (PLS-SEM) to examine the hypothesized relationships.

Table 5: Correlations among study variables

Variables	1	2	3	4	5	6	7	8	9
EU (1)	1								
Industry (2)	0.228	1							
Regional Context (3)	-0.245	-0.353	1						
SME Size (4)	0.603	0.105	-0.159	1					
SCI (5)	0.392	0.155	-0.193	0.334	1				
SCRE (6)	0.356	0.071	-0.158	0.469	0.387	1			
Regional Context x EU (7)	0.192	0.108	0.034	0.124	0.225	0.114	1		
Industry x EU (8)	-0.191	-0.117	0.105	-0.065	-0.145	-0.048	-0.479	1	
SME Size x EU (9)	-0.389	-0.061	0.112	-0.464	-0.117	-0.25	-0.295	0.165	1

Legends: Environmental uncertainty (EU); supply chain innovativeness (SCI); supply chain resilience (SCRE).
Source(s): Primary Data

Hypotheses testing and model assessment

As presented in Table 6 and Figure 2, environmental uncertainty (EU) had a significant positive effect on supply chain resilience (SCRE) (β = 0.242, $p < .001$, $f^2 = 0.062$, 95% BCa CI [0.127, 0.357]), supporting H1. Because the 95% bias-corrected and accelerated confidence interval excluded zero, the relationship was considered statistically significant. The effect size ($f^2 = 0.062$) indicates a small effect of environmental uncertainty on supply chain resilience.

Similarly, environmental uncertainty significantly and positively influenced supply chain innovativeness (SCI) (β = 0.257, $p < .001$, $f^2 = 0.048$, 95% BCa CI [0.120, 0.386]), providing support for H2. The confidence interval did not include zero, confirming the significance of the relationship. The corresponding effect size ($f^2 = 0.048$) also indicates a small effect.

Consistent with H3, Table 6 shows that supply chain innovativeness (SCI) had a significant positive effect on supply chain resilience (SCRE) (β = 0.292, $p < .001$, $f^2 = 0.090$, 95% BCa CI [0.164, 0.405]). Because the 95% bias-corrected and accelerated confidence interval excluded zero, the relationship was considered statistically significant, thereby providing support for H3. The effect size ($f^2 = 0.090$) indicates a small-to-moderate effect of supply chain innovativeness on supply chain resilience.

Hypothesis 4 proposed that supply chain innovativeness (SCI) mediates the relationship between environmental uncertainty (EU) and supply chain resilience (SCRE). The mediating effect was examined using the bootstrapping procedure with 10,000 resamples and bias-corrected and accelerated 95% confidence intervals (BCa CI) in SmartPLS 4, following the recommendations of Hair et al. (2022). As presented in Table 6, the indirect effect of EU on SCRE through SCI was positive and statistically significant (β = 0.075, $p < .001$, 95% BCa CI [0.037, 0.131]). Because the confidence interval excluded zero, the indirect effect was significant, thereby supporting H4.

The total effect of the EU on SCRE was significant (β = 0.317). After introducing SCI into the structural model, the direct effect of EU on SCRE remained significant but decreased from β = 0.317 to β = 0.242 ($p < .001$). The simultaneous significance of the direct and indirect effects indicates that SCI partially mediates the relationship between EU and SCRE (Zhao et al., 2010). Furthermore, the variance accounted for (VAF) was 23.7%, indicating that approximately one-quarter of the total effect of environmental uncertainty on supply chain resilience is transmitted through supply chain innovativeness. According to established guidelines, a VAF value between 20% and 80% indicates partial mediation (Hair et al., 2022). These findings suggest that environmental uncertainty enhances supply chain resilience both directly and indirectly through supply chain innovativeness.

Table 6 and Figure 2 present the results of the moderation analysis. SME size significantly moderated the relationship between environmental uncertainty (EU) and supply chain innovativeness (SCI) (β = 0.137, $p < .05$), indicating that the effect of environmental uncertainty on supply chain innovativeness varies with firm size. Similarly, regional context exerted a significant moderating effect on the relationship between EU and SCI (β = 0.199, $p < .05$), suggesting that the influence of environmental uncertainty on supply chain innovativeness differs across regions. However, the moderating effect of industry type was not statistically significant (β = 0.002, $p > .05$), indicating that industry type does not significantly alter the relationship between environmental uncertainty and supply chain innovativeness.

Given the cross-sectional design and the use of self-reported survey data, procedural remedies were implemented to minimize the potential effects of common method bias (Podsakoff et al., 2003). Respondents were assured of anonymity and confidentiality, and two knowledgeable respondents were surveyed from each firm to reduce single-informant bias. Furthermore, the questionnaire was carefully designed to eliminate ambiguous and double-barreled questions, while all measurement items were adapted from previously validated scales and refined through expert review and a pilot study. Finally, the questionnaire was kept concise to minimize respondent fatigue and reduce the likelihood of careless responses (Podsakoff et al., 2003).

Statistically, common method bias was assessed using the full collinearity variance inflation factor (VIF) approach. As shown in Table 6, all VIF values were below the conservative threshold of 3.3, with the highest value being 1.762, indicating that neither multicollinearity nor common method bias posed a threat to the validity of the model (Hair et al., 2022; Kock, 2015). The predictive relevance of the structural model was evaluated using the blindfolding procedure. The Q^2 values for supply chain innovativeness (SCI) (Q^2 = 0.141) and supply chain resilience (SCRE) (Q^2 = 0.173) were greater than zero, confirming that the model possessed predictive relevance for both endogenous constructs (Hair et al., 2022). The explanatory power of the model, assessed using the coefficient of determination (R^2), showed that environmental uncertainty explained 22.1% of the variance in SCI (R^2 = 0.221), while environmental uncertainty and supply chain innovativeness jointly explained 19.9% of the variance in SCRE (R^2 = 0.199), indicating modest explanatory power. Furthermore, the RMSEA values of 0.012 for SCI and 0.019 for SCRE were below the recommended threshold of 0.06, indicating good model fit (Hu & Bentler, 1999). Overall, the structural model demonstrated satisfactory quality and was considered appropriate for testing the hypothesized relationships.

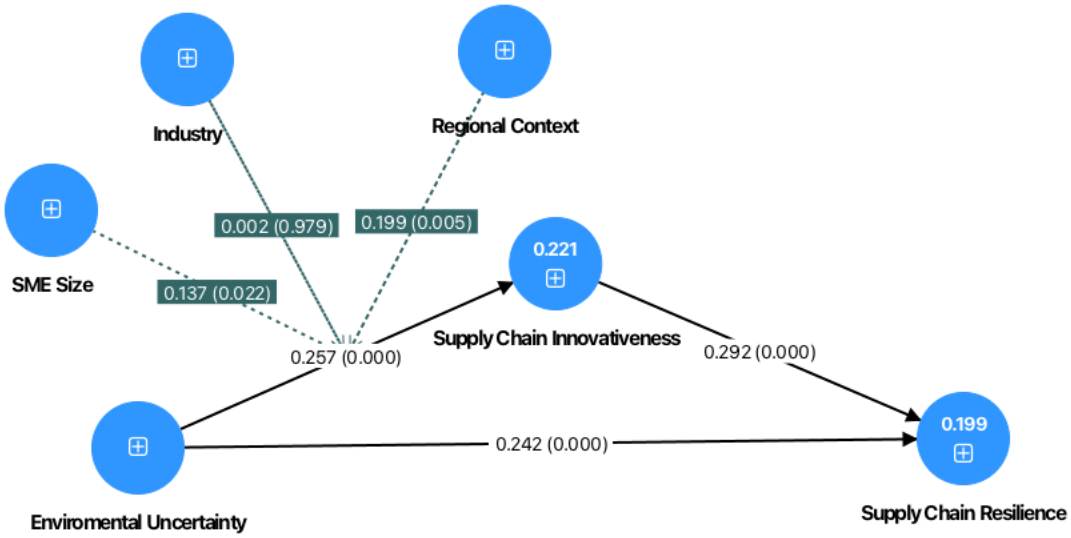
Table 6: **Structural model results**

Direct Effect	β	μ	δ	λ	P values	BCa CI	f2	VIF
EU -> SCI	0.257	0.253	0.069	3.744	0.00	.12; .386	0.048	1.751
EU -> SCRE	0.242	0.243	0.059	4.13	0.00	.127; .357	0.062	1.182
Industry -> SCI	0.024	0.023	0.051	0.459	0.646	-.078; .125	0.001	1.189
Industry x EU -> SCI	0.002	0.006	0.067	0.026	0.979	-.138; .124	0	1.341
Regional Context -> SCI	-0.113	-0.113	0.051	2.198	0.028	-.212; -.012	0.013	1.213
Regional Context x EU -> SCI	0.199	0.199	0.071	2.795	0.005	.06; .333	0.035	1.423
SME Size -> SCI	0.204	0.208	0.073	2.781	0.005	.059; .348	0.03	1.762
SME Size x EU -> SCI	0.137	0.135	0.06	2.288	0.022	.022; .257	0.02	1.4
SCI -> SCRE	0.292	0.293	0.062	4.751	0.00	.164; .405	0.09	1.182
Indirect effect	**β**	**μ**	**δ**	**λ**	**P values**	**BCa**		
EU -> SCI -> SCR	0.075	0.073	0.023	3.22	0.001	.037; .131		
Total effect	**β**	**μ**	**δ**	**λ**	**P values**	**BCa**		
EU -> SCI	0.257	0.253	0.069	3.744	0.00	.12; .386		
EU -> SCRE	0.317	0.316	0.056	5.691	0.00	.21; .426		
Industry -> SCI	0.024	0.023	0.051	0.459	0.646	-.078; .125		

Industry x EU -> SCI	0.002	0.006	0.067	0.026	0.979	-.138; .124
Regional Context -> SCI	-0.113	-0.113	0.051	2.198	0.028	-.212; -.012
Regional Context x EU -> SCI	0.199	0.199	0.071	2.795	0.005	.06; .333
SME Size -> SCI	0.204	0.208	0.073	2.781	0.005	.059; .348
SME Size x EU -> SCI	0.137	0.135	0.06	2.288	0.022	.022; .257
SCI -> SCRE	0.292	0.293	0.062	4.751	0.00	.164; .405
Predictive Criteria	R2	Adj R2	Q2	RMSE	MAE	
SCI	0.221	0.207	0.173	0.012	0.631	
SCRE	0.199	0.195	0.141	0.019	0.649	

Legends: Environmental uncertainty (EU); supply chain innovativeness (SCI); Supply chain resilience (SCRE); beta (β), mean of the bootstrap distribution of β (μ), standard error (δ), t-value (λ), bias corrected and accelerated confidence interval (BCa CI) 95% confidence interval, effect size (f^2) variance inflation factor (VIF), root mean square error (RMSE), mean absolute error (MAE), coefficient of determination (R^2).
Source(s): Primary Data

Figure 2: Final model



Source: Author's own creation

Discussion of the results

The findings support H1 by demonstrating that environmental uncertainty (EU) positively influences supply chain resilience (SCRE) among manufacturing SMEs/firms. This suggests that firms operating in turbulent environments develop adaptive capabilities that enable them to anticipate, absorb, and respond effectively to supply chain disruptions. Consistent with Dynamic Capability Theory, environmental uncertainty compels firms to continuously reconfigure resources and operational processes in response to changes in demand, supply, and technology (Teece, 2007). Consequently, manufacturing SMEs enhance resilience by adopting flexible production schedules, strengthening inventory management, and investing in technologies that improve operational responsiveness. This finding corroborates previous studies by Singh (2020), Chowdhury et al. (2019), and Wang, Chen, et al. (2025), which demonstrate that firms facing greater environmental uncertainty strengthen resilience through flexibility, technological integration, and collaboration across the supply chain.

The results further confirm H2 by showing that environmental uncertainty positively influences supply chain innovativeness (SCI). This finding suggests that uncertainty acts as a catalyst for innovation by encouraging firms to reconfigure resources, strengthen collaborative relationships, and pursue product, process, and market innovations to cope with environmental turbulence. The finding supports Resource-Based Theory, which posits that firms leverage strategic resources to sustain competitive advantage under changing environmental conditions (Barney, 1991). It is also consistent with the findings of Li et al. (2025) and Lin et al. (2025), who reported that environmental uncertainty stimulates innovation among manufacturing SMEs through increased investment in research and development, technological adaptation, and collaborative innovation.

The findings also support H3 by demonstrating that supply chain innovativeness significantly enhances supply chain resilience. Firms that continuously develop innovative products, processes, and market practices are better positioned to respond to disruptions, maintain operational continuity, and satisfy changing customer requirements. This finding reinforces the Dynamic Capability perspective that innovation enables organizations to renew and reconfigure resources in response to environmental change (Teece, 2007). It further agrees with Siagian et al. (2021), Ateş et al. (2022), and Dickens et al. (2024), who found that innovation enhances resilience by improving supply chain flexibility, information sharing, and organizational responsiveness.

The results further reveal that SCI partially mediates the relationship between EU and SCRE, indicating that environmental uncertainty enhances resilience both directly and indirectly through innovation. This finding suggests that uncertainty encourages firms to invest in innovative capabilities, which subsequently strengthen their resilience to supply chain disruptions. The result is consistent with Wang, Chen, et al. (2025), who found that firms exposed to environmental uncertainty strengthen resilience through technological collaboration and innovation, and with Bag and Rahman (2023), who argue that supply chain innovativeness enables firms to develop dynamic capabilities required to respond effectively to turbulent environments. From the perspectives of Resource-Based Theory and Dynamic Capability Theory, SCI represents a strategic capability through which firms transform valuable resources into adaptive mechanisms that enhance resilience.

Finally, the moderation analysis indicates that both SME size and regional context significantly strengthen the relationship between environmental uncertainty and supply chain innovativeness, whereas industry type does not exert a significant moderating effect. The significant effect of SME size suggests that larger SMEs possess greater financial, technological, and human resources to support innovation under conditions of uncertainty. Likewise, the significant moderating effect of regional context implies that differences in infrastructure, institutional support, and market access shape firms' innovation responses to environmental uncertainty. In contrast, the non-significant moderating effect of industry type suggests that the positive influence of environmental uncertainty on supply chain innovativeness is relatively consistent across manufacturing subsectors.

5. Conclusion and Recommendations

Conclusion

Drawing on the complementary perspectives of Resource-Based Theory (RBT) and Dynamic Capability Theory (DCT), this study examined the relationships among environmental uncertainty (EU), supply chain innovativeness (SCI), and supply chain resilience (SCRE) using data from 400 manufacturing SMEs in Uganda. The findings revealed that environmental uncertainty significantly and positively influences both supply chain resilience and supply chain innovativeness, while supply chain innovativeness significantly enhances supply chain resilience. Furthermore, supply chain innovativeness partially mediates the relationship between environmental uncertainty and supply chain resilience, indicating that firms strengthen resilience by leveraging innovation to respond to environmental turbulence. The study, therefore, concludes that manufacturing SMEs can enhance supply chain resilience by developing innovative capabilities that enable them to anticipate, adapt to, and recover from environmental uncertainties. These findings extend the application of RBT and DCT to the context of manufacturing SMEs in developing economies and provide empirical evidence that supply chain innovativeness constitutes a key mechanism through which firms transform environmental challenges into resilience-enhancing capabilities.

Theoretical Implications

Grounded in Resource-Based Theory (RBT) and Dynamic Capability Theory (DCT), this study advances the understanding of how environmental uncertainty influences supply chain resilience in manufacturing SMEs. First, the findings extend RBT by demonstrating that supply chain innovativeness constitutes a valuable strategic resource through which firms respond to environmental uncertainty and strengthen supply chain resilience. Rather than viewing environmental uncertainty solely as a source of operational risk, the study shows that it can stimulate firms to mobilize and deploy innovative resources that enhance their adaptive capacity.

Second, the study enriches Dynamic Capability Theory by providing empirical evidence that supply chain innovativeness functions as a dynamic capability through which manufacturing SMEs integrate, reconfigure, and renew resources to cope with environmental turbulence. The significant mediating role of supply chain innovativeness demonstrates that firms transform environmental challenges into resilience by developing innovative products, processes, and collaborative practices. Consequently, the study provides empirical support for the complementary application of RBT and DCT in explaining how strategic resources are translated into adaptive capabilities that strengthen supply chain resilience. By providing evidence from manufacturing SMEs in Uganda, the study also extends the applicability of these theories to firms operating in resource-constrained environments within developing economies.

Policy implications

The findings suggest that policymakers should strengthen the resilience of manufacturing SMEs by promoting supply chain innovativeness. The government should establish targeted innovation support programs, including tax incentives, affordable credit facilities, innovation grants, and subsidized access to modern production technologies to enable SMEs to respond effectively to environmental uncertainty. Policymakers should also foster collaborations between manufacturing SMEs, universities, and research institutions to facilitate knowledge transfer, technology adoption, and research and development. Furthermore, continuous capacity-building programs on supply chain risk management, innovation, and resilience should be provided to SME owners and managers. Finally, given the significant moderating effect of SME size, targeted financial and technical support should be directed towards smaller manufacturing SMEs to strengthen their innovation capabilities and resilience to supply chain disruptions.

Practical Implications

The findings suggest that manufacturing SMEs should proactively prepare for environmental uncertainty by strengthening their innovation capabilities and supply chain flexibility. Managers should continuously monitor potential disruptions, adapt production schedules, invest in appropriate technologies, and foster an organizational culture that encourages employees, customers, and supply chain partners to contribute innovative ideas for new products, services, and operational processes. Furthermore, managers should recognize that environmental uncertainty and supply chain innovativeness are complementary rather than independent. By integrating innovation into their response to uncertainty, SMEs can enhance collaboration, improve resource utilization, and strengthen their ability to anticipate, adapt to, and recover from supply chain disruptions.

Limitations and Future Research

This study has several limitations that provide opportunities for future research. First, the use of a cross-sectional quantitative design limited the ability to capture how manufacturing SMEs develop and sustain supply chain resilience over time. Future studies should adopt longitudinal or mixed-methods designs to provide deeper insights into the dynamic processes through which firms build resilience under environmental uncertainty. Second, the study focused on manufacturing SMEs located in Kampala, Wakiso, Mukono, and Jinja districts. Consequently, caution should be exercised when generalizing the findings to all manufacturing firms in Uganda. Future research should replicate this study using broader and more geographically diverse samples drawn from all regions of Uganda to enhance the generalizability of the findings. Additionally, future studies may examine other organizational capabilities, such as digital transformation, supply chain integration, and organizational learning, as potential mechanisms through which environmental uncertainty influences supply chain resilience.

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Determinants of Local Content Participation among Domestic Firms in Uganda's Oil and Gas Sector

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Abstract: This study examined the determinants of local content participation among domestic firms operating in Uganda's oil and gas sector. The study adopted a mixed-methods cross-sectional research design. Data were collected from 280 firms registered on the National Supplier Database of the Petroleum Authority of Uganda. Quantitative data were collected using structured questionnaires administered to Procurement Officers, Accountants, and National Content Officers, while qualitative data were obtained through interviews with Chief Executive Officers. Quantitative data were analyzed using descriptive statistics, Pearson correlation and hierarchical regression analysis using SPSS Version 26. Qualitative data were analyzed using thematic analysis. The findings revealed that capacity building has a positive and statistically significant relationship with local content participation ($r = .501$, $p < .01$), while firm capabilities also exhibited a positive and statistically significant relationship with local content participation ($r = .417$, $p < .01$). Hierarchical regression results further showed that capacity building significantly predicts local content participation ($\beta = .444$, $p < .001$), while firm capabilities also exert a positive and significant influence ($\beta = .343$, $p < .001$). The final regression model explained 36.1% of the variation in local content participation (Adjusted $R^2 = .361$). Qualitative findings revealed that training, knowledge transfer and access to finance enhance domestic firms' ability to participate in oil and gas activities, while production capacity, infrastructure, skilled human resources and financial resources improve firms' competitiveness and readiness to exploit procurement opportunities in the sector. The qualitative findings corroborated the quantitative results by demonstrating that capacity building and firm capabilities are critical drivers of local content participation among domestic firms.

Keywords: *Local content participation, capacity building, firm capabilities, domestic firms, oil and gas sector, Uganda.*

1. Introduction

Local content participation has become a central policy objective in petroleum-producing countries because it promotes domestic participation in oil and gas activities, stimulates industrial development, enhances technology transfer, and increases the retention of sector benefits within local economies. Countries such as Norway, Brazil, and Malaysia have successfully utilized local content policies to strengthen domestic firms and increase national participation in petroleum value chains (Tsani et al., 2024). Across Africa, governments have increasingly adopted local content frameworks to ensure that extractive industries contribute to employment creation, enterprise development, and broader economic transformation (Hilson & Ovadia, 2020). These initiatives seek to maximize the developmental benefits derived from natural resource exploitation by increasing the utilization of local suppliers, labor, and services within oil and gas operations. (Hilson & Ovadia, 2020).

In Africa, local content has become a major development strategy in countries such as Nigeria, Ghana, Angola, and Mozambique, where governments have introduced policies aimed at increasing domestic participation in petroleum supply chains (Hilson & Ovadia, 2020). Despite these efforts, many African countries continue to experience low levels of local firm participation due to limited technological capacity, inadequate access to finance, and weak operational capabilities among domestic enterprises (Tsani et al., 2024). Existing evidence suggests that local firms often face difficulties in meeting the technical and quality standards required by multinational oil companies, thereby limiting their ability to benefit from sector investments (Hilson & Ovadia, 2020). Consequently, understanding the factors that influence local content participation remains a critical concern for policymakers and industry stakeholders across the continent (Tsani et al., 2024).

Within East Africa, recent oil and gas discoveries have intensified efforts to promote local content as a mechanism for ensuring that petroleum investments contribute to domestic economic development. Countries

such as Uganda, Tanzania, and Kenya have introduced local content policies and supplier development initiatives to enhance the participation of domestic firms in petroleum activities. However, studies indicate that many local firms in the region continue to face challenges associated with inadequate skills, weak production capacity, limited infrastructure, and insufficient financial resources. These challenges constrain the ability of domestic enterprises to effectively participate in oil and gas procurement opportunities and reduce the overall level of local content participation within the sector (Tsani et al., 2024).

In Uganda, local content promotion has become a key component of the country's petroleum development strategy (Republic of Uganda, 2013). The Government of Uganda has established several policy and institutional interventions, including the National Supplier Database, supplier development programs, and local content requirements intended to increase the participation of Ugandan firms in the oil and gas sector. (Petroleum Authority of Uganda, 2025). These initiatives are intended to ensure that domestic firms benefit from petroleum investments through increased procurement opportunities, employment creation, and business growth (Petroleum Authority of Uganda, 2025). The expectation is that greater utilization of local firms and locally available resources will contribute to industrial development and sustainable economic transformation.

Despite these interventions, local content participation among domestic firms remains below national expectations (Petroleum Authority of Uganda, 2025). Although a growing number of Ugandan firms are registered on the National Supplier Database, only a limited proportion actively participate in oil and gas procurement activities (Petroleum Authority of Uganda, 2025). Several studies have reported that domestic firms continue to face challenges related to limited technical expertise, inadequate financing, weak infrastructure, and insufficient operational capacity required to compete within the petroleum supply chain (Tsani et al., 2024). Consequently, a significant share of sector expenditure continues to accrue to foreign suppliers and internationally established companies rather than domestic enterprises (Petroleum Authority of Uganda, 2025). This situation limits the extent to which Uganda can realize the intended economic benefits associated with local content policies (Hilson & Ovadia, 2020).

Existing literature suggests that capacity building is an important mechanism for enhancing the participation of domestic firms in complex and highly technical industries such as oil and gas (Anzolin & Pietrobelli, 2020). Capacity building involves initiatives such as training, knowledge transfer, access to finance, and skills development that improve the ability of firms to perform effectively and compete for available opportunities (Tsani et al., 2024). Studies have shown that firms that receive adequate training and knowledge support are better positioned to understand industry requirements, comply with operational standards, and participate in procurement activities (Anzolin & Pietrobelli, 2020). Similarly, access to financial resources enables firms to invest in equipment, technology, and operational improvements necessary for participation in the petroleum value chain (Uganda Bankers Association, 2024).

Firm capabilities have also been identified as critical determinants of organizational performance and competitiveness (Tsani et al., 2024). Firm capabilities refer to the production capacity, infrastructure, human resources, and capital resources that enable organizations to deliver products and services efficiently (Anzolin & Pietrobelli, 2020). In the oil and gas sector, firms are expected to demonstrate strong operational capabilities to satisfy requirements relating to quality, safety, reliability, and timely delivery of goods and services (Chuwa, 2023). Firms possessing stronger capabilities are therefore more likely to secure procurement opportunities and participate effectively in local content activities (Hilson & Ovadia, 2020).

Although previous studies have acknowledged the importance of capacity building and firm capabilities, limited empirical evidence exists regarding their influence on local content participation among domestic firms operating in Uganda's oil and gas sector. Much of the existing literature has focused on policy implementation, regulatory frameworks, and local content legislation, while relatively little attention has been directed toward understanding the firm-level factors that determine actual participation in local content activities. Consequently, there remains a limited understanding of the extent to which capacity building and firm capabilities contribute to local content participation among Ugandan firms participating in the petroleum sector (Tsani et al., 2024).

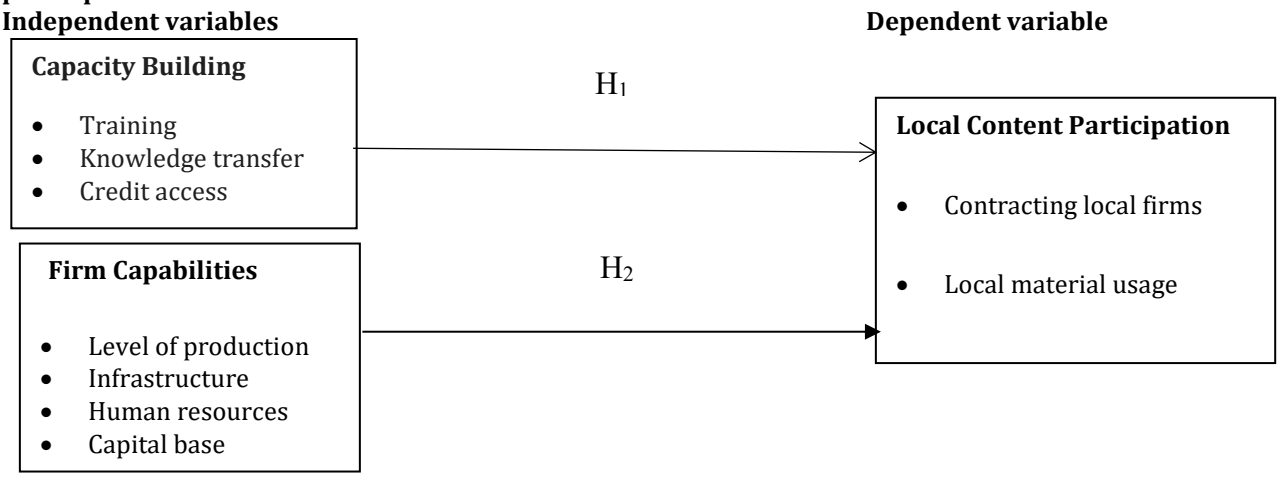
This study, therefore, examined the determinants of local content participation among domestic firms operating in Uganda's oil and gas sector, with a specific focus on the influence of capacity building and firm capabilities. The study was based on the argument that local content participation depends not only on the availability of policy opportunities but also on the ability of firms to develop the competencies, resources, and operational capabilities required to exploit those opportunities effectively.

Aim of the Study

This study aimed to examine the determinants of local content participation among domestic firms operating in Uganda's oil and gas sector.

Conceptual Framework

Figure 3: Capacity building, firm capabilities, government regulations compliance and local content participation



Source: Adopted from Hanson & Nwakile (2025)

Theoretical Foundation

This study was anchored in the Resource-Based Theory (RBT) developed by (Barney, 1991). The theory posits that organizational performance and competitiveness are influenced by the possession and effective utilization of valuable, rare, inimitable, and non-substitutable resources (Barney, 1991). According to the theory, firms achieve superior outcomes when they develop unique resources and capabilities that enable them to respond effectively to market opportunities and environmental challenges (Rugman & Verbeke, 2012). Resources such as knowledge, skills, infrastructure, technology, financial capital, and human competencies are considered strategic assets that can enhance organizational performance and competitiveness (Madhok & Li, 2013).

The Resource-Based Theory was considered relevant to this study because local content participation within Uganda's oil and gas sector depends largely on the ability of domestic firms to develop and utilize resources necessary for participation in petroleum supply chains (Hansen, 2020). Capacity building initiatives such as training, knowledge transfer, and access to finance enhance the resource base of firms by improving knowledge, skills, and operational readiness required for participation in oil and gas activities (Medani, 2022). Similarly, firm capabilities reflected through production capacity, infrastructure, human resources, and capital resources represent strategic assets that determine the ability of firms to compete for procurement opportunities within the sector (Jaworska, 2023).

The theory further suggests that firms possessing stronger resources and capabilities are more likely to achieve better performance outcomes than firms with weaker resource bases (Rosetti & Choi, 2015). Within the context of Uganda's oil and gas sector, domestic firms with higher levels of capacity building and stronger operational capabilities are expected to participate more effectively in local content activities through increased utilization of local suppliers, local labor, and locally available materials (Alinda et al., 2022). The theory, therefore,

provides a suitable foundation for explaining how capacity building and firm capabilities influence local content participation among domestic firms operating in Uganda's oil and gas sector (Wang & Ahmed, 2021).

2. Literature Review and Hypothesis Development

Capacity Building and Local Content Participation

Capacity building is widely recognized as a fundamental driver of local content development in the oil and gas industry because it enhances the ability of domestic firms to participate effectively in petroleum value chains. It refers to the deliberate process through which organizations develop the technical knowledge, managerial competencies, technological capabilities, institutional systems, and financial capacity required to undertake industry activities and compete within complex business environments. In the petroleum sector, capacity building encompasses supplier development programs, workforce training, technology and knowledge transfer, business mentoring, and access to financial resources that strengthen the competitiveness of local enterprises (Hanson & Nwakile, 2025).

Training equips domestic firms with the technical and managerial competencies required to comply with procurement procedures, health and safety regulations, quality assurance systems, and environmental standards established by international oil companies. Knowledge and technology transfer further enable local suppliers to acquire operational expertise, modern production techniques, and industry best practices through collaboration with multinational corporations, thereby improving their capacity to deliver goods and services that satisfy petroleum industry requirements (Tsani et al., 2024). Likewise, access to finance enables firms to invest in production facilities, modern equipment, technological innovations, and skilled personnel necessary for meeting contractual obligations and expanding their participation in oil and gas supply chains (Hanson & Nwakile, 2025).

The relationship between capacity building and local content participation has received considerable attention within the extractive industry literature. Tordo et al. (2013) argue that local content policies achieve better outcomes when governments and industry stakeholders invest continuously in supplier development and institutional capacity enhancement. Similarly, Owusu & Vaaland (2021) contend that strengthening the capabilities of domestic suppliers improves their competitiveness and increases their participation in procurement opportunities within extractive industries. Tsani et al. (2024) further observe that investments in capacity building promote sustainable local industrial development by enabling indigenous firms to undertake increasingly sophisticated activities across petroleum value chains.

Despite Uganda's local content policy framework, domestic firms continue to experience limitations associated with inadequate technical expertise, insufficient financial resources, and limited technological capabilities, which reduce their ability to satisfy the operational standards required by petroleum operators (Sen, 2018). These challenges constrain the participation of local enterprises in oil and gas procurement despite the availability of local content opportunities. Consequently, firms that possess stronger capacity-building mechanisms through continuous training, knowledge transfer, technological development, and improved financial capability are more likely to increase their participation in local content activities than firms with limited capacity development initiatives. Drawing on the reviewed literature, the following hypothesis was formulated:

H1: Capacity building has a positive and significant influence on local content participation among domestic firms operating in Uganda's oil and gas sector.

Firm Capabilities and Local Content Participation

Firm capabilities refer to an organization's ability to integrate, deploy, and utilize its available resources efficiently to achieve strategic objectives and sustain competitive advantage within dynamic business environments (Cusumano et al., 2020; Teece et al., 1997). These capabilities include production capacity, technological competence, financial strength, organizational infrastructure, and human resource expertise that enable firms to meet customer requirements and respond effectively to market opportunities (Cusumano et al., 2020). Within the oil and gas industry, strong firm capabilities are essential because suppliers must consistently satisfy stringent quality, safety, environmental, and delivery requirements established by multinational petroleum companies (Hansen et al., 2020).

Production capability enables firms to manufacture goods and deliver services in the quantities and quality required by petroleum operators, while technological capability facilitates operational efficiency, innovation, and compliance with international industry standards (Cusumano et al., 2020). Human resource capability ensures the availability of skilled technical personnel capable of executing specialized petroleum activities, whereas financial capability enables firms to invest in modern production equipment, infrastructure, certification processes, and business expansion necessary for participation in petroleum procurement. Collectively, these capabilities strengthen the competitiveness of domestic firms and improve their ability to secure contracts within oil and gas supply chains.

Existing literature suggests that firm capabilities constitute an essential determinant of successful local content implementation. Hansen et al., (2020) argue that domestic enterprises possessing stronger organizational and operational capabilities are more likely to integrate successfully into extractive industry value chains because they can consistently satisfy procurement requirements. Likewise, Owusu & Vaaland (2021) maintain that enhanced firm capabilities improve the competitiveness of indigenous suppliers and facilitate greater participation in local procurement activities. Tsani et al., (2024) further emphasize that strengthening firm capabilities remains central to achieving sustainable local content outcomes because capable domestic firms are better positioned to respond to technological change, industry expansion, and evolving sustainability requirements.

In Uganda, however, many domestic firms continue to experience capability gaps characterized by inadequate production systems, limited technological infrastructure, insufficient financial resources, and shortages of specialized technical personnel, which reduce their competitiveness within the petroleum industry (Sen, 2018). These constraints limit the ability of indigenous firms to comply with procurement standards and compete effectively with experienced international suppliers. Therefore, firms possessing stronger production, technological, financial, and human resource capabilities are expected to demonstrate higher levels of local content participation than firms with relatively weaker organizational capabilities.
Guided by the reviewed literature, the following hypothesis was formulated:
H2: Firm capabilities have a positive and significant influence on local content participation among domestic firms operating in Uganda's oil and gas sector.

3. Methodology

Research Design
The study adopted a mixed-methods cross-sectional research design. The mixed methods approach was adopted because it enabled the collection and integration of quantitative and qualitative data to obtain a more comprehensive understanding of the determinants of local content participation among domestic firms operating in Uganda's oil and gas sector (Creswell, 2018). Quantitative data were used to establish the nature and strength of the relationships among the study variables, while qualitative data were used to explain the observed statistical relationships by capturing participants' experiences, perceptions, and contextual factors influencing local content implementation. The integration of the two strands provided a broader understanding of the phenomenon than either approach could achieve independently. The cross-sectional design was considered appropriate because data were collected from respondents at a single point in time, allowing the researcher to examine the relationships between capacity building, firm capabilities, and local content participation (Saunders et al., 2023).

Study Population
The study targeted 346 domestic firms registered on the National Supplier Database maintained by the Petroleum Authority of Uganda. These firms constituted the population because they represented organizations eligible to participate in oil and gas procurement activities and local content initiatives within Uganda's petroleum sector (Petroleum Authority of Uganda, 2025).

Sample Size and Sampling Procedure
Using Yamane's (1967) formula, a sample size of 280 firms was determined from the population of 346 firms. The firms were selected using simple random sampling to provide each firm with an equal chance of participation in the study. Within each participating firm, three respondents, namely the Procurement Officer,

Accountant, and National Content Officer, were purposively selected because of their involvement in procurement activities, financial management, and local content implementation, respectively. In addition, Chief Executive Officers were purposively selected for key informant interviews because of their strategic knowledge regarding firm participation in Uganda's oil and gas sector (Yamane, 1967).

Data Collection Methods and Instruments

Quantitative data were collected using structured questionnaires administered to Procurement Officers, Accountants, and National Content Officers. The questionnaire was designed using a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). Qualitative data were collected through semi-structured interviews conducted with Chief Executive Officers. The interviews provided deeper insights into how capacity building and firm capabilities influence local content participation among domestic firms operating within Uganda's oil and gas sector (Creswell, 2018).

Measurement of Variables

Capacity building was measured using training, knowledge transfer, and access to credit. Firm capabilities were measured using production capacity, infrastructure, human resources, and capital base. Local content participation was measured using contracting local firms and local material usage. These dimensions were adopted based on existing literature relating to local content development and domestic firm participation in extractive industries (Alinda et al., 2022; Medani, 2022).

Data Quality Control

Data quality control procedures were undertaken to ensure that the data collected were accurate, complete, valid, reliable, and suitable for statistical analysis. This process is essential because poor-quality data may lead to biased statistical estimates and incorrect conclusions (Saunders et al., 2019). After data collection, all returned questionnaires were checked for completeness, consistency, and coding accuracy before data entry into SPSS Version 27.0. The dataset was screened for missing values, outliers, validity, reliability, and the assumptions underlying regression analysis. Missing data accounted for less than 5% of the responses and were therefore considered acceptable for statistical analysis (Tabachnick & Fidell, 2019). Standardized residuals and boxplots indicated that no extreme outliers were present. The results of the data quality assessment are summarized in Table 1.

Table 1: Summary of Data Quality Assessment

Test	Indicator	Recommended Threshold	Obtained Value
Content Validity	Overall CVI	≥ 0.80	0.87
Construct Validity	KMO	≥ 0.60	0.847–0.901
Construct Validity	Bartlett's Test	$p < 0.05$	$p < 0.001$
Reliability	Overall Cronbach's Alpha	≥ 0.70	0.886
Normality	Shapiro–Wilk Test	$p > 0.05$	0.076–0.093
Multicollinearity	Tolerance	> 0.20	0.702–0.741
Multicollinearity	VIF	< 5.00	1.349–1.425
Linearity	Scatter Plots	Linear pattern	Positive linear relationship
Homoscedasticity	Residual Scatter Plot	Random dispersion	Random distribution around zero

The results presented in Table 1 indicate that the questionnaire possessed acceptable validity and reliability. The overall Content Validity Index (CVI) of 0.87 exceeded the recommended threshold of 0.80, while the overall Cronbach's Alpha coefficient of 0.886 exceeded the recommended minimum of 0.70, confirming that the instrument was both valid and reliable. Furthermore, all regression assumptions were satisfied. The Shapiro–Wilk test confirmed normality, tolerance and VIF values indicated the absence of multicollinearity, scatter plots confirmed linearity, and the residual plot demonstrated homoscedasticity. Collectively, these results indicate that the dataset was suitable for parametric tests.

Common Methods Variance

To assess the presence of common method variance (CMV), Harman's single-factor test was performed using Principal Component Analysis. The results are presented in Table 2.

Table 2: Common Methods Variance Assessment: Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	11.697	17.723	17.723	11.697	17.723	17.723
2	5.428	8.224	25.947	5.428	8.224	25.947
3	3.733	5.656	31.603	3.733	5.656	31.603
4	2.031	3.077	34.680	2.031	3.077	34.680
5	1.493	2.262	36.942	1.493	2.262	36.942
6	1.400	2.121	39.063	1.400	2.121	39.063
7	1.341	2.033	41.095	1.341	2.033	41.095
8	1.301	1.971	43.066	1.301	1.971	43.066
9	1.276	1.933	45.000	1.276	1.933	45.000
10	1.217	1.844	46.843	1.217	1.844	46.843
11	1.195	1.811	48.654	1.195	1.811	48.654
12	1.158	1.754	50.408	1.158	1.754	50.408
13	1.150	1.743	52.151	1.150	1.743	52.151
14	1.108	1.679	53.830	1.108	1.679	53.830
15	1.073	1.626	55.456	1.073	1.626	55.456
16	1.055	1.599	57.056	1.055	1.599	57.056
17	1.039	1.574	58.630	1.039	1.574	58.630
18	.998	1.512	60.142			
19	.960	1.455	61.597			
20	.942	1.428	63.025			
21	.915	1.386	64.411			
22	.894	1.355	65.766			
23	.867	1.313	67.079			
24	.856	1.297	68.376			
25	.831	1.259	69.635			
26	.826	1.251	70.886			
27	.795	1.205	72.091			
28	.772	1.169	73.260			
29	.763	1.157	74.417			
30	.754	1.142	75.559			
31	.744	1.127	76.685			
32	.721	1.092	77.778			
33	.710	1.075	78.853			
34	.688	1.043	79.895			
35	.657	.996	80.891			
36	.644	.976	81.867			
37	.618	.936	82.803			
38	.599	.907	83.710			
39	.582	.882	84.593			
40	.562	.852	85.444			
41	.552	.837	86.281			
42	.535	.810	87.091			
43	.516	.782	87.873			
44	.495	.750	88.623			
45	.484	.734	89.357			
46	.481	.728	90.086			
47	.456	.691	90.777			
48	.436	.660	91.437			
49	.426	.646	92.083			
50	.419	.634	92.717			
51	.401	.607	93.325			
52	.384	.582	93.907			

53	.378	.573	94.480
54	.371	.562	95.042
55	.353	.535	95.577
56	.334	.506	96.083
57	.318	.482	96.566
58	.310	.469	97.035
59	.292	.442	97.477
60	.290	.439	97.916
61	.259	.392	98.308
62	.258	.390	98.699
63	.227	.344	99.043
64	.224	.340	99.383
65	.213	.322	99.705
66	.195	.295	100.000

Extraction Method: Principal Component Analysis.

The results indicate that the first unrotated factor accounted for 17.723% of the total variance, which is well below the commonly accepted threshold of 50%. This suggests that common method variance is unlikely to be a significant concern in the study, indicating that the relationships among the study variables were not substantially influenced by common method bias.

Data Analysis

Quantitative data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 26. Descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize the characteristics of respondents and study variables. Pearson correlation analysis was conducted to establish the existence, direction, and strength of relationships among the study variables. Hierarchical regression analysis was subsequently performed to determine the predictive influence of capacity building and firm capabilities on local content participation. Qualitative data obtained from interviews were analyzed using thematic analysis, where responses were organized into themes aligned with the study objective and variables (Braun & Clarke, 2022).

Ethical Considerations

Ethical approval was obtained from the relevant institutional authorities before the commencement of data collection. Permission to collect data was obtained from the Petroleum Authority of Uganda and participating firms. Respondents were informed about the purpose of the study and their participation was voluntary. Confidentiality and anonymity were maintained throughout the research process, and information obtained from respondents was used strictly for academic purposes.

4. Results and Discussion

Response Rate

The study targeted 346 firms registered on the National Supplier Database of the Petroleum Authority of Uganda. Out of the targeted firms, 280 participated in the study, representing a response rate of 81%. Additionally, 841 questionnaires were completed and returned out of the 1,038 questionnaires distributed, representing a questionnaire response rate of 81%. Furthermore, 18 out of the targeted 21 Chief Executive Officers participated in the interviews, representing an interview response rate of 85.7%. These response rates were considered adequate for statistical analysis and interpretation because they exceeded the minimum response rate generally recommended for survey-based studies (Groves et al., 2021). The high response rate further reduced the likelihood of non-response bias and enhanced the credibility of the study findings.

Characteristics of Firms

The majority of firms were located in the Central Region, accounting for 235 (83.9%). Most firms had operated for between 5 and 10 years, representing 97 (34.6%). Service provision constituted the dominant business activity, accounting for 121 (43.2%) firms. Small enterprises employing between 10 and 49 employees represented the largest category with 122 (43.6%) firms. Most firms were private limited companies,

accounting for 176 (62.9%). In addition, 98 (35.0%) firms reported that they had never supplied goods or services to the oil and gas sector. These findings suggest that although many domestic firms have positioned themselves to participate in petroleum activities, actual integration into the oil and gas supply chain remains limited. The large proportion of firms without prior supply experience highlights the continued need to strengthen the capabilities and preparedness of domestic firms if local content objectives are to be achieved.

Correlation Analysis

Pearson correlation analysis was conducted to establish the existence, strength, and direction of the relationships among the study variables before regression analysis. Correlation analysis was important because it provided preliminary evidence regarding whether capacity building and firm capabilities were associated with local content participation and therefore warranted further investigation through predictive modelling.

Table 3: Pearson Correlation Matrix (N = 280)

Items	1	2	3	4	5	6	7	8	9	10	11
Capacity Building-1	1										
Training-2	.878**	1									
Knowledge Transfer-3	.832**	.662**	1								
Credit Access-4	.806**	.550**	.455**	1							
Firm Capabilities-5	.166**	.150**	.143**	.126*	1						
Production-6	.170**	.153**	.162**	.115*	.895**	1					
Infrastructure-7	.129*	.120*	.095	.108*	.883**	.736**	1				
Human Resources-8	.125*	.107*	.110*	.097	.882**	.712**	.709**	1			
Local content participation-9	.501**	.467**	.452**	.345**	.417**	.354**	.380**	.365**	1		
Contracting Local Firms-10	.454**	.429**	.424**	.294**	.425**	.363**	.387**	.372**	.940**	1	
Local Material Usage-11	.489**	.451**	.427**	.356**	.360**	.303**	.328**	.315**	.941**	.769**	1

** Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

The results revealed that capacity building has a positive and statistically significant relationship with local content participation ($r = .501$, $p < .01$). The magnitude of the correlation indicates a moderate positive association, suggesting that improvements in training, knowledge transfer, and access to credit are associated with corresponding increases in local content participation. The finding implies that firms that continuously invest in developing employee competencies, facilitating knowledge acquisition, and improving access to financial resources are more likely to participate in local content activities through contracting local firms and utilizing locally available materials.

The findings can be interpreted through the Resource-Based Theory, which posits that organizational outcomes are influenced by the possession and development of valuable resources and capabilities that enhance competitiveness and performance. (Barney, 1991). Capacity building represents an important mechanism through which firms acquire strategic resources in the form of knowledge, skills, and financial capacity. As these resources accumulate, firms become better positioned to satisfy procurement requirements and compete effectively within the oil and gas sector. The positive correlation therefore suggests that firms possessing stronger capacity-building initiatives are more capable of transforming available opportunities into actual participation in local content activities. The findings support Medani (2022), who argued that capacity development enhances organizational effectiveness, and Ahmed, (2022), who observed that investments in skills and knowledge improve organizational participation and performance.

Despite the positive relationship observed, the moderate correlation coefficient ($r = .501$) suggests that capacity building alone does not guarantee increased local content participation. Other factors beyond

organizational training and knowledge acquisition may influence firms' participation in local content activities. For example, government procurement policies, contract qualification requirements, firm size, access to technology, regulatory compliance costs, and the competitiveness of international suppliers may either facilitate or constrain local firms regardless of their level of capacity development. Furthermore, firms already participating successfully in oil and gas contracts may subsequently receive additional training, mentoring, and financial support from industry stakeholders, suggesting the possibility of reciprocal rather than strictly one-way relationships. Therefore, while the findings support the proposed relationship, they should not be interpreted as evidence that capacity building is the sole determinant of local content participation.

The results further revealed that firm capabilities have a positive and statistically significant relationship with local content participation ($r = .417$, $p < .01$). This finding indicates that firms possessing stronger production capacity, infrastructure, human resources, and capital resources are more likely to engage in local content activities. The positive association suggests that operational readiness and organizational competence increase the ability of firms to satisfy the technical, quality, and delivery requirements associated with oil and gas procurement opportunities.

From the perspective of the Resource-Based Theory, firm capabilities represent strategic assets that enable organizations to create value and sustain competitive advantage. (Madhok & Li, 2013). Production systems, infrastructure, skilled personnel, and financial resources constitute valuable organizational resources that enhance the ability of firms to compete for contracts and participate effectively in petroleum supply chains. The positive relationship observed in this study, therefore, provides empirical support for the theory by demonstrating that firms with stronger resource bases are more likely to achieve higher levels of local content participation. The finding is consistent with Jaworska, (2023), who argued that organizational capabilities are essential determinants of competitiveness, and Wang & Ahmed, (2021), who observed that capabilities improve the ability of firms to exploit market opportunities. Although firm capabilities were positively associated with local content participation, the correlation was moderate ($r = .417$), indicating that operational capabilities alone may not be sufficient to explain successful participation. Some firms possessing adequate infrastructure, skilled personnel, and production capacity may still experience limited participation because of procurement practices that favor experienced international contractors, limited access to market information, lengthy certification processes, or financing constraints. Conversely, smaller firms with relatively limited capabilities may secure contracts through strategic partnerships, subcontracting arrangements, or government-supported local content initiatives. These considerations suggest that contextual and institutional factors may also influence local content outcomes alongside internal organizational capabilities. The significant positive relationships among the study variables provided preliminary support for the proposed hypotheses and justified further examination through regression analysis.

Regression Analysis

Hierarchical regression analysis was conducted to determine the predictive influence of capacity building and firm capabilities on local content participation. Capacity building was entered in Model 1, followed by firm capabilities in Model 2. This approach enabled the researcher to determine the individual contribution of capacity building and the additional contribution made by firm capabilities in explaining variation in local content participation.

Table 4: Model Summary

Model Summary[c]

					Change Statistics				
Model	R	R Square	Adjusted Square	R-Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.501[a]	.251	.248	.791340505077735	.251	93.253	1	278	.000
2	.605[b]	.366	.361	.729597952784280	.115	50.043	1	277	.000

a. Predictors: (Constant), Capacity Building
b. Predictors: (Constant), Capacity Building, Firm Capabilities
c. Dependent Variable: Local content participation

The model summary results show that capacity building alone explained 24.8% of the variation in local content participation (Adjusted R^2 = .248). This implies that differences in training, knowledge transfer, and access to credit account for nearly one-quarter of the observed variation in local content participation among domestic firms operating in Uganda's oil and gas sector. The remaining 75.2% of the variation was attributable to factors not included in the model.

Following the introduction of firm capabilities, the explanatory power of the model increased from 24.8% to 36.1% (Adjusted R^2 = .361). This indicates that capacity building and firm capabilities jointly explained 36.1% of the variation in local content participation, while 63.9% remained attributable to factors outside the model. The unexplained variation suggests that local content participation is influenced by additional organizational and environmental factors not examined in this study. These may include government enforcement of local content regulations, procurement transparency, firm experience within the petroleum sector, technological readiness, quality certification, market competition, strategic partnerships, and macroeconomic conditions. Consequently, while capacity building and firm capabilities make important contributions, they represent only part of the broader set of determinants influencing participation in Uganda's oil and gas value chain. The R^2 Change value of .115 further indicates that firm capabilities contributed an additional 11.5% towards explaining local content participation beyond the contribution of capacity building alone.

The findings suggest that local content participation is not determined by a single organizational factor but rather by a combination of organizational resources and capabilities. Consistent with the Resource-Based Theory, the results demonstrate that firms possessing stronger resource endowments and organizational capabilities are more likely to achieve superior outcomes in terms of participation in local content activities. The increase in explanatory power following the inclusion of firm capabilities further suggests that operational competence complements capacity-building efforts in enhancing firm participation within Uganda's oil and gas sector.

ANOVA Results

The ANOVA results are presented in Table 4, indicating whether the regression models are statistically significant. The F-statistic and corresponding significance values show whether the independent variables, when considered together, are associated with local content participation.

Table 5: ANOVA

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	58.397	1	58.397	93.253	.000[b]
	Residual	174.089	278	.626		
	Total	232.486	279			
2	Regression	85.035	2	42.518	79.873	.000[c]
	Residual	147.451	277	.532		
	Total	232.486	279			

a. Dependent Variable: Local content participation
b. Predictors: (Constant), Capacity Building
c. Predictors: (Constant), Capacity Building, Firm Capabilities

The ANOVA results indicate that both regression models were statistically significant. Model 1 was significant ($F = 93.253$, $p < .001$), confirming that capacity building significantly predicts local content participation. Similarly, Model 2 remained statistically significant ($F = 79.873$, $p < .001$), indicating that the combined effect of capacity building and firm capabilities significantly predicts local content participation among domestic firms operating in Uganda's oil and gas sector.

The statistical significance of both models demonstrates that the observed relationships are unlikely to have occurred by chance. The findings, therefore, provide empirical evidence that organizational resources and capabilities are important determinants of participation in local content activities. The results further reinforce the assumptions of the Resource-Based Theory, which argues that differences in organizational performance can be explained by differences in resource ownership and capability development among firms (Barney, 1991). Consequently, firms possessing stronger resource bases and operational competencies are more likely to achieve higher levels of participation within petroleum supply chains. Nevertheless, statistical significance should not be interpreted to mean that the proposed model completely explains local content participation. The significant F-statistics merely indicate that the independent variables collectively improve prediction beyond chance. Other unmeasured factors may equally contribute to firms' participation, highlighting the complexity of local content implementation within Uganda's oil and gas sector.

Regression Coefficients

The coefficient results are presented in Table 4.5, showing the direction and strength of the relationship between capacity building, firm capabilities and local content participation.

Table 6: Coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.124	.200		5.621	.000
	Capacity_Building	.625	.065	.501	9.657	.000
2	(Constant)	.186	.227		.820	.413
	Capacity_Building	.554	.061	.444	9.152	.000
	Firm_Capabilities	.384	.054	.343	7.074	.000

a. Dependent Variable: Local content participation

The regression coefficients revealed that capacity building had a positive and statistically significant influence on local content participation ($\beta = .444$, $p < .001$). This finding implies that improvements in training, knowledge transfer, and access to credit significantly increase the likelihood of firms participating in local content activities. The positive coefficient indicates that firms investing in capacity-building initiatives are more likely to strengthen their readiness to satisfy procurement requirements and exploit opportunities available within the oil and gas sector.

The finding can be interpreted through the Resource-Based Theory, which suggests that investments in knowledge, skills, and financial resources create valuable organizational assets that enhance competitiveness and performance. Capacity-building initiatives therefore strengthen the internal resource base of firms and improve their ability to transform opportunities into tangible outcomes. The relatively strong coefficient suggests that the acquisition of knowledge and competencies may be more important than physical resources alone in promoting local content participation. The finding supports Medani, (2022), who argued that capacity development strengthens organizational effectiveness, and Ahmed, (2022), who observed that investments in human capital and organizational learning improve firm performance and participation. However, the positive influence of capacity building may vary across firms depending on their ability to translate acquired knowledge into operational improvements. Training programs that are not aligned with industry needs, inadequate follow-up support, and limited financial resources may reduce the practical benefits of capacity-building initiatives. Furthermore, firms already engaged in oil and gas activities may receive more opportunities for training and knowledge transfer than less experienced firms, suggesting that successful participation may itself contribute to further capacity development.

The results further revealed that firm capabilities had a positive and statistically significant influence on local content participation ($\beta = .343$, $p < .001$). This finding indicates that firms possessing stronger production

systems, infrastructure, human resources, and capital resources are more likely to participate in local content activities. The positive coefficient suggests that operational capabilities increase the ability of firms to satisfy industry standards, deliver quality goods and services, and compete effectively for procurement opportunities. Consistent with the Resource-Based Theory, firm capabilities represent strategic resources that enable organizations to achieve competitive advantage and superior performance outcomes. The findings, therefore, suggest that firms possessing stronger operational capabilities are better positioned to convert available market opportunities into actual participation within petroleum supply chains. The finding supports Jaworska, (2023), who emphasized the importance of organizational capabilities in achieving competitiveness, and Wang & Ahmed, (2021), who argued that firm capabilities enhance organizational effectiveness and market participation. It is also important to recognize that strong firm capabilities do not automatically translate into successful local content participation. External barriers, including stringent procurement requirements, high compliance costs, limited access to finance, delays in certification, and competition from well-established international suppliers, may limit the ability of capable domestic firms to secure contracts. Therefore, improvements in firm capabilities should be accompanied by supportive policy and institutional interventions to maximize their contribution to local content development.

A comparison of the standardized beta coefficients indicates that capacity building ($\beta = .444$) exerts a stronger influence on local content participation than firm capabilities ($\beta = .343$). This finding suggests that although operational capabilities are important, investments in training, knowledge transfer, and access to finance contribute more substantially towards improving local content participation. The implication is that domestic firms may first require adequate knowledge, skills, and financial preparedness before they can effectively utilize their operational capabilities to participate in oil and gas activities. The findings therefore support H1 and H2 and confirm that capacity building and firm capabilities are significant predictors of local content participation among domestic firms operating in Uganda's oil and gas sector. Although capacity building emerged as the stronger predictor, the difference between the standardized coefficients ($\beta = .444$ versus $\beta = .343$) should be interpreted cautiously because both variables contribute significantly to explaining local content participation. The findings, therefore, suggest complementarity rather than substitution. Capacity-building initiatives are likely to be most effective when accompanied by investments in production infrastructure, technology, and organizational systems that enable firms to apply newly acquired knowledge in practice.

Qualitative Findings

Capacity Building and Local Content Participation

The qualitative findings revealed that capacity building plays a critical role in enhancing local content participation among domestic firms operating in Uganda's oil and gas sector. Participants explained that training programs, knowledge transfer initiatives, and access to finance improve the ability of firms to understand procurement requirements, comply with industry standards, and compete for available opportunities within the petroleum sector. Several participants noted that capacity-building initiatives have increased awareness of operational procedures, quality requirements, and safety standards necessary for participation in oil and gas activities.

Participants further observed that knowledge transfer initiatives facilitated through interactions with international oil companies provide local firms with opportunities to acquire technical expertise and industry-specific competencies. However, respondents emphasized that the effectiveness of capacity-building programs is often constrained by limited access to financial resources required to operationalize acquired knowledge and skills. These findings support the quantitative results, which demonstrated that capacity building positively influences local content participation. The findings further reinforce the Resource-Based Theory by suggesting that knowledge, skills, and financial resources constitute strategic assets that enhance the ability of firms to participate in local content activities.

Participants also highlighted several challenges that reduced the effectiveness of capacity-building initiatives. These included limited funding to implement acquired knowledge, irregular training opportunities, inadequate post-training support, and difficulties accessing affordable credit. Some respondents observed that although training programs improved awareness, many firms lacked the financial and technological capacity required

to compete successfully for large procurement contracts. These observations suggest that capacity building alone may not be sufficient unless complemented by broader institutional and financial support mechanisms.
Beyond confirming the statistical findings, participants explained that the quality of capacity-building programs differed considerably across firms. While some firms benefited from continuous technical mentoring and supplier development initiatives, others reported that training opportunities were irregular and largely concentrated among firms that had already established relationships with international oil companies. Participants further noted that knowledge acquired through training could not always be translated into improved participation because many firms lacked the financial resources and equipment required to implement new skills. These observations help explain why some firms continue to experience low levels of local content participation despite receiving training.

Firm Capabilities and Local Content Participation

Participants indicated that firm capabilities significantly influence participation in local content activities within the oil and gas sector. Production capacity, infrastructure, human resources, and financial resources were identified as critical determinants of a firm's ability to secure contracts and deliver goods and services within the petroleum industry. According to participants, firms possessing stronger operational capabilities are more likely to satisfy industry requirements relating to quality, safety, reliability, and timely delivery.

Several participants emphasized that inadequate infrastructure, limited production systems, and shortages of specialized technical expertise continue to constrain the participation of many domestic firms. Participants further noted that firms with stronger organizational capabilities are better positioned to compete with foreign suppliers and take advantage of procurement opportunities created within the oil and gas sector. These findings corroborate the quantitative results, which revealed that firm capabilities significantly influence local content participation. The findings are also consistent with the Resource-Based Theory, which argues that organizational performance is influenced by the possession and effective utilization of valuable resources and capabilities.

Respondents further explained that even firms possessing adequate production facilities and skilled personnel sometimes encountered barriers beyond their control, including complex procurement procedures, limited access to information regarding bidding opportunities, and strong competition from established foreign contractors. These findings demonstrate that local content implementation is shaped not only by internal organizational capabilities but also by the broader regulatory and market environment.

The qualitative findings provided explanations for the statistical relationships observed in the quantitative analysis. While the regression results established that capacity building significantly influenced local content participation, interview participants explained that the effectiveness of capacity-building initiatives depended on the consistency of training programs, access to finance, and opportunities to apply acquired knowledge. Similarly, although firm capabilities were found to be significant predictors of local content participation, participants highlighted procurement barriers and institutional constraints that limited the ability of capable firms to secure contracts. These qualitative findings demonstrate that successful local content implementation depends not only on organizational resources but also on the broader operating environment.

5. Conclusion

The study examined the determinants of local content participation among domestic firms operating in Uganda's oil and gas sector, with particular focus on the influence of capacity building and firm capabilities. The findings revealed that capacity building and firm capabilities have positive and statistically significant influences on local content participation. Capacity building emerged as the strongest predictor, suggesting that investments in training, knowledge transfer, and access to finance significantly enhance the participation of domestic firms in local content activities. Firm capabilities were also found to contribute significantly to local content participation, indicating that production capacity, infrastructure, human resources, and capital resources are important for effective participation within petroleum supply chains. The study concludes that strengthening organizational resources and capabilities is essential for increasing local content participation and improving the integration of domestic firms into Uganda's oil and gas sector.

Study Implications

The findings have important theoretical and practical implications. Theoretically, the study provides empirical support for the Resource-Based Theory by demonstrating that organizational resources and capabilities significantly influence local content participation. The findings suggest that firms possessing stronger knowledge resources, financial capacity, infrastructure, and operational capabilities are more likely to participate in local content activities. Practically, the findings imply that policymakers and industry stakeholders should prioritize interventions that strengthen capacity-building initiatives and firm capabilities if the objectives of local content policies are to be realized. The study, therefore, highlights the importance of developing both human and organizational capabilities as a means of increasing domestic participation in petroleum value chains.

Recommendations

Based on the findings that capacity building and firm capabilities significantly influence local content participation, the study recommends that the Petroleum Authority of Uganda (PAU), the Ministry of Energy and Mineral Development, and international oil companies establish structured supplier capacity development programs targeting domestic firms. These programs should include certified technical training, procurement compliance workshops, mentorship arrangements, and technology transfer initiatives conducted at least twice a year. Their effectiveness should be monitored using indicators such as the number of firms trained, certification completion rates, and the percentage increase in local firms prequalified for oil and gas contracts. To improve access to finance, the study recommends that the Uganda Development Bank, commercial financial institutions, and relevant government agencies develop affordable financing facilities specifically designed for domestic suppliers participating in the oil and gas sector. These financing mechanisms should be introduced within two years and assessed using indicators such as the number of firms accessing credit, the value of loans disbursed, repayment rates, and the proportion of financed firms that successfully secure petroleum procurement contracts.

The study also recommends that domestic firms strengthen their production systems, infrastructure, human resources, and capital resources through phased organizational capacity improvement plans implemented over a three- to five-year period. Progress should be monitored using measurable indicators including production capacity, quality certifications obtained, the number of skilled personnel employed, investment in production infrastructure, and the number and value of contracts secured within the petroleum sector.

The study further recommends that the Petroleum Authority of Uganda, industry associations, international oil companies, and domestic firms strengthen collaboration through regular supplier forums, joint ventures, subcontracting arrangements, and supplier development initiatives held at least once every quarter. Progress should be assessed using indicators such as the number of partnership agreements established, joint ventures formed, contracts awarded to local firms, the proportion of locally sourced materials used, and changes in overall local content participation.

Study Limitations

The study was limited to domestic firms registered on the National Supplier Database of the Petroleum Authority of Uganda and therefore, may not fully capture the experiences of firms operating outside the database. The study also employed a cross-sectional design, which limited the ability to examine changes in local content participation over time. In addition, the study focused on capacity building and firm capabilities and did not examine other organizational, institutional, or environmental factors that may influence local content participation.

Areas for Further Research

Future studies should examine additional factors that influence local content participation among domestic firms operating in the oil and gas sector. Such factors may include access to market information, strategic partnerships, technological innovation, institutional support, and supply chain integration. Future researchers may also employ longitudinal research designs to examine how local content participation evolves as Uganda's petroleum sector progresses towards full-scale production. Comparative studies involving other petroleum-producing countries within Africa may further provide insights into factors that enhance domestic participation in oil and gas value chains.

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Trends and Development of Occupational Competency Assessment and Certification in Addis Ababa: Implications for TVET-Industry Partnership

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Abstract: This study aimed to assess the Ethiopian Occupational Competence Assessment and Certification Center (OCACC), considering its mandate to improve the competency level of graduates. A descriptive survey design with a qualitative method was employed. Interview held with leaders and experts of OCACC. Then, interviews were transcribed for analysis, supplemented with field notes and documents. The study investigated occupational standard (OS) perspectives, training standard (TS), and readiness of graduates. The findings showed that a graduate's school-to-work transition (SWT) is constrained by school (supply) and out-of-school (demand) factors. Gaps were observed because of inadequate attention to cooperative training and due to the industry's low awareness and frustration during the CoC assessment. Also, there was a scarcity of experts who developed and validated assessment tools at OCACC. Regarding opportunities, a strategy and participatory system exist. Finally, policy options were forwarded to fill the gap between the existing state and what OCAC strives to be in digitalization, competency development, and TVET-industry partnership.

Key Words: *Competency assessment, occupational standards, training standards, cooperative training, TVET-Industry partnership*

1. Introduction

According to the Central Statistical Agency (CSA) (2007) projection of 2025 estimation (est.), there are about 111. 6 million inhabitants, of which nearly half are female, and about 78.8% dwell in rural areas, where agriculture is their mainstay. It is also interesting to note that although nearly half of the Ethiopian population constitutes an active labor force, unemployment is a glaring problem with a rate of 19.1% (2018 est.). Ethiopia has an alphabet that dates to the Axumite period (4th century A.D), but the country remained the "Land of the Thumb Print" with about 51.8% (2017 est.) literacy rate. There is educational expansion in Ethiopia at all levels. However, the system needs to travel long distances to improve quality. Moreover, institutions focus on knowledge with inadequate consideration for value and skill formation. The TVET system is also not strongly linked with small and medium enterprises (SMEs). TVET institutions (public, private, & NGO) expanded to 1403 in 2023, and enrolment increased from 5264 in 1999 to 387,792 in 2018 (Amare 2023). Nevertheless, there is a mismatch between job seekers and employment possibilities.

By way of addressing these challenges, the researcher is interested in conducting trend analysis in one of the priority areas, i.e., Occupational Assessment and Certification at TVET Colleges in Addis Ababa. The Technical and Vocational Education and Training (TVET) program is designed to enable trainees to get paid jobs or create their own jobs (self-employed). Hence, the task of making vocational graduates self-supportive is demanding and should not be left only to training institutions.

A major reform shift was made in the Ethiopian TVET system after the launch of the MoE 2008 TVET strategy, which was supported by the revised Federal TVET Proclamation No. 954/2016 (FDRE, 2016). An outcome-based TVET approach has been practiced in Ethiopia, and more than 400 occupations are prepared by practitioners who represent companies. The TVET strategy stipulated various interventions, including the national qualifications framework for TVET (NTQF); occupational standards; accreditation system; and introduction of a competence-based system for assessment and certification.

The Occupational Assessment and Certification Directive (MoE, 2010c) requires that "the competence requirements in the different qualification levels of the country's vast occupational classifications shall be the basis for the assessment and certification in all industry sectors" (p. 2). The national TVET strategy also envisages that occupational (competence or standards-based) assessment will be conducted internally by TVET institutions and externally by accredited assessors in assessment centers. External assessment will be followed by certification upon passing the assessment. Assessment and certification are independent of

training and regulated by an organ, which is referred to as a Certificate of Competency (CoC) or OCACC (MoE, 2008; FTA, 2014).

In Addis Ababa, there are five branches of the Center of Competencies or OCACCs under the City Administration Competency Assurance Agency. The five CoC branches (eastern, western, central, southern, & northern) conduct trade tests for graduates of TVET institutes by accredited assessors. The occupational competency assessment incorporates knowledge, attitudes, and skills aspects in the form of written or oral questions and practical tests. This occupational competency assessment process has been underway since 2008 (FTA, 2014; MoE, 2010c).

This research, therefore, tries to investigate the problem from the perspective of apprenticeship, assessment and certification policy framework, candidates' participation based on sector and occupations, and countries' experience. The study is expected to add value to the existing literature, practice, research, and policy in both international and local contexts. To this end, the purpose of the research is to assess the status of the Ethiopian Occupational Competence Assessment and Certification Center (OCACC) of Addis Ababa, given its mandate to improve the competency level of TVET graduates and other candidates, thereby providing policy suggestions to enhance the performance of the system. In due course, trends, gaps, and prospects of OCACC were examined. Bearing in mind the above purpose, the research tried to answer the following basic questions:

- What major differences exist in the trend of Occupational Competence Assessment and Certification (OCAC) in terms of candidates' participation based on sector and occupation?
- How is OCACC related to TVET institutions and the industry, including production sectors and service providers?
- What policy gaps and challenges exist regarding the future perspective of the OCAC system?

2. Theoretical Framework

Theories and Concepts of Competency

The term competency is derived from the Latin word 'Competere', which means to be suitable. The concept was developed in Psychology, referring to individuals' ability to respond to demands placed on them by the environment. It is a philosophical view on how we come to understand or know, guided by the pragmatic philosophy of Richard Rorty (1991) and John Dewey's (1916) philosophy associated with cooperative education/training that occurs through practical hands-on experience. The concept of competence has emerged during the second half of the 20th century (Martin, 2007). However, occupational competence assessment in Ethiopia has been introduced since 2008.

Theoretically, according to Mulder (2017), the Outcome-Based or Competence-Based Education and Training (CBET) has been embraced by different theories, and disciplines including learning theories, theories of social constructivism and learner agency (Billett), action theory (Vonken), professional expertise (Evers & Van der Heijden), capabilities (Cairns & Malloch), interpersonal competence and competence acquisition (Argyris), the lack of potential assessment in promotion (Peter & Hull), performance (Gilbert), labor relations (Stokes), education quality improvement (Grant et al.), mathematics (Gelman & Green), cultural sciences (Popov et al.), management theory (Barabasch), and competence in language and communication (Chomsky).

As there are different perspectives and approaches towards competency, it is difficult to propose a universally agreed-upon definition of competence. Azimov et al. (2009) describe competence as a combination of knowledge, skills, and abilities formed in learning a specific vocation, as well as the ability to perform any activity based on the acquired knowledge, skills, and attitudes. According to Rüschoff (2022), there is no mutual understanding of what constitutes competence. Despite the heterogeneous nature of the approaches, cognitive and performance dimensions of competence are widely used (Rüschoff, 2022).

For instance, Americans encourage behavioral aspects that stress the significance of individual characteristics and behavioral competence to develop better performance. In the UK, a functional approach to competency is practiced. It focuses on functional analysis and the development of occupational standards grounded on a unit of competencies reflecting real-life situations. The French multidimensional views deal with knowledge, functional and behavioral competencies, and the German holistic approach describes competency as the

capacity of a person to act holistically, incorporating not only content or subject knowledge and ability but also core and generic abilities (Stan & Jolanta, 2016; Getachew, 2014).

This study embraces a description by Mulder (2017) that discusses the concept of competence as a balanced perspective of integrated knowledge, attitude, and skills (KAS). This conceptualization is multidisciplinary and is not considered a one-size-fits-all practice and tries to consider the situation of occupational competency in the TVET system. As discussed in the above sections, the conceptualization of the competency approach needs to incorporate knowledge, skills, and attitudes. If training programs incline to one of these competency descriptions, undesired outcomes will be manifested.

The modular or competency-based education and training (CBET), unlike the conventional system, allows the trainee to be trained and certified in any one of the modules (jobs) he/she likes. The following comparison of the basic differences inherent in the two approaches helps to understand the merits of competency-based vocational training programs.

Table 1: Conventional versus Competency-based TVET Program (ICDR, 2000).

No.	Conventional TVET	CBET (Modular) TVET
1	Content-based	Competency-based
2	Time-based	Performance-based
3	Group paced	Individually paced
4	Delayed feedback	Immediate feedback
5	Textbook/Workbook	Modules and media materials
6	Limited field experience	Learning in the field
7	Lecturers, demonstration	Assistance of a resource person
8	General objective	Specific objectives
9	Subjective criteria	Objective criteria
10	Certificates or credentials indicate the successful completion of courses	Certificates or credentials practically demonstrate certain competencies

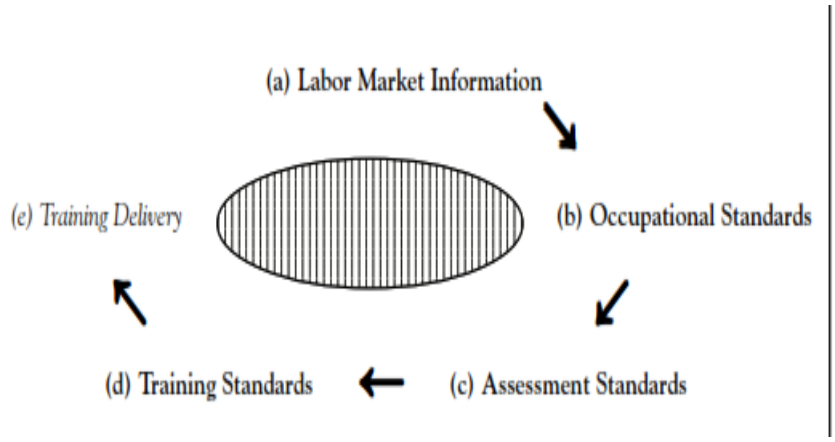
Linking the Occupational Standard (OS) and Training Standard (TS)

Competence is at the core of the VET system, encompassing the ability to use knowledge, skills, and attitudes to perform work activities and to realize expected results. As one of the approaches for preparing a competency-based curriculum, Occupational Standards (OS) and Training Standards (TS) are being developed using various formats to be employed by trainers, trainees, employers, chambers, and other stakeholders.

An “occupation” is a cluster of related jobs that share common occupational tasks of similar complexity and performance across various industrial/service sectors (Stan & Jolanta, 2016). Occupational standards are related to activities performed by a person for a certain occupation, but training standards are developed from the activities in occupational standards, and they include learning outcomes that ensure the requisite attitude, skill, and knowledge by individuals to enable them to perform an agreed task in an occupation (EU, 2011).

Occupational and training standards determine the skills, knowledge, and values required for individuals to perform competently in a workplace. Whereas occupational standards describe what a person does in a given job, training standards define how a person acquires those competencies (OECD, 2024). The conflicting nature of training and employment requirements and the content of OS dictates that the information for OS development should come from employers, training providers, Ministries of Labor and Education, chambers, and other stakeholders. Before undertaking the development of OS, stakeholders need labor market information (LMI) to provide "early warning", identify priorities for standards development, and scrutinize changing skill demands in occupations, as shown in Figure 1 below (Fretwell, Lewis, & Deij, 2001).

Figure 1: Steps in the Development of Occupational and Training Standards

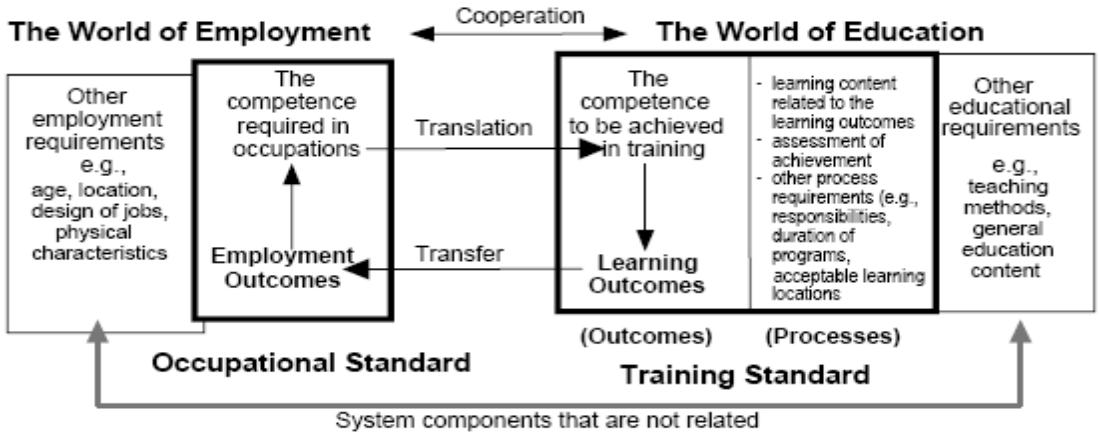


Source: Fretwell, Lewis, and Deij (2001)

According to Fretwell, Lewis, and Deij (2001), curriculum development is on the supply side of the occupational training equation, and at times, there could be a conflict of interest with the demand side, which incorporates occupational standards and assessments.

As illustrated in Figure 2, TS consists of outcomes and processes. Accordingly, the linkage is between TS outcomes and OS or employment outcomes. In a situation where this linkage is direct, employment requirements will determine the learning outcomes. However, the relationship often may have a reciprocal effect, where training outcomes could to a certain extent influence employment outcomes.

Figure 2: Translating Occupational Standards into Training Standards



Source: Mansfield & Schmidt (1999).

Training standards (TSs) need to be linked to occupational standards (OSs) if training is to be relevant to real-life situations. However, such linkages may not be present because training institutions often do not use existing standards. In the logic of *employment*, employers are interested in what people need to do, how they will do it, and how well they do it. They are interested in *outcomes.* In the logic of *education*, education professionals are interested in what people learn, how they will learn it, and how the quality and content of learning will be assessed. Education uses a language of input (syllabus, subject), process (teaching/learning methods), and assessment. TVET institutions, unlike employers, will guard their independence and ability to design training programs. They may consider occupational standards defined by employers as narrow in scope and an invasion of their area of responsibility (Fretwell, Lewis & Deij, 2001).

To this end, there is a need to reconcile supply-side issues (training) and demand-side aspects (employment) through work-based learning (WBL) and apprenticeship schemes. Methodologies for the development of occupational standards range from task-based to competence-based occupational analysis.

Occupational Competency Assessment (OCA)

Occupational standards are the basis for training, assessment, and certification that contribute to the improvement of the quality and relevance of TVET. The assessment consists of theoretical or practical content that will vary as it is compared with another individual (norm-referenced) or it may be based on criteria.

Drawing on diverse sources, MacKenzie and Polvere (2009) elaborated terminologies related to assessment in their TVET glossary. Hence, assessment is defined as "the sum of methods and processes used to evaluate the attainments (knowledge, know-how, skills & competences) of an individual, and typically leading to certification," while an assessor is "a person qualified to carry out assessment" (p. 61).

According to the OCA directive, certification is defined as "a formal process of recognizing that an individual is qualified in terms of the required knowledge, skills, and proper work attitudes based on the occupational standards set by industry" (MoE, 2010c, p.3). Certification refers to who the person is, and what he or she knows and can do, with implications for a quality culture of learning at TVET institutes. Competence is the criterion by which assessment and certification are made.

According to Selamawit (2014), occupational competency assessment is aimed at collecting evidence about candidates' knowledge, skills, and attitudes to make judgments about whether an individual is competent or not to the expected workplace standard. The provision of occupational assessment can also serve as the foundation to hire, train, and develop employees. Competence tests are offered for graduates who completed TVET programs and other individuals by way of facilitating the recognition of prior learning (RPL).

The occupational competency assessment and certification center is mandated to accredit assessors to conduct trade tests and license TVET institutions or companies as assessment centers for specific occupational qualification levels. It also provides reports and statistics on the results of assessment and, at the same time, maintains and manages the registry/database of workers/candidates assessed and to be certified (OCAAC, 2012).

Based on Cedefop (2015) & Fretwell, Lewis, & Deij (2001), information from assessed candidates or learners, and other stakeholders who participate in assessment can be used to provide:

- feedback to individual learners (e.g., about their competence development process, their strengths and weaknesses, career mobility, lifelong learning, & certification);
- feedback to TVET providers (e.g., regarding design & organization of certification, benchmarking, & other processes such as pedagogical approach, learning sites, etc.);
- feedback to employers (e.g., about hiring, promotion, & planning of internal training);
- feedback at system level (e.g., concerning learning-outcomes-based standards, requirements for trainers & assessors, and stakeholder involvement).

Concerning occupational competency assessment principles, validity, reliability, impartiality, and transparency were considered when developing assessment and certification policies. Moreover, eight key quality certification features were identified: (a) addressing certification in quality assurance mechanisms; (b) providing clear reference points for assessment; (c) provision of information to stakeholders; (d) selection, requirements, and training of assessors; (e) quality of assessment methods and procedures; (f) quality of verification and grading; (g) appeal procedures; (h) documentation, evaluation and monitoring of certification (Cedefop, 2015).

Occupational competency assessment rubrics and metrics are expected to be evidence-based and objective. Otherwise, OCA systems developed haphazardly make school-to-work transition decisions difficult.

Based on the works of Biemans, et al., (2009), challenges to execution of competence-based assessment derive from: a) the fact that practical assessment (as compared to classroom examination) is not only time-consuming

but also requires standardization of observation and preparations of reliable and valid assessment tools; and b) the dilemma of striking the balance between national standards for assessment and local need for flexibility. Studies from Ethiopia on OCA challenges revealed a lack of autonomy for CoC agencies, inadequate feedback for TVET institutions concerning assessment scores, a mismatch between OS and labor market needs, fairness in employing single verifiers, and a lack of internal and external assessors (Ashebir, Solomon, & Getachew, 2026).

Hence, occupational competency being the foundation for assessment and certification, it is vital for quality assurance and strengthening candidates' interest and job fit. In connection with this, occupational competency assessment (OCA) plays a key role in improving ties between TVET colleges and industries/companies.

3. Research Design and Method

Research Approach

This study aimed to investigate practices, gaps, and emerging trends in occupational competency, which is one of the policy debates in vocational training. To address this challenge, a descriptive survey method was used to reveal the existing gaps in the vocational training system of occupational assessment. The research design was qualitative with a mix of quantitative approaches. The quantitative aspect relies on the statistical information from OCACC and the TVET Agency. Qualitative design, including a review of experience, was selected to examine viewpoints and deeper insights on OCA. The approach and materials consulted were chosen depending on policy relevance and appropriateness to the context.

Sources of information and data collection instruments

The data for the study were obtained from primary and secondary sources. Firsthand information is obtained through data gathering tools, including interviews. To complement this, the researcher employed secondary sources such as research done in similar areas, documents related to the CoC test at OCAC, relevant books, journal articles, reports, and a review of experiences of countries.

An interview was preferred to get in-depth information on the challenges and opportunities of OCA in the TVET system. Before undertaking the interview, the researcher tried to get the consent of the participants and explained the objectives of the study. The interview was conducted with leaders and experts of OCACC. Regarding qualitative data, individual interviews were transcribed for analysis and supplemented with documentary surveys. For the quantitative data, frequency counts and percentages were used in the Tables.

4. Findings from Current Practices

CoC Test Assessment Results

Table 2: Summary CoC Test Assessment by Year and Competent Trainees (Database of OCACC)

Year	Assessed Trainees	Competent Trainees	Competent Trainees (%)
2008	2113	220	10.41
2009	6589	1715	26.03
2010	23185	4184	18.05
2011	38309	5460	14.25
2012	40661	7751	19.06
2013	40636	17985	44.26
2014	72235	44569	61.70
2015	102553	62557	61.00
2016	114291	64313	56.27
2017	130259	80577	61.86
2018	161192	93916	58.26
2019	179574	95561	53.22
2020	144373	74548	51.64
2021	110295	62390	56.57
2022	170103	103312	60.73

2023	147515	79626	53.98
Total	**1483883**	**798684**	**53.82**

As shown in Table 2, there were some fluctuations and declining trends of assessment results in due course. However, the increasing trend is mostly exhibited. For instance, the number of candidates who were found to be competent on the CoC test has increased from 14.25% in 2011 to 60.73% in 2022 in Addis Ababa City Administration. In the beginning, both the number of assessed candidates and their rate of competency were found to be low. This might be due to awareness problems, a high dropout rate that shows enormous differences between the registered candidates and those assessed in the testing centers, and ill-preparation on the part of vocational training centers and companies. As of 2013, trainees' rate of competency somewhat increased, but in 2020, a decreasing rate was observed due to the COVID-19 pandemic. In 2021/22, a slight increase was shown in terms of competency rates.

Table 3: Aggregate Assessment by Sector and Gender (Database of OCACC)

	Female		Male		Grand Total		
Sector	**Assessed**	**Competent**	**Assessed**	**Competent**	**Assessed**	**Competent**	**%**
Agriculture	268	222	324	287	592	509	85.98
Automotive	286	175	5202	2914	5488	3089	56.29
Business	25673	3064 (11.9%)	13300	2148 (16.2%)	38973	5212	13.8
Business and Finance	13435	6481 (48.2%)	6973	3635 (52.13%)	20408	10116	49.57
Construction	5907	3165	27213	16187	33120	19352	58.43
Culture	438	184	542	352	980	536	54.69
Culture, Sport, & Tourism	3226	2952	1308	1154	4534	4106	90.56
Electricity/Electronics	1029	480	4662	1760	5691	2240	39.4
Electro Technology	3	2	5	5	8	7	87.50
Gender & Development	31	8	56	52	87	60	68.97
Health	32340	10665 (32.9%)	11308	4412 (39)	43648	15077	34.5
Hotel and Tourism	2656	1915 (72.1%)	886	639 (72.1%)	3542	2554	72.11
ICT	6844	1706	6326	2564	13170	4270	32.4
Labor and Social Affairs	65	48	63	43	128	91	71.09
Leather Technology	306	206	445	241	751	447	59.52
Manufacturing	267	134	3247	1373	3514	1507	42.9
Textile and Garment	2079	1161 (55.8%)	839	631 (75.2%)	2918	1792	61.41
Transport Operations	1	1			1	1	100
Grand Total	94854	32569	82699	38397	177553	70966	39.97

As indicated in Table 3, in traditionally female-dominated areas such as Business, Finance, Health, Hotel and Tourism, and Textile and Garment, candidates' competency was found to be similar in most areas to that of their male counterparts. Although male candidates rated slightly higher in some sectors, the gender gap was not high. It might also be surprising to see more male candidates in Gender and Development than females. In general, sectors like Business, Electricity/Electronics, Health, ICT, and Manufacturing were among the less performing areas that need attention. A very low level of participation was observed in the Transport Operations sector (only one female candidate took the test and proved herself to be competent).

Interview Results and Discussions

At a pilot level, OCAC started in September 2008. The number of candidates receiving the service increased from less than 4000 in the beginning to nearly 100,000 in 2015. Such a high level of participation and growing demand for occupational competency assessment or trade tests brought several opportunities and challenges to the OCAC system.

The findings from the interviews of officials and experts at OCACC are summarized as opportunities and challenges. Some of these findings were substantiated by the research work of other professionals and institutions in the area.

For the question or thematic area, *"What new experience (opportunities) came as a result of OCAC? Or what is the difference in the TVET system before and after institutionalizing OCAC?",* interview participants from OCACC tried to elaborate benefits of introducing CoC test in TVET system concerning the impact on quality, enhancing cooperative training and partnerships, attempts to meet international standard, and accountability and opportunity for self-check, and future directions in the following manner:

Regarding the impact on quality, one of the officials stated:
In the previous TVET system, the focus was on the number of graduates, not on the quality of the training, trainees, and trainers. In the new OCAC scheme, those who are going to be assessed are not only trainees or graduates but also individual employees at small and medium-sized enterprises and TVET trainers. During the commencement of OCAC, the competency level of trainers was 37%. Recently, most trainers have become competent due to continuous assessment and professional development.
Furthermore, one of the experts at OCACC revealed:

In the previous TVET system, there was no skill gap assessment and the way the status of TVET institutes was checked was also weak. In the existing OCAC, OCACC will conduct the assessment to identify skill gaps and inform the results to the concerned candidates and TVET institutes, who send trainees for occupational assessment. Those candidates who do not yet qualify for the level will remain in the TVET institutes and retake the occupational test. Candidates outside of TVET institutes can also take the test several times until they become competent in certain units of competency. Those found to be competent after the test can continue to the next level of training or get a certificate for the level at which they are qualified. If TVET centers cannot qualify 62% of their trainees through the occupational test, they will not be accredited.

In support of the above findings, Habte (2015) mentioned that occupational competency assessment strengthens quality assurance mechanisms by providing guidelines for TVET institutes and companies/employers that set valid and reliable controls in place. Proper implementation of this system warrants that employees and trainees are trained, assessed, proven competent, and confidently discharge their responsibilities.

As to cooperative training initiatives, the official stressed:
Unlike the previous one-time traditional apprentice training that usually takes place towards the end of the training, cooperative training, which is undertaken for each unit of competence, has strengthened the ties between TVET institutes and the industry. The industry gradually started taking ownership by staying away from the previous trend of blame-shifting to TVET colleges/institutions. This joint training scheme enabled the industry and service sector to get a competent workforce. It also had repercussions on the production and service delivered. For TVET institutes, it is a good opportunity to expose their trainees to real-life situations. So, cooperative training became a win-win policy initiative for both TVET institutes and the industry.

Regarding the OCACC's partnership with TVET institutes and the industry, one of the experts explained:
Many sector organizations, TVET institutes, and individual candidates make use of the testing and certification services offered by OCACC. Since it deals with crosscutting and multidisciplinary occupations, it serves diverse groups. OCACC has close relationships with TVET institutes, concerned bureaus or agencies, and industries. Apart from these major stakeholders, the partners of OCACC include small and medium enterprises (SMEs), chambers of commerce, the Ethiopian Employers' Federation, cooperatives, etc.

Concerning attempts to meet international standards, the official stated, '*The dynamic nature of OCAC tools and practices in TVET institutes demands the system to change itself to stay competitive and cope with the international standard. The experience sharing and benchmarking activities will also facilitate the mobility of the labor force and thereby foster interchangeability*'.

In connection with accountability and opportunity for self-check, one of the officials portrayed, *'assessment result not only assists candidates to check their existing level of competency but also necessitates TVET institutes to reexamine their curriculum after identifying the skill gaps. Ultimately, it forces the institutes to possibly adjust or terminate the specific program if it is not mendable'*. According to the other expert, *'contrary to the previous assessment that takes too long until all portions of the TVET program are covered, level-based assessment enables candidates to be self-reliant and see their skill level within a short period of time upon completion of one unit of competency. The one-to-one nature of OCAC also closes the door for plagiarism'*.

On top of this, previous studies confirmed the existence of positive developments in terms of associating assessment with the learning outcomes or workplace requirements (i.e., national competency standards) along with the authenticity, cognitive complexity, directness, consistency, and transparency of assessment

(Atakilt, Worku, & Melesse, 2016). Also, the research by Habte (2015) pointed out that the assessment result or certificate by OCACC helped graduates to be competent in the market, strengthen the capability of assessment centers, differentiate weak and strong performances, and create opportunities for promotion, joining universities, and employability enhancement.

The last issue under opportunities, because of OCAC implementation, was related to policy direction. In this respect, the official at OCACC expounded that '*occupational standard is set by the TVET at the federal level, which is to be used by TVET institutes (to develop a training manual) and OCACC (measurement). Gradually, most of the assessments will be undertaken by the industry*'.

For the question or thematic area, "W*hat are the challenges in OCACC?",* the OCAC system in Addis Ababa City Administration is not blameless. As one of the officials indicated, '*Although not like the beginning, there were some sorts of challenges attributed to attitude. Quality-related problems persist when implementing OCAC programs in some occupations. Making use of external assessors from companies or industries is one of the major limitations of the OCAC system'.*

Similarly, one of the experts revealed that *'evaluators' decision, in some cases, lacks consistency. There is also the difficulty of getting assessors or evaluators and incompatibility between the small number of assessors and trainees' demand for assessment. Because of this, assessment results were not issued on time'*. Besides, the same expert expressed, *'scarcity of high-level trainers at OCAC to conduct refresher training, develop assessment tools, and validate the tool forced the organization to rely on foreign expatriates for some occupations'*.

In summary, the challenges observed in OCACC were:

- Awareness problems in some sectors, industries, and even among certain leaders
- The assessment tool lacks contextualization.
- The gap in training resulted in failure and frustration during the CoC assessment.
- Employees and TVET trainees will not be successful without short-term training.
- High staff turnover exhibited.

The above findings on the challenges of OCAC implementation were consistent with studies by FTA and OCACC. As to FTA (2016), the main challenges in occupational assessment and certification were the implementation gap against principles, tools, and standard procedures of occupational competency assessment; preparing and certifying assessors; accrediting assessment centers; and conducting assessments. Regarding competence levels of assessed individuals, reasons for candidates' incompetence were inadequate attention to cooperative training, disparity among training tools and assessment tools, absence of sufficient facilities in the assessment centers, and lack of information for the candidates (OCACC, 2012).

5. Conclusion and Recommendations

The term competence is a foundation for assessment and certification in vocational training that plays a key role in the school-to-work transition. As components of competence, knowledge, skills, and attitudes, it bridges the world of education (training standard) with the world of employment (occupational standard). In this respect, in-school actors (supply side) need to create synergy with in-company actors (demand side).

Based on the findings, there were fluctuations and declining trends in occupational assessment results in the beginning (since 2008). However, as of 2013, trainees' rate of competency increased, but in 2019, a decreasing rate was observed due to the COVID-19 pandemic. The number of candidates receiving the service increased from less than 3000 (10.41%) in the beginning to 170,000 (60.73%) in 2022. Such an elevated level of participation and growing demand for occupational competency assessment brought several opportunities and challenges to the OCAC system.

Interview participants from OCACC displayed opportunities for CoC or competency test concerning the impact on quality, enhancing cooperative training and partnerships, attempts to meet international standards, accountability, and opportunity for self-check and future directions. Conversely, the challenges observed in

OCACC were awareness problems in some sectors, including industries, and even among certain leaders; scarcity of qualified trainers and assessors; assessment tools lack contextualization; gaps in training resulted in failure and frustration during CoC assessment; and the existence of high staff turnover.

Accordingly, the implementation of OCACC in Addis Ababa is characterized by weak partnerships with industry, the absence of sufficient facilities in the assessment centers, a lack of information for the candidates, and the scarcity of qualified trainers and assessors. Hence, there is a need for a strategic win-win alliance between actors at TVET and the industry. It is also important to support the system with technology and focus on training assessors and company supervisors. with implications for policy and future research in the direction of the demand side.

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Tax Enforcement and Tax Compliance in Southwestern Nigeria

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Abstract: This study assessed the influence of tax enforcement on tax compliance in Southwestern Nigeria. A descriptive survey design was adopted. The study population comprised 1,146 NRS staff members, including tax controllers, heads of divisions, tax auditors, audit officers, and tax collector officers, all of whom play a direct role in tax auditing, enforcement, and taxpayer engagement. A purposive sample of 364 staff members was drawn from this population in Southwestern Nigeria, focusing on individuals whose roles provided them with direct insights into tax audit processes. The study focused on 360 staff members of the Nigeria Revenue Service (NRS) in Southwestern Nigeria. Data for the analysis were obtained through a structured questionnaire administered to the NRS staff. Analysis was conducted using Feasible Generalized Least Squares (FGLS). The results showed that Public Awareness and Education campaigns and Tax Rate Reduction policies, as enforcement-related strategies, had a significant positive effect on tax compliance. Legal actions, whistle-blower program and tax-amnesty instruments fail to reach significance, indicating weak or heterogeneous behavioral responses. The study concludes that enforcement strategies encompassing both persuasive/educational elements and incentive-based measures are significant drivers of improved tax compliance in the southwestern Nigerian context.

Keywords: *Tax enforcement, tax compliance, Southwestern Nigeria, Revenue Service.*

1. Introduction

Governments in every nation need to mobilize enormous financial resources to operate effectively and to provide public goods and services that enhance sustainable development. Taxation over the years has proven to be one of the cheapest and most reliable sources of revenue generation. However, the extent to which the government can mobilize funds through taxes is highly dependent on the level of taxpayers' compliance in terms of reporting income correctly, tax filing, and remitting adequate taxes. Tax compliance is therefore pivotal to the fiscal sustainability of every economy (Alm, 2019). Low tax compliance levels are still a major threat to revenue mobilization and growth of many developing nations, including Nigeria.

Despite several reforms over the years, Nigeria's tax system has been marked by a high level of inefficiency, with a Tax-to-GDP ratio hovering below 10 per cent. This is an abysmal performance when compared to the African average of about 16 percent and many OECD countries' ratings above 30 percent (OECD, 2022). One of the challenges facing the achievement of sustainable tax compliance is taxpayers' inability to comply with tax compliance, which extends beyond the audit process. Factors such as tax enforcement, sanctions, encompassing penalties, and prosecution serve as a broader arsenal used to improve the level of tax compliance in bringing other taxpayers into the tax net. According to Slemrod (2019), the ratio of Nigeria's tax-to-GDP ratio rose, which has enhanced this entire enforcement framework, which was in line with deterrence theory, which concludes that compliance increases with the perceived certainty of penalty and punishment to offenders.

Therefore, drawing on deterrence theory, each enforcement mechanism tax penalty and fines legal actions, whistleblower programs, and detection speed operates through distinct perceptual pathways, where heightened audit likelihood elevates perceived detection risk through whistleblower programs, stiffer penalties amplify the cost-benefit differential of noncompliance, and swift detection reinforces the certainty of sanction, collectively shaping taxpayers' subjective expected utility calculations that drive voluntary versus enforced compliance from public awareness and education. Conversely, beyond pure deterrence, procedural fairness and trust-based mechanisms moderate these effects, such that transparent enforcement procedures enhance perceived legitimacy and internalized tax morale, while coercive, arbitrary enforcement undermines trust, triggering strategic noncompliance that offsets the deterrent gains from formal penalties thus yielding a dual-process framework where enforcement influences compliance both rationally through expected costs and

relationally through normative commitment, with the relative weight of each pathway depending on taxpayers' prior experiences and institutional credibility as well as tax amnesty program.

Based on Lederman's (2019) position, which says there should be a possibility that a significant counter-argument exists whenever heavy-handed enforcement can "crowd out" taxpayers' intrinsic motivation to comply. This assumption highlights the central issue: "There is no consensus on the net effect of tax enforcement in Nigeria, and a comprehensive, national-level evaluation is lacking". While enforcement is a critical component of the compliance strategy, existing research has been fragmented, often focusing on narrow aspects or conducted at the state level. This leaves policymakers without clear empirical guidance on how the spectrum of enforcement activities affects national compliance and whether the current balance between coercion and cooperation is effective. Therefore, this study seeks to evaluate whether tax enforcement affects tax compliance in Nigeria.

2. Literature Review

Several authors have studied the influence of tax enforcement on tax compliance using different sectors, especially in developed countries. Murphy (2008) investigated the effect of both the deterrent-based enforcement and the gentleman approach (which is persuasion and cooperation) on tax compliance. They emphasized determining the best approach to dealing with tax offenders in such a way as to increase support for the law and consequently reduce the rate of subsequent non-compliance. The study found that the deterrence-based enforcement strategies serve to stigmatize offenders, as a result, leaving them with a feeling of resentment both towards the authority enforcing the rules and towards subsequent voluntary compliance. The study suggested that while enforcement is necessary in driving immediate tax compliance, it must be done in a way that the punishment for offending will not lead to further reoffending. It must be done in a way to secure the taxpayers' long-term voluntary compliance.

Filippin et al. (2013) investigated the relationship between enforcement and morale of taxpayers, which are part of the perceived factors affecting compliance. The study utilized the sample data representing a combination of household and tax administration in Italy. It found that the relationship between tax morale and tax enforcement is positive. Tax enforcement was also observed to affect tax compliance positively. Pomeranz (2015) analyzed data from 40,000 firms in Chile to find out how information from third parties affects VAT enforcement. The study concluded that the announcement of a new audit does not have much impact on transactions already undergoing paper trials. This indicated that Paper Trials, which is a form of tax audit, has a deterrent effect, thereby increasing tax compliance.

Similarly, Mutarindwa and Rutikanga (2014) explored the audit of taxpayers' accounts and tax enforcement on the tax growth of Rwanda. Questionnaires were administered to 100 audit staff of the revenue Authority in Rwanda for the purpose of gathering primary data, while the databases of both the Large Tax Offices (LTOs) and Small and Medium Tax Offices (MSTOs) were explored for secondary data. The analysis revealed that tax audit enforcement increases compliance rate and discourages tax evasion, and hence positively impacts tax collection in Rwanda. It was revealed that taxpayers' attitude to tax audit enforcement hurts revenue generation. In Malaysia, Mohdali et al. (2014) investigated the effect of punishment threat on tax compliance behavior. It was revealed from the mixed-mode survey that the threat of punishment has no impact on taxpayers' compliance decisions. It shows that taxpayers avoid taxes more when they are threatened with tax audits as well as penalties, thus triggering their intentions to be less compliant.

Nurkhin et al. (2018) examined the effect of tax awareness, tax understanding, and tax amnesty awareness on taxpayers' compliance in Indonesia. According to the results, tax understanding, taxpayers' awareness, and amnesty perception are major determinants of taxpayers' compliance because the relationship was significant. It was also found that gender influenced taxpayers' compliance, as females were found to be more tax compliant than men. This study looked in the direction of positivity.

Lederman (2019) analyzed existing empirical studies to identify evidence that tax enforcement may backfire and decrease taxpayers' motivation to comply, resulting in them reducing their tax payment. It found that enforcement generally increases tax compliance in the United States. It further revealed that when there is no

or low tax enforcement, in some ways, it signals to taxpayers that non-compliance is socially acceptable. Sigle et al. (2018) built a model termed the Slippery Slope Framework (SSF) to examine how Trust and power enhance the compliance of corporations in the Netherlands using the data of 271 organizations. It was found that power has a negative relationship with Voluntary compliance and no relationship with enforced compliance. There was, however, an indication that a high-Power level of the tax authority undermines the positive effect of trust on voluntary compliance. The research recommended a trust-based tax regulatory activity for worldwide adoption. However, a different result could be obtained if a similar study is conducted in Nigeria.

Slemrod (2019) tried to review the empirical studies on tax enforcement and compliance by outlining the normal framework that allows an assessment of which enforcement intervention is worth doing. It was concluded that a high probability of being caught reduces compliance in the United States. Along the same line, Widuri et al. (2019) studied the effect of penalties, trust in the tax authority, and tax audit on compliance. The sample of 153 respondents analyzed revealed that tax Audit, tax penalties, and Trust significantly affect taxpayers' compliance both partially and simultaneously. Olaniyi and Ilesanmi (2019) weighed the effect of tax audit on tax compliance using government spending and penalties as proxies. Data from 229 companies were extracted for analysis from the tax audit department of the Kwara State Internal Revenue Service (KSIRS). It showed that tax audit and penalty have a positive and significant impact on tax compliance in KSIRS. This study is, however, limited in scope as it focused on tax compliance at a state level, which cannot be generalized to cover the nation as a whole.

Ayoade (2020) observed that using deterrence enforcement strategies or persuasive methods depends on the number of taxpayers the regulators are responsible for managing. It was found that the regulators responsible for smaller numbers of taxpayers tend to explore the persuasive and reward approach to drive compliance. This is because it was easier to establish more cooperative and collaborative relationships with a small number of taxpayers than with relatively large numbers. Although the study was carried out in Nigeria and the study was conducted six years ago, this current study serves as current in making decisions by tax authorities.

In Indonesia, Rosid & Romadhaniah (2023) assessed the influence of law enforcement on the level of tax compliance using survey data gathered across 352 tax offices in the country. Tax law enforcement was observed to have a positive and significant influence on tax compliance. The result further showed that the audit coverage ratio influences tax compliance. Similarly, criminal investigation appeared to be a major influencing factor in influencing the efficiency of tax enforcement. Awotomilusi (2022) assessed the influence of penalties on tax yield in Southwestern Nigeria in his own study. Data were obtained from 302 respondents through structured questionnaires who are staff of the FIRS covering four states. As a result of the study, tax enforcement and tax penalties have a positive and significant corrective effect on tax yield in Southwest Nigeria and should always be applied to boost tax compliance. Tax amnesty, which is the other side of the coin in relation to tax penalty, was excluded from the study, leading to a one-sided conclusion. More so, this study focused on tax yield and administered the structured questionnaires to only taxpayers and managers of businesses but failed to accommodate NRS staff who are responsible for tax payment.

Maccarthy et al. (2023) obtained data from 277 staff of the Federal Inland Revenue Service in South- South states in Nigeria to investigate the relationship between tax enforcement measures and revenue generation in Nigeria. They revealed that Tax Penalties have a significant relationship with Value-Added Tax generation. It was concluded that Tax Enforcement measures have a positive relationship with VAT compliance, resulting in increased revenue in Nigeria. This result was limited to the effect of Tax Penalties on VAT compliance, hence limiting other Tax Enforcement measures. Similarly, Loyland et al. (2024) attempted to evaluate the effect of expanding tax enforcement on tax compliance. Mechanical audit correction effect and behavioral effect were used as proxies for compliance gains. With the use of regression discontinuity analysis, it was found that at a certain threshold, taxpayers had a significant reduction in their self-reported deductions in the subsequent years' filing after an initial tax audit. It was also found that the behavioral effect over three years after the audit response significantly responded to the adjustment in the audit.

Sarfo and Agoba's (2026) conclusion on determinants of voluntary tax compliance in Africa's informal sector was that there is no single approach to improving tax compliance. The use of deterrence through tax audits and

fines would help improve tax compliance, while others hold a contrasting view on the use of a motivational or rewarding approach. Similarly, Abdulrazaq and Babatunde (2024) assessed the extent to which tax enforcement strategies mitigate tax non-compliance in Northwest Nigeria. With a sample of 345 SMEs, data were analyzed through descriptive and inferential statistics. It was revealed that tax enforcement strategies, proxied by the issuance of tax clearance certificates, the granting of tax amnesty, and the imposition of tax penalties, influence the compliance of SMEs in Northwest Nigeria significantly. The study suggested the use of punitive tax measures in terms of penalty and sanctions, coupled with the persuasive (Issue of tax clearance certificate and grant of tax amnesty), to promote and enhance tax compliance. There are, however, many other vital strategies employed in practice for tax enforcement by the tax authorities that have not been captured in this study. Although the study is domiciled in Nigeria, it only considered 345 SMEs, which limits the application of the results to tax authorities for tax policy.

Turyana and Supriatiningsih (2025) did an empirical examination of service quality and tax sanctions implementation on taxpayers' compliance in Indonesia. Ninety-six taxpayers responded to the questionnaire deployed, and the data gathered were analyzed with the use of multiple regression techniques. The results showed that service quality and sanction enforcement significantly affect the compliance of taxpayers in Indonesia. The study highlights the importance of quality human resources and innovative service facilities, which are positive enforcement on one side, and sanctions, which represent negative enforcement on the other side, as a balanced approach to advance tax compliance behavior. Overall, studies in the literature pointed out that tax enforcement could either result in negative or positive encouragement, each of which has different ways of affecting tax compliance. The few studies relating to tax compliance in southwest Nigeria focus more on the negative enforcement, such as tax penalties.

Furthermore, despite growing evidence linking tax enforcement with tax compliance from international and local arenas, these existing findings remain inconclusive regarding the nature of the relationship. Furthermore, empirical evidence from southwestern Nigeria remains limited. Addressing this gap, the present study formulated the following hypotheses:
$H0_1$: Tax penalty and fines has insignificant association with tax compliance in southwest Nigeria.
$H0_2$: Tax rate reduction has insignificant associated with tax compliance in southwest Nigeria.
$H0_3$: Legal actions have an insignificant association with tax compliance in southwest Nigeria.
$H0_4$: Technology and data analytics have an insignificant impact on tax compliance in southwest Nigeria.
$H0_5$: Public awareness and education have an insignificant impact on tax compliance in southwest Nigeria.
$H0_6$: Tax amnesty programs have an insignificant impact on tax compliance in southwest Nigeria.
$H0_7$: Whistleblower programs have an insignificant impact on tax compliance in southwest Nigeria.
$H0_8$: Taxpayers' trust has an insignificant impact on tax compliance in southwest Nigeria.

3. Methodology

To achieve the purpose of this study, a survey method research design was employed. The research was conducted across twenty-one (21) Nigeria Revenue Service (NRS) offices in the Southwestern region of Nigeria, spanning Lagos, Ogun, Ondo, Osun, Ekiti, and Oyo States. These offices, which include Large, Medium, and Small Tax Offices, were selected for their strategic location in key economic centers, extensive operational coverage, and standardized procedures, making them suitable for collecting representative data.

The population comprised 1,146 NRS staff members such as tax auditors in the region, audit officers, tax controllers, heads of divisions, and tax collector officers. This category of staff plays a significant role in tax auditing, enforcement, and taxpayer engagement for the purpose of tax compliance behaviors. For the study, the sample size of 364 staff members were determined using Yamane's formula at a 95% confidence level and 5% margin of error from this population, which is statistically sufficient to represent the population of 1,146 staff members, while purposive sampling was intentionally employed to target only those officers directly involved in field enforcement, audit, and taxpayer education roles, as their specialized functions provide the most relevant and informed perspectives on the enforcement-compliance nexus.

Furthermore, 364 staff members constituted individuals who were involved and provided direct insights into tax audit processes to verify the level of taxpayers' compliance. More so, since the study examines the impact

of tax enforcement on tax compliance in Nigeria, data were collected only from the Nigeria Revenue Service (NRS) staff rather than actual taxpayers. This is a deliberate sampling choice justifying that NRS staff possess unique, system-level insights into filing patterns, enforcement challenges, and fraud indicators that taxpayers themselves may underreport or misrepresent due to social desirability bias.

Data were collected through a structured, closed-ended questionnaire. The data collected through a structured questionnaire were analyzed using regression analysis based on OLS and FGLS to assess the influence of tax enforcement on tax compliance in Nigeria. The model was adapted from Ojonta (2011), Olaoye and Ekundayo (2019), Oladele et al. (2021), Olatunbosun (2022), and Sarfo and Agoba (2026), as stated below, were employed for this study:

$$TCOM_i = \beta 0 + \beta_1 TPN_i + \beta_2 TRR_i + \beta_3 LEG_i + \beta_4 TED_i + \beta_5 PAE_i + \beta_6 TAP_i + \beta_7 WBP_i + \beta_8 TPT_i + \varepsilon_i.$$

Where
$TCOM_i$ represents Tax Compliance
TPN_i represents Tax Penalty and Fines.
TRR_i is the Tax Rate Reduction
LEG_i is Legal Actions
TED_i is Technology and Data Analytics
PAE_i is Public Awareness and Education
TAP is the Tax Amnesty Program
WBP_i is Whistleblower Programs
TPT_i is the Taxpayers' Trust
A priori expectation: $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7, \beta_8, > 0$

Measurement of Variables

Tax Compliance

This was measured by analyzing the responses on taxpayers' filing and reporting, attitudes towards taxation, perceived enforcement, willingness to comply, voluntary disclosure, personal and business tax compliance, used as a proxy for voluntary compliance (Nui, 2012). Furthermore, while actual compliance records were inaccessible due to confidentiality restrictions imposed by the Nigeria Revenue Service (NRS) in 2025, perceptual measures of awareness, filing behavior and attitudes were deliberately adopted as theoretically grounded proxies that reliably capture taxpayers' compliance intentions from the tax authorities and dispositional orientations, which extensive prior research has established as strong predictors of actual compliance behavior (Nkundabanyanga et al. (2017).

Tax Enforcement

Tax enforcement was measured using the following proxies: penalties and fines, tax rate reduction, legal actions, technology and data analytics, tax amnesty, whistleblower programs, and taxpayers' trust. Taxpayers' trust captures taxpayers' perceptions, which can be visualized by tax authorities as procedural fairness and institutional legitimacy that shape how effectively deterrence-based enforcement instruments, such as audits and penalties, translate into actual compliance behavior.

Data Processing for Regression Analysis

The responses to the items under a specific variable were averaged to create a single score that represented that construct, which was applied uniformly across all variables, to produce the composite values (from the primary data drawn from a structured questionnaire designed with multiple items under each construct) appropriate for regression analysis. This helps researchers to ensure that these variables are signified by a single continuous score, capturing the overall tendency of responses while minimizing measurement error through the averaging method. According to Hair et al. (2022), standard practices in quantitative research are required where multi-item scales are aggregated into a composite index for proper analysis. Hence, the composite scores computed for the variables were used as the independent and dependent variables in the regression analysis for the study.

4. Results and Discussion

Based on the respondents from NRS staff from the southwest who participated in the study, the effect of tax enforcement on tax compliance-related questions is briefly presented in the tables.

Demographic Characteristics Analysis

Table 1 presents 364 responses using frequency and percentage of those who participated in the current study. Table 1 shows that males constituted 204 respondents (56.04%) of the total respondents, and 160 (43.96%) were female counterparts, indicating that there is slightly higher representation of female respondents in the study, although gender distribution was balanced. Similarly, respondents were categorized into five age groups; 38 respondents (10.44% were between 20 and 29 years, and 94 respondents (25.83% were between 26 and 40 years. More so, 132 respondents' represents 36.26% were between 40 and 49 years, representing the largest age group. In the same vein, 83 respondents (22.8% were within 50 and 59 years. Lastly, 17 respondents (4.67%) were 60 years and above. This implies that the majority of respondents in the NRS office are still active and within the working age range of 40 to 49 years.

Educationally, Table 1 shows the result of the educational qualifications of the respondents, which indicates that 2 respondents, representing 0.55%, had a diploma certificate. 240 respondents, representing 65.93%, held a B.Sc. degree from universities within and outside Nigeria. 108 respondents (29.67% possessed an M.Sc. or MBA, while 14 respondents' represents 3.85% held a PhD degree. In summary, over 95% were graduates with B.Sc., M.Sc. and PhD qualifications. This is an indication that 95% of the respondents had the logical and technical ability to supply trustworthy information on tax audit and compliance issues.

In terms of organizational hierarchy, 91 respondents (25% were officers, 66 respondents (18.13% were supervisors), 32 respondents (8.79% were managers in NRS staff, 160 respondents (43.96% were senior staff), and 15 respondents (4.12% were directors in NRS staff. In summary, senior staff formed the largest category, while directors were the least represented. Based on the years of engagement, the respondents' years of engagement varied as follows: 72 respondents, representing 19.78%, had less than five years of engagement; 127 respondents, representing 34.89%, had 6-10 years in terms of engagement, while 165 respondents, representing 45.33%, had 11 years and above, which is the largest group among the respondents. This suggests that the study was knowledgeable of practitioners with long-term experience in tax supervision and enforcement processes.

Again, the majority of the respondents were members of ICAN and CITN, with 116 (31.87%) and 119 (32.69%) respectively, which is 235respondents represent (64.56%), while others were members of ANAN, ACCA, CFE and CFA as shown in Table 1. This implies that the respondents have technical knowledge and their responses are credible. Furthermore, 209 respondent represents 57.42% were from Lagos, 52 respondent represents 14.29% from Ogun state, 31 respondent represents 8.52% were from Oyo state, followed by 27 respondent represents 7.42% from Ondo state, 23 respondent represents 6.32% were from Ekiti state, and 23 respondent represents 6.04% were from Osun state. In summary, Lagos state accounted for over half of the respondents, indicating its position as Nigeria's major commercial and tax administration hub.

Table 1: Demographic Profile of Respondents

Variables	Category Description	Frequency	Percentage (%)	Mean	Std. Dev.
Gender	Male	204	56.04	0.56	0.5
	Female	160	43.96		
Age	20–29 yrs	38	10.44	2.85	1.04
	30–39 yrs	94	25.82		
	40–49 yrs	132	36.26		
	50–59 yrs	83	22.8		
	60+ yrs	17	4.67		
	Diploma	2	0.55	3.37	0.57
	B.Sc.	240	65.93		

Highest Educational Qualification	M.Sc.	108	29.67		
	PhD	14	3.85		
Position in Organization	Officer	91	25	2.84	1.33
	Supervisor	66	18.13		
	Manager	32	8.79		
	Senior Staff	160	43.96		
	Director	15	4.12		
Years of Engagement	1–5 yrs	72	19.78	2.26	0.77
	6–10 yrs	127	34.89		
	11+ yrs	165	45.33		
Professional Qualification	ICAN	116	31.87	2.64	1.44
	ANAN	74	20.33		
	CITN	119	32.69		
	ACCA	5	1.37		
	CFE	26	7.14		
	CPA	20	5.49		
State Location	Ekiti	23	6.32	4.35	1.31
	Ondo	27	7.42		
	Osun	22	6.04		
	Ogun	52	14.29		
	Lagos	209	57.42		
	Oyo	31	8.52		

Source: Author's Computation, 2026

Reliability and Validity of the Measurement Instrument

In this section, the results of the reliability and validity of the construct measures were evaluated after checking and screening of the data. The reliability and validity of the measurement instrument were assessed following the guidelines of Hair et al. (2022). Internal consistency reliability was evaluated using Cronbach's alpha and composite reliability, with all constructs exceeding the recommended threshold of 0.70, while lead to the conclusion that it satisfies the reliability threshold. Content validity was established by adapting measurement items from previously validated scales and subjecting the questionnaire to expert review by academics and practitioners in the tax audit department to ensure the relevance, clarity, and adequacy of the items. Construct validity was assessed through convergent validity using the average variance extracted (AVE), with all constructs recording AVE values above the recommended threshold of 0.50, thereby demonstrating adequate convergent validity (Hair et al., 2022).

Tax Enforcement

The individual construct of tax enforcement was shown in Table 2. The responses include: no extent, very low extent, an extent, high extent, very high extent, mean, and standard deviation. The result based on respondents indicates that the penalty for late filing appeared to be the highest perceived tax enforcement mechanism, with a mean score of 3.52, while the minimum was the underreporting fine, with a mean value of 2.89. The majority agreed that tax enforcement is one of the keys to bringing more taxpayers into the tax net in Nigeria. Table 2 shows that the mean scores of the items range from 2.89 to 3.52. Negotiation in disputes is possible has the highest mean score (3.32), while investigation leads to additional assessment has the lowest mean score (2.76). In summary, the findings reveal that retaliatory enforcement strategies like penalties, legal actions, and technology are important and very crucial for tax compliance. In short, taxpayer activities materialize to respond more satisfactorily to timely communication, equitable treatment, transparency, trust, among others in the tax system. For this reason, the government should balance tax enforcement with relevant taxpayers' education, meaningful engagement, and organisational reform regularly, and this will enhance tax compliance behaviours.

Table 2: Responses on Tax Enforcement

Item	No Extent	Very Low Extent	An Extent	High Extent	Very High Extent	Mean	Std Dev
Late Filing Penalty Effective	2.47	11.54	32.42	39.01	14.56	3.52	0.96
Underreporting Fine Effective	10.44	23.08	40.11	19.78	6.59	2.89	1.05
Interest on Unpaid Tax Effective	7.69	21.43	31.59	28.57	10.71	3.13	1.11
Tax Rates Promote Compliance	6.04	22.25	32.97	29.95	8.79	3.13	1.05
Reduced Rates Promote Compliance	7.69	25	34.07	27.2	6.04	2.99	1.04
Legal Action is Timely	8.79	22.53	34.34	25.27	9.07	3.03	1.09
Legal Threat Promotes Compliance	8.79	23.63	33.52	23.9	10.16	3.03	1.11
Technology Detects Fraud	10.99	21.15	29.95	27.2	10.71	3.05	1.16
Analytics Identify High-Risk Cases	6.87	21.98	36.54	24.73	9.89	3.09	1.06
Education Improves Understanding	10.99	24.45	34.07	22.8	7.69	2.92	1.1
Awareness Discourages Evasion	10.71	21.43	31.32	27.75	8.79	3.02	1.13
Education Materials Helpful	7.42	28.02	31.59	27.75	5.22	2.95	1.03
Tax Amnesty Promotes Compliance	7.42	21.98	33.52	27.75	9.34	3.1	1.08
Tax Incentives Encourage Compliance	7.97	22.8	39.01	21.98	8.24	3	1.05
Whistleblower Program Effective	9.89	21.43	34.34	25.82	8.52	3.02	1.1
Whistleblower Reward Motivating	9.62	25.27	31.59	25.55	7.97	2.97	1.1
Handling Complaints Improves Compliance	6.32	19.51	34.89	29.67	9.62	3.17	1.05
Trust Promotes Voluntary Compliance	5.49	14.84	36.81	31.87	10.99	3.28	1.03

Source: Authors' Computation, 2026

Tax Compliance

In this section, the focus was on the evaluation of compliance behaviour among taxpayers in south-west Nigeria based on the survey responses. Table 3 showed that the highest mean score was 3.47, which is for returns filing on time, which means it is very significant, implying that faithfulness to filing deadlines is well recognized. In short, the mean scores of the items range from 2.79 to 3.47; returns filed on time have the highest (3.47), while income fully reported has the lowest mean score. Furthermore, the overall results suggest that the tax compliance behaviour of taxpayers with voluntary timely filing behaviour is the one that improved tax compliance. Meanwhile, taxpayers' trust, understanding of tax laws, tax transparency, and confidence are concerns that have questioned the level of tax compliance improvement.

Table 3: Responses to Tax Compliance

Variables	No Extent	Very Low Extent	An Extent	High Extent	Very High Extent	Mean	Std. Dev.
Returns filed on time	1.37	13.19	35.71	36.81	12.91	3.47	0.93
Income fully reported	8.24	31.87	38.19	16.48	5.22	2.79	0.99
Deductions are accurate	9.07	19.78	35.16	26.65	9.34	3.07	1.09
Tax laws understood	9.07	24.45	34.62	24.45	7.42	2.97	1.07
Tax as a civic duty	9.89	22.8	32.97	23.63	10.71	3.02	1.14
The tax system is fair	9.62	26.65	34.62	20.05	9.07	2.92	1.1
Trust in tax revenue use	10.16	17.58	39.56	22.8	9.89	3.05	1.1
Aware of the tax audit role	8.79	26.1	32.97	24.18	7.97	2.96	1.08

Audit risk perceived as low	9.07	22.25	35.44	25	8.24	3.01	1.08
Audit is effective at detection	6.32	20.05	37.64	24.45	11.54	3.15	1.07
Penalty concern for noncompliance	7.42	20.05	34.07	28.85	9.62	3.13	1.08
Compliance for society	6.32	21.43	39.01	23.08	10.16	3.09	1.05
Would pay even if others evade	10.16	17.31	33.79	26.65	12.09	3.13	1.15
Tax system is complex	6.32	20.33	41.76	22.8	8.79	3.07	1.02
General tax compliance is high	7.42	29.95	35.16	18.96	8.52	2.91	1.06
Evasion is common in the community	10.16	24.45	32.69	22.8	9.89	2.98	1.13
Audit needed for compliance	6.04	20.88	33.79	28.85	10.44	3.17	1.06
Would use the disclosure program	8.24	23.9	32.97	24.18	10.71	3.05	1.11
Aware of the disclosure program	9.62	22.8	35.16	21.98	10.44	3.01	1.12
Need more disclosure incentives	6.04	17.58	41.76	25.27	9.34	3.14	1.01
Business pays tax on time	11.26	27.75	28.3	23.63	9.07	2.91	1.15
Business tax burden is reasonable	7.69	20.88	37.36	25	9.07	3.07	1.06
Business ensures compliance	3.57	15.11	32.69	32.69	15.93	3.42	1.04

Source: Authors' Computation, 2026

Tax Enforcement and Tax Compliance in Nigeria

The study used OLS and FGLS models to assess the effect of tax enforcement and tax compliance in Nigeria. However, the p-value from post estimation test revealed a significant p-value of 0.0000, which implies that there is an issue of Heteroskedasticity in the OLS model. Therefore, the error was corrected through Feasible GLS, which serves as a remedy for the problem. This brings non-constant variance into consideration, hence resulting in more reliable estimates. More so, the p-value indicates the fitness and reliability of the model to show a statistically significant relationship between explanatory and dependent variables. Hence, the p-values of (0.0000) and (0.0001) provide evidence that the model was fit. The cumulative R^2 are 12% (0.1214) and 11% (0.1147), which gives the cumulative effect of explanatory variables jointly on the dependent variable. This means that 12% and 11% of the total variation in tax compliance in Nigeria is caused by tax enforcement, while the remaining 88% and 89% of the total variation in tax compliance in Nigeria is caused by other variables not included in the model. The 11% R-square value is consistent with reputable tax compliance literature, where compliance behavior is intrinsically multifaceted and multidetermined, with studies in developing economies (Nigeria) typically documenting explanatory power in this range due to the presence of unmeasured contextual, psychological, and cultural factors beyond formal enforcement mechanisms that were used in the study.

Table 4 revealed that tax penalties and fines, tax rate reduction, public awareness and education, and technology and data analytics have positive and significant effects on tax compliance at the 5% level. This is consistent with the results of Olatunbosun (2022), McCarthy et al. (2023), Loyland et al. (2024), Abdulrazaq and Babatunde (2024), Turyana and Supriatiningsih (2025), and Sarfo and Agoba (2026). On the other hand, legal actions, whistleblower program, tax amnesty program, and taxpayer trust have positive and insignificant effects on tax compliance at the 5% level. In conclusion, the results show that tax enforcement (tax penalties & fines, tax rate reduction, public awareness and education, and technology and data analytics) leads to more tax compliance behavior in Nigeria. Is an indication that when the government focuses on those key tax enforcement measures in conjunction with more robust and taxpayer-friendly tax policies may lead to better voluntary tax compliance in Nigeria.

Table 4: Estimates of the Effect of Tax Enforcement on Tax Compliance

Variables	OLS Estimate	Feasible GLS (WLS) Estimate
TPF (Tax Penalties & Fines)	0.0504*	0.0465**
	-0.0262	-0.0257
	[1.92]	[1.81]
TRR (Tax Rate Reduction)	0.0616***	0.0562**
	-0.0226	-0.0227
	[2.73]	[2.48]
LEG (Legal Actions)	0.0263	0.026
	-0.0209	-0.0207
	[1.26]	[1.26]
TED (Tech & Data Analytics)	0.0407*	0.0392**
	-0.0218	-0.0215
	[1.87]	[1.82]
PAE (Public Awareness and Education)	0.0701***	0.0797***
	-0.0258	-0.0253
	[2.72]	[3.15]
TAP (Tax Amnesty Program)	0.0363	0.025
	-0.0227	-0.022
	[1.60]	[1.13]
WBP (Whistleblower Prog.)	0.0178	0.0138
	-0.0199	-0.0201
	[0.89]	[0.69]
TPT (Taxpayer Trust)	-0.0263	-0.0244
	-0.0225	-0.0221
	[-1.17]	[-1.11]
_cons	2.2267***	2.2736***
	-0.1391	-0.136
	[16.01]	[16.72]
Observations	364	364
R-squared	0.1214	0.1147
Adj R-squared	0.1016	0.0948
Root MSE	0.3019	0.2965
F-statistic	6.13	5.75
Prob > F	0.0000	0.0000
Breusch-Pagan Test	p = 0.0000	Corrected
RESET (Omitted Var.)	p = 0.0001	—
Multicollinearity	Mean VIF = 1.10	Mean VIF = 1.10

***p < 0.01, **p < 0.05, *p < 0.10
Source: Author's computation, 2026

Discussion of Findings

The result from assessing the effect of tax enforcement mechanisms on tax compliance in southwestern Nigeria showed that the enforcement apparatus, which includes penalties for late filing, rate reductions, technology and data analytics, and public awareness and education, has a significant influence on compliance activities. Compliance activities such as accurate deductions and civic-mindedness have an insignificant influence on tax compliance in southwestern Nigeria. More so, the result shows that robust tax compliance outcomes can be hindered by structural challenges, which include limited understanding of tax laws, distrust in public revenue use as well as perceived unfairness. The results in this study indicate that factors that play statistically significant drivers of compliance include tax penalties and fines, tax rate reduction, technology and data analytics, and public awareness campaigns in southwestern Nigeria, while other factors that are punitive-only approaches include legal threats and reliance on whistleblower programs, implying less influence on tax compliance in Nigeria. This supports the studies of Maccarthy et al. (2023), Loyland et al. (2024), Abdulrazaq

and Babatunde (2024), and Turyana and Supriatiningsih (2025), who documented a significant relationship between tax enforcement mechanisms and tax compliance.

Test of Hypotheses

Results in Table 4 show all the variables of the study with the directional values of their coefficients (positive or negative), the p-value, as well as their effect on the dependent variable at their independent level of significance. From the results, the formulated hypotheses of the study can now either be rejected or fail to be rejected. Table 5 provides a summary of the test of the hypotheses.

Table 5: Summary of the Tested Hypotheses

Hypotheses		Decision
>TCOM	1	Rejected
TRR —>TCOM	2	Rejected
LEG —>TCOM	3	Fail to Reject
TED —>TCOM	4	Rejected
PAE>TCOM	5	Rejected
TAP —>TCOM	6	Fail to Reject
WEP>TCOM	7	Fail to Reject
TPF —>TCOM	8	Fail to Reject

Source: Generated by Researchers Based on Table 4.

Based on the hypotheses stated earlier in this study, the results suggested that four out of eight null hypotheses formulated were rejected while four were not rejected as shown in Tables 4 and 5. The research was conducted across twenty-one (21) Nigeria Revenue Service (NRS) offices in the Southwestern region of Nigeria, spanning Lagos, Ogun, Ondo, Osun, Ekiti, and Oyo States. These offices, which include Large, Medium, and Small Tax Offices, were selected for their strategic location in key economic centers, extensive operational coverage, and standardized procedures, making them suitable for collecting representative data.

5. Conclusion and Recommendations

This study assessed the influence of tax enforcement on tax compliance in Nigeria. The population comprised 1,146 NRS staff members such as tax auditors in the region, audit officers, tax controllers, heads of divisions, and tax collector officers. To achieve the objective of the study, the survey research design was adopted using a self-structured questionnaire to obtain data from the NRS staff. The results from the 364 respondents showed that tax enforcement strategies such as public awareness and education campaigns and tax rate reductions influence compliance in Nigeria. This means that tax enforcement approaches combining persuasive, educational, and incentive-based measures are more effective than merely coercive strategies. More so, tax penalties and fines influence tax compliance significantly. Therefore, the study recommend the NRS and other relevant tax authorities should improve level taxpayer education programs that can serve as awareness to tax obligations and consequences of non-compliance, implement moderately fair tax rates to reduce the perceived tax burden, and strengthen technological and data analytics systems to support compliance monitoring, as these integrated measures can sustainably improve voluntary compliance, promote trust in the tax system, and increase government revenue for national development.

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Work Team Stability and Quality of Health Care in Uganda: Evidence from Health Centre IVs in South Western Uganda

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Abstract: This study investigated the relationship between work team stability and quality of health care in Health Centre IVs in South Western Uganda. The study employed a cross-sectional mixed-methods design. Data were collected from healthcare workers in selected Health Centre IVs using questionnaires, key informant interviews, and document reviews. Quantitative data were analyzed using descriptive statistics, Pearson correlation, and regression analysis, whereas qualitative data were analyzed thematically. The results indicated a positive and statistically significant relationship between work team stability and quality of health care ($r = 0.440$, $p < 0.01$). Regression analysis further showed that work team stability significantly predicted quality of health care ($\beta = 0.352$, $p = 0.003$), accounting for 19.4% of the observed variation in quality of health care ($R^2 = 0.194$). The study contributes empirical evidence on the relationship between work team stability and quality of health care in public Health Centre IV facilities in Uganda. It demonstrates that workforce stability is an important organizational factor associated with improved health care quality and provides context-specific evidence to support workforce management and health policy interventions in Uganda.

Keywords: *Work Team Stability, Quality of Health Care, Health Centre, Uganda*

1. Introduction

Quality of health care is widely recognized as a fundamental component of effective health systems and population well-being (World Health Organization, 2021). High-quality care is characterized by safety, effectiveness, timeliness, and patient-centeredness, which are essential for improving health outcomes and reducing preventable mortality, particularly in low- and middle-income countries (Matovu et al., 2022). Across Africa, gaps in quality of care continue to be reported despite expansion in service access, with persistent challenges observed in clinical practices, patient safety, and responsiveness of services within health systems (Hategeka et al., 2020). These patterns highlight the need to focus not only on access to care but also on how health services are organized and delivered within facilities.

In Uganda, health sector reforms have prioritized increased service coverage through investments in infrastructure, human resources, and primary health care systems. Reports from the Ministry of Health Uganda, (2024) indicate that variations in quality of health care persist across public health facilities, including Health Centre IVs. National survey findings show concerns related to waiting times, patient safety, and consistency in care delivery, particularly in rural and semi-urban settings (Uganda Bureau of Statistics & ICF, 2022). Additional studies in Uganda report differences in facility performance linked to organizational conditions and workforce-related factors within health facilities (Kabunga et al., 2024). These observations point to the importance of examining internal facility conditions associated with variations in service delivery.

Work team stability is discussed in the literature as an organizational condition within health care settings, referring to continuity of staff, clarity of roles, and consistency in team composition over time (Salas et al., 2018). Studies conducted across African health systems report workforce challenges such as staff turnover, absenteeism, and staffing imbalances, which affect team composition and daily operations (Waweru et al., 2020). In Uganda, similar patterns have been documented in public health facilities alongside variations in care processes and patient experiences (Apiyo et al., 2022). However, these studies primarily focused on workforce shortages, staffing imbalances, health system performance, and patient experiences rather than specifically examining how work team stability, reflected in staff continuity, team consistency, and role clarity, influences the quality of health care. Furthermore, none of these studies specifically investigated this relationship within Health Centre IV facilities in South Western Uganda. This study, therefore, addresses this knowledge gap by

examining the relationship between work team stability and quality of health care in Health Centre IVs in South Western Uganda.

2. Literature Review and Hypothesis Development

Work team stability is conceptualized as the extent to which health care teams maintain continuity in staffing, clarity of roles, and consistency in team composition over time (Salas et al., 2018). Within health care settings, stable teams are characterized by reduced turnover, predictable team structures, and clearly defined responsibilities among staff. In contrast, instability in teams is reflected through frequent staff transfers, absenteeism, and reliance on temporary personnel, which alter team composition and disrupt routine operations (Waweru et al., 2020). In primary health care environments, particularly in resource-constrained settings, these workforce conditions are commonly reported and are associated with variations in how care activities are organized within facilities. Salas et al. (2018) argue that stable teams facilitate effective communication, coordination, and collaboration, which are essential for delivering high-quality health services. However, Waweru et al. (2020) contend that workforce instability remains a persistent challenge in many health systems, particularly where staffing shortages and frequent personnel movements disrupt teamwork and continuity of care. These contrasting perspectives suggest that although team stability is desirable, its influence may depend on the organizational context within which health care services are delivered.

Quality of health care is defined in terms of the extent to which health services meet established standards related to effectiveness, patient safety, and patient-centeredness (World Health Organization, 2021). These dimensions are used to assess whether care provided meets expected standards while responding to patient needs. In public health facilities, variations in these dimensions are observed across settings, with differences in service delivery linked to internal organizational conditions within facilities (Matovu et al., 2022). In the Ugandan context, quality of care in Health Centre IVs is assessed through indicators such as consistency in service provision, patient experiences, and adherence to clinical standards (Ministry of Health Uganda, 2024). While the World Health Organization (2021) emphasizes adherence to quality standards as the foundation of effective health service delivery, Matovu et al. (2022) demonstrate that organizational differences across health facilities continue to influence the quality of services provided. This suggests that achieving quality health care requires not only compliance with established standards but also organizational conditions that enable health workers to perform effectively.

The relationship between work team stability and quality of health care is discussed in the literature in relation to how team organization is associated with care processes within health facilities. Studies in health systems report that variations in team composition are observed alongside differences in coordination of care, communication among staff, and continuity in service delivery (Rosen et al., 2018). In African health systems, workforce-related conditions such as staffing imbalances and turnover are reported together with variations in service delivery practices within facilities (Hategeka et al., 2020). In Uganda, similar patterns are documented where organizational and workforce conditions within facilities are observed alongside differences in care processes and patient experiences (Kabunga et al., 2024). Although these studies consistently acknowledge the importance of teamwork in supporting health service delivery, they differ in their emphasis. Rosen et al. (2018) primarily associate stable teams with improved coordination and continuity of care, whereas Hategeka et al. (2020) attribute variations in service delivery to broader workforce constraints, including staffing shortages and turnover. Similarly, Kabunga et al. (2024) highlight that organizational conditions continue to influence patient experiences within Ugandan public health facilities. These differences indicate that work team stability is an important organizational factor but is unlikely to operate in isolation, thereby justifying further investigation into its relationship with the quality of health care in Health Centre IV facilities in South Western Uganda. Based on the literature, the following hypothesis is developed.

Theoretical Foundation

This study was guided by the Input–Mediator–Outcome (IMO) Framework of Team Effectiveness developed by Ilgen et al. (2005), which explains how team characteristics influence organizational performance through team processes. According to the framework, work team stability, reflected in employee retention, team consistency, and role clarity, serves as a critical input that enhances communication, coordination, trust, and collaboration among health care workers. These mediating processes improve continuity of care, reduce errors,

strengthen teamwork, and ultimately enhance the quality of health care in terms of effectiveness, patient-centeredness, patient safety, and patient satisfaction. The framework, therefore, provides the theoretical basis for the study by explaining why stable work teams are expected to improve health care quality within Health Centre IV facilities in South Western Uganda.

Hypothesis

H1: There is a significant relationship between work team stability and quality of health care in Health Centre IVs in South Western Uganda.

3. Methodology

Research design

The study adopted a cross-sectional design within a mixed methods approach to examine the relationship between work team stability and quality of health care in Health Centre IVs in South Western Uganda. Cross-sectional designs are suitable for analyzing relationships among variables at a single point in time without altering the study setting, while mixed methods approaches allow integration of quantitative and qualitative evidence to strengthen the interpretation of findings (Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2010). This design enabled the study to capture both measurable relationships and contextual explanations within health care facilities.

Study setting and population

The study was conducted in government-owned Health Centre IVs in South Western Uganda, which provide outpatient, inpatient, maternity, and emergency services and serve as referral centers for lower-level facilities (Ministry of Health Uganda, 2023). The study population comprised 43 Health Centre IV facilities, representing the organizational units under study, and within these facilities, health care providers and patients were considered as respondents because they are directly involved in service delivery and utilization of care.

Unit of analysis and unit of inquiry

The unit of analysis was the Health Centre IV facility since the study focused on organizational conditions at the facility level. The unit of inquiry included health care providers and patients within the selected facilities, as they provided relevant information on work team stability and quality of health care, respectively, consistent with methodological guidance that units of inquiry should be those most knowledgeable about the study variables (Kothari, 2004).

Sample Size and Sampling Techniques

A sample of 38 Health Centre IV facilities was selected from a population of 43 government-owned Health Centre IVs in South Western Uganda. The sample size was determined using the Krejcie and Morgan (1970) sample size determination table, which recommends a sample of 38 for a finite population of 43 units. The selected Health Centre IVs were then chosen using simple random sampling, whereby each facility was assigned a unique identification number and selected through a lottery method to ensure that every Health Centre IV had an equal chance of inclusion. At the respondent level, the study included 238 health care providers and 172 patients drawn from the selected facilities. Health care providers were selected using simple random sampling from staff lists obtained from each participating Health Centre IV. The number of providers selected from each facility was determined proportionately according to the staffing level to ensure adequate representation across facilities. Patients were selected using simple random sampling from those attending outpatient services during the data collection period after meeting the study inclusion criteria. Eligible patients were assigned sequential numbers and selected randomly until the required sample size for each facility was attained. Purposive sampling was used to select key informants, including facility in-charges and other senior health personnel, because of their knowledge and experience regarding staffing patterns, team functioning, and quality of health care (Bryman, 2016; Patton, 2015).

Data Collection Methods

Data were collected using questionnaires, key informant interviews, and document review. The questionnaire was developed by the researcher based on an extensive review of the literature on work team stability and quality of health care, with questionnaire items designed to reflect the study constructs and their respective

dimensions. The instrument was developed in line with previously published theoretical and empirical studies and was subjected to validity and reliability testing before the main data collection. Questionnaires were used to obtain quantitative data in a standardized form suitable for statistical analysis, while interviews were used to capture detailed explanations on team conditions and care practices within the facilities. Document review was used to complement primary data and enhance credibility through triangulation of sources, which is widely recommended in organizational and health research (Bowen, 2009; Flick, 2018).

Measurement of Variables

The study examined work team stability as the independent variable and quality of health care as the dependent variable. Work team stability was measured using indicators such as employee retention, consistency in team composition, and role clarity, which reflect stability in team functioning within organizational settings (Salas et al., 2018). Quality of health care was measured using effectiveness, patient-centeredness, patient safety, and patient satisfaction, which are recognized dimensions of care quality in health systems (World Health Organization, 2021).

Data Analysis

Data were aggregated at the facility level since these were the units of analysis. Quantitative data were analyzed using descriptive statistics, Pearson correlation, and regression analysis. Descriptive statistics summarized respondent characteristics and variable distributions, correlation analysis assessed the strength and direction of the relationship between work team stability and quality of health care, and regression analysis determined the extent to which work team stability explained variation in quality of health care (Pallant, 2020). Qualitative data were analyzed using thematic analysis to identify patterns related to team stability and service delivery.

Quality Control of Research Instruments

Quality control was undertaken to ensure that the study instruments generated valid and reliable data. This involved assessing construct validity and internal consistency reliability through a pilot study conducted among 47 respondents (approximately 10% of the study sample) drawn from selected Health Centre IVs outside the main study area.

Table 1: Summary of Quality Control of Research Instruments

Quality Aspect	Method	Statistical Test	Criterion	Results
Construct Validity	Pilot study	KMO and Bartlett's Test	KMO ≥ 0.70; Bartlett's Test $p < 0.05$	KMO = 0.792–0.836; Bartlett's Test $p = 0.000$
Reliability	Pilot study	Cronbach's Alpha	$\alpha \geq 0.70$	$\alpha = 0.811–0.884$

The KMO values exceeded the recommended threshold of 0.70, while Bartlett's Test was statistically significant for all study constructs, confirming satisfactory construct validity. Similarly, Cronbach's Alpha coefficients ranged from 0.811 to 0.884, indicating good internal consistency. The findings confirmed that the research instruments were both valid and reliable for the main study.

Data Management

Data management involved processing, cleaning, and testing the dataset to ensure its suitability for statistical analysis. Quantitative data were coded, entered into SPSS Version 27, verified for accuracy, merged and aggregated at the Health Centre IV level before analysis, while qualitative data were organized for thematic analysis.

Table 2: Summary of Data Management Procedures

Activity	Procedure	Criterion
Data Processing	Coding, data entry, verification, merging and aggregation	Complete dataset
Missing Value Analysis	MCAR assessment and imputation	Missing values <5%
Outlier Detection	Z-scores, Mahalanobis distance and boxplots	Z-score ±3.29; Mahalanobis <13.82

Normality	Skewness, Kurtosis, Shapiro-Wilk	Skewness/Kurtosis within ±2.5; $p > 0.05$
Homogeneity of Variance	Levene's Test	$p > 0.05$
Linearity	Scatterplots	Linear relationships
Multicollinearity	Tolerance and VIF	Tolerance >0.20; VIF <10
Common Method Bias	Harman's Single-Factor Test	A single factor explains <50% of the total variance

The results indicated that missing data were minimal and randomly distributed, requiring only limited imputation. No significant outliers were detected, and all assumptions for parametric analysis were satisfied. Common method bias was also assessed using Harman's Single-Factor Test. The unrotated exploratory factor analysis showed that the first factor accounted for less than 50% of the total variance, indicating that common method bias was not a significant concern in the study (Podsakoff et al., 2003). Consequently, the dataset was considered suitable for Pearson correlation and regression analyses.

Ethical Considerations

Ethical approval was obtained before data collection, participation was voluntary, and confidentiality of respondents was maintained throughout the study in line with accepted research standards. (Israel & Hay, 2006).

4. Results

Response Rate and Sample Characteristics

The study targeted Health Centre IV facilities and respondents within those facilities, including health care providers and patients. The comparison between the targeted sample and the achieved responses is presented in Table 3.

Table 3: Target and Achieved Sample

Category	Target (n)	Achieved (n)	Response (%)
Health Centre IV facilities	38	35	92.1%
Health care providers	238	238	100%
Patients	172	172	100%

Source: (Primary Data, 2025)

Table 3 shows that data were collected from 35 out of the 38 Health Centre IV facilities targeted, representing a response rate of 92.1%. At the respondent level, all targeted health care providers (n = 238) and patients (n = 172) participated in the study. The number of facilities included was considered adequate for statistical analysis at the organizational level, while the full response from providers and patients strengthened the reliability of the findings.

Descriptive Statistics

Descriptive statistics for the study variables are presented in Table 4.

Table 4: Descriptive Statistics for Study Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Work team stability	35	1.80	4.60	3.42	0.58
Quality of health care	35	2.10	4.70	3.55	0.62

Source: (Primary Data, 2025)

Table 4 indicates that work team stability across Health Centre IV facilities was moderate (Mean = 3.42), with noticeable variation reflected in the range of responses, suggesting differences in staff continuity, team

composition, and role clarity across facilities. Quality of health care was also recorded at a moderate mean (Mean = 3.55), indicating that the level of care provided was not consistent across facilities, with variations observed in effectiveness, patient safety, and patient-centeredness. The spread in both variables, as shown by the standard deviations and range values, suggests that facilities differ in organizational conditions and levels of care, providing a basis for examining whether variations in work team stability are associated with corresponding differences in quality of health care.

Correlation Analysis

Pearson correlation analysis was run to examine the relationship between work team stability and quality of health care using a two-tailed test, as presented in Table 3.

Table 5: Pearson Correlation Coefficient Matrix

Variable	1	2	3	4	5
Work Team Stability-1	1				
Staff retention-2	0.812**	1			
Team consistency-3	0.845**	0.521**	1		
Role clarity-4	0.798**	0.488**	0.463**	1	
Quality of Health Care-5	0.440**	0.398**	0.417**	0.440**	1

Note: $p < 0.01$ (2-tailed)
Source: (Primary Data, 2025)

Table 5 shows a positive and statistically significant relationship between work team stability and quality of health care ($r = 0.440$, $p < 0.01$), indicating that higher levels of work team stability are associated with higher levels of quality of health care across Health Centre IV facilities. The results further show that staff retention, team consistency, and role clarity are all positively related to quality of health care, suggesting that stable staffing, consistent team composition, and clear role definition are associated with higher levels of care across facilities. The overall pattern indicates a moderate association between work team stability and quality of health care. Based on these findings, the hypothesis that there is a significant relationship between work team stability and quality of health care in Health Centre IVs in South Western Uganda is accepted.

Regression Analysis

Regression analysis was run to examine the effect of work team stability on the quality of health care, as presented in Table 6.

Table 6: Regression Results

Variable	Unstandardized B	Std. Error	Standardized Beta (β)	t-value	Sig. (p-value)
Constant	1.284	0.412		3.116	0.004
Work team stability	0.317	0.103	0.352	3.087	0.003
Model Summary	Value				
R	0.440				
R Square (R^2)	0.194				
Adjusted R^2	0.170				
F-statistic	9.529				
Sig. (F)	0.003				

Source: (Primary Data, 2025)

Table 6 shows that the overall regression model is statistically significant ($F = 9.529$, $p = 0.003$), indicating that work team stability significantly explains variation in quality of health care. The coefficient results further show that work team stability has a positive and statistically significant effect on quality of health care ($\beta = 0.352$, $p = 0.003$). The unstandardized coefficient ($B = 0.317$) indicates that a unit increase in work team stability is associated with an increase in the quality of health care. The R^2 value of 0.194 shows that work team stability

explains 19.4% of the variation in quality of health care, while the remaining 80.6% is explained by other factors not included in the study. These results confirm a positive relationship between work team stability and quality of health care, and therefore the hypothesis is accepted.

Qualitative Findings

Key informant interviews revealed that work team stability was perceived as an important organizational factor influencing the quality of health care in Health Centre IV facilities. Respondents consistently indicated that stable staffing promotes continuity of care, effective coordination, and clear allocation of responsibilities, thereby improving service delivery. As one respondent explained, *"Facilities that maintain stable teams are able to coordinate services more efficiently because staff understand each other's working patterns, strengths, and responsibilities, which reduces delays during patient management"* (Respondent 1, December 2025). This finding supports the quantitative results, which demonstrated a positive and statistically significant relationship between work team stability and quality of health care ($r = 0.440$, $p < 0.01$).

Participants further noted that frequent staff transfers and shortages disrupted teamwork and reduced service efficiency because newly deployed staff required time to become familiar with facility procedures. One respondent observed that *"Frequent staff movements disrupt service delivery because new staff require time to understand how the facility operates, including patient flow patterns and internal coordination processes"* (Respondent 4, December 2025). Similarly, another respondent stated that *"When facilities operate with fewer staff than required, the available workers become overstretched, and this affects their concentration and ability to maintain quality service standards"* (Respondent 3, December 2025). These perspectives help explain the quantitative finding that facilities with greater work team stability reported higher levels of quality of health care.

Role clarity also emerged as an important dimension of team stability. Respondents indicated that teams that work together consistently develop a clear understanding of individual responsibilities, reducing duplication of duties and improving coordination during patient care. As one respondent remarked, *"Teams that work together consistently know who is responsible for each task, and this reduces confusion when managing patients, especially during busy periods"* (Respondent 2, December 2025). These qualitative findings are consistent with the statistical evidence indicating that role clarity contributes to overall work team stability.

Documentary review further corroborated these findings. Duty rosters, staffing schedules, and health facility assessment reports revealed variations in staff retention, absenteeism, and team composition across facilities. One assessment report noted that *"The facility continues to experience staffing gaps particularly in nursing and laboratory units, resulting in increased workload for available staff, extended working hours, and occasional delays in service provision due to insufficient personnel to manage patient demand during peak periods and emergencies"* (Health Facility Assessment Report, 2024). Facilities with relatively stable staffing patterns demonstrated stronger coordination of activities and more consistent service delivery than those experiencing frequent staffing changes. The convergence of interview evidence, documentary review, and quantitative findings strengthens the credibility of the conclusion that work team stability is an important organizational factor associated with quality of health care in Health Centre IV facilities.

Discussion

The findings showed a positive and statistically significant relationship between work team stability and quality of health care in Health Centre IV facilities, indicating that variations in staff continuity, team consistency, and role clarity are associated with differences in how health care is organized and delivered across facilities. These findings are consistent with recent literature which emphasizes that effective team functioning depends on stable structures, shared understanding, and coordination mechanisms within teams (Mathieu et al., 2020; Weller, 2024). In health care settings, where service delivery is highly interdependent, stability in team composition supports coordination of tasks and consistency in care practices. However, studies such as (Bae & Mark, 2021; Leape et al., 2020) indicate that improvements in quality of care are also influenced by leadership practices and organizational systems, suggesting that team stability alone may not fully explain variations in how work is organized within facilities.

The findings are also consistent with health systems literature which shows that organizational conditions, including workforce environment and staffing arrangements, are associated with variations in health care quality. Studies by (Jha et al., 2021; Kruk et al., 2018) indicate that differences in care across facilities are linked to internal organizational factors such as staffing, supervision, and work environment. At the same time, research by (Leatherman, 2020; McHugh & Aiken, 2022) highlights that resource availability, infrastructure, and policy conditions can shape service delivery regardless of staffing stability. This suggests that while the present findings align with existing evidence, work team stability operates alongside other structural and organizational factors that influence how care is delivered within facilities.

The qualitative findings provide further insight by illustrating how these patterns are experienced within facilities. Facilities with stable staffing were described as having clearer coordination of activities and more structured work processes, while those with frequent changes in team composition experienced challenges in organizing tasks and maintaining consistency in service delivery. These observations are consistent with studies by Edmondson & Lei (2020), which shows that stability in team membership and clarity of roles support coordination and reduce inefficiencies within organizations. However, research by Blumenthal et al., (2020) also indicates that even in settings with relatively stable teams, challenges in organizing care may persist due to broader system-level constraints. These findings reinforce that variations in staff continuity, team consistency, and role clarity are associated with how work is organized within facilities, while also being influenced by wider organizational conditions within Health Centre IVs.

Although the findings demonstrate that work team stability contributes to the quality of health care, they also suggest that it represents only one aspect of a broader organizational system influencing service delivery. Health care quality is inherently multidimensional and is shaped by the interaction of workforce, organizational, structural, and policy-related factors. Previous studies have shown that organizational factors such as leadership effectiveness, staff motivation, supervision, organizational culture, and communication practices, together with contextual factors including availability of medicines and medical supplies, health facility infrastructure, financial resources, staffing adequacy, workload, and implementation of health policies, collectively influence the quality of care delivered within health facilities (Jha et al., 2021; Leatherman, 2020; McHugh & Aiken, 2022). Improvements in work team stability are likely to yield greater benefits when accompanied by interventions that strengthen these complementary organizational and contextual conditions, thereby promoting more comprehensive improvements in the quality of health care.

5. Conclusion, Recommendations and Implications

The findings demonstrate that work team stability is associated with quality of health care in Health Centre IV facilities, with variations in staff continuity, team consistency, and role clarity reflected in how care is organized and delivered across facilities. Facilities characterized by more stable team arrangements exhibited more coordinated work processes, while those with unstable staffing patterns experienced disruptions in the organization of activities. These results highlight the importance of internal team conditions in shaping how health care services are structured within primary health care facilities.

The study contributes to the literature by providing facility-level evidence on the relationship between work team stability and quality of health care within Health Centre IVs in South Western Uganda. It extends existing work by showing that organizational conditions within facilities are associated with differences in how care is organized, rather than focusing only on system-level factors. The integration of quantitative and qualitative findings further demonstrates how variations in team stability are reflected in day-to-day operations within health facilities.

Recommendations

Based on the findings, the study recommends that Health Centre IV managers should minimize unnecessary staff transfers within facilities to promote continuity of care and preserve institutional knowledge. Facility managers should establish regular team coordination meetings, clarify staff roles and responsibilities, and strengthen supportive supervision to improve communication and teamwork. Structured orientation and mentoring programs should be provided for newly deployed health workers to facilitate their integration into existing teams and minimize disruptions to service delivery. Health facility managers should also conduct

periodic workforce assessments to identify staffing gaps, monitor workload distribution, and ensure that critical service units maintain adequate staffing levels.

Managerial Implications

The Ministry of Health, District Local Governments, District Health Officers, and the Health Service Commission should strengthen workforce planning policies that promote staff stability within Health Centre IV facilities. Recruitment and deployment strategies should prioritize filling critical staffing shortages, particularly in nursing, laboratory, pharmacy, and clinical departments, while reducing avoidable transfers of experienced health workers. The government should provide adequate financial resources to improve staff welfare, including accommodation, retention incentives, and continuing professional development, particularly in rural and hard-to-reach facilities. The Ministry of Health should also develop and implement national guidelines on team-based service delivery, staff orientation, and role clarification to promote consistency in workforce management across public health facilities. In addition, district health authorities should incorporate indicators such as staff retention, absenteeism, vacancy rates, and team continuity into routine health sector performance monitoring to support evidence-based workforce planning.

Policy Implications

At the policy level, there is a need to strengthen workforce management policies that support the stability of health care teams within public health facilities. This includes developing guidelines that regulate staff deployment and transfers, improving staffing structures within Health Centre IVs, and ensuring consistent allocation of personnel across facilities. In addition, policies should support institutional systems that enhance role clarity and coordination within facilities. Addressing these aspects at the policy level may contribute to improving how health services are organized within primary health care settings. Future research should examine additional factors that influence the quality of health care, given that a large proportion of variation is explained by factors beyond work team stability.

Study Limitations

The findings of this study should be interpreted in light of several methodological considerations. Although the cross-sectional design enabled the examination of relationships among the study variables at a single point in time, it does not permit causal inferences. This consideration was addressed by applying appropriate correlational and regression analyses that were consistent with the study design, while future studies may employ longitudinal designs to establish causal relationships. The study relied on self-reported data from health care providers and patients, which may be influenced by social desirability and recall effects. To minimize this possibility, respondents were assured of confidentiality and anonymity, standardized research instruments were used, and the findings were triangulated with key informant interviews and document review. Despite these measures, some degree of response bias cannot be entirely ruled out. The study was conducted in Health Centre IVs in South Western Uganda, and the findings therefore reflect the organizational context of these facilities. To enhance external validity, Health Centre IVs were selected from across the region using appropriate sampling procedures; however, caution should be exercised when applying the findings to other levels of health facilities or different geographical settings. Future research should extend this work by including a wider range of health facilities, incorporating objective performance indicators alongside self-reported measures, and examining additional organizational factors that may influence the quality of health care.

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Ethical Approval: Ethical approval for this study was obtained from the relevant institutional review body before data collection. Permission to conduct the study was also obtained from the selected Health Centre IV facilities. Participation in the study was voluntary, and informed consent was obtained from all respondents. Confidentiality and anonymity of participants were maintained throughout the research process.

Author Contributions: SB conceived and designed the study, developed the research instruments, collected and analyzed the data, interpreted the findings, and prepared the original manuscript. RB, MB, EM, and CM provided academic supervision throughout the study, contributed to the conceptualization and methodological refinement of the research, critically reviewed and revised the manuscript for important intellectual content, and approved the final version for publication. All authors read and approved the final manuscript.

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Does Job-Related Affective Wellbeing Differ Across Biocharacteristic Determinants in the Congolese Higher Education Sector

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Abstract: Psychological and emotional health are believed to impact employees' productivity and well-being. Hence, promoting the latter within workplaces by implementing proper policies, whilst adapting to the nature and strength of its relationship with bio-characteristic determinants, as well as profile groups' disparities, guarantees both employee wellness and organisational performance. A total of 948 higher education employees, representing three socio-professional categories, completed a Job-related Affective Wellbeing Scale (JAWS), which included a profile section for those who volunteered to participate in the study. In addition to descriptive statistics, Pearson product-moment correlation, *t-test,* and ANOVA were also used to answer the research study's questions. The study revealed that Congolese higher education staff were in good mental and psychological health. Gender correlated positively with depression and anxiety. Likewise, age correlated positively with depression but associated negatively with enthusiasm. Women appeared to be more likely than men to experience depression and anxiety disorders. Younger participants reported significantly higher mean levels of depression than older participants, who displayed more enthusiasm. Master's degree holders were more enthusiastic than those who held a bachelor's degree. Higher education staff who live alone are more depressive and more anxious than those who are legally married and also appeared to experience less comfort at work than those who are legally married. Those staff member participants who are legally married were less enthusiastic than those who live with a partner without any legal matrimonial bond. Academic staff appeared to be more anxious than both administrative staff and scientific staff participants. Proper well-being policies must be implemented that adapt to staff members' gender, age, marital status, level of education, and socio-professional categories, as correlation disparities were observed in this regard.

Keywords: *Job-related Affective Wellbeing scale, Well-being, Depression, Anxiety, Comfort, Enthusiasm, Congolese higher education*

1. Introduction

It is common knowledge that employee well-being determines their overall health, impacted by aspects that include emotional health (Kraljević, Doan, Demou, Craig, & Kromydas, 2025). Workplace well-being affects productivity and work engagement in addition to mental and physical health (Arevin, Rustam, Widaningsih, Saryanti, & Wulandari, 2024). It also fosters organisational culture by enhancing employees' personal growth, as well as social relationship improvement at work (Putra, Kusumawati, Kartikasari, & Dewi, 2024). Thus, beyond being perceived as a moral obligation, well-being at work is a business strategy, mitigating risks, reducing medical expenses and improving bottom-line results that offer a strategic advantage to organisations (Pandey, Maheshwari, & Malik, 2025).

The crucial character of employee well-being is a concern for all; however, little systematic research has examined the issue in sub-Saharan Africa (Wolf, Torrente, McCoy, Rasheed, & Aber, 2015), not to mention the widely under-researched DR Congo and, specifically, its higher education sector. A search from Scielo, Scopus and Google Scholar databases provided only one article on job-related well-being (Kamenga, Ngongo, Moba, & Mbuyi, 2021); however, this study used an economic index to assess well-being. Consequently, one may question if, in such an environment, organisations can implement effectively tailored prevention programmes and design related policies that foster workplace well-being.

The aforementioned calls for trained leadership, capable of detecting early signs of stress to engage in promptly supportive and empathetic conversations (Winters, 2020). Also, effective well-being policies in organisations need to be tailored according to field data, which includes the socio-demographic characteristics of the targeted groups (Pandey, Maheshwari, & Malik, 2025). Hence, the present study is significant, as it investigated the

differences between and within socio-demographic groups, as well as their relationships with workplace well-being in the context of the Congolese higher education sector.

Besides providing insightful analyses that would guide the design of holistic well-being programmes, this study also sought to enrich the limited available literature for the Congolese context, in general, and of the country's higher education sector, in particular.

2. Literature Review

Employee well-being, which refers to a multidimensional construct that manifests through positive and negative effects that determine the overall quality of their experience at work (Pandey, Maheshwari, & Malik, 2025), features among the few issues that correlate with mental health, attracting attention from both general and governmental debates worldwide. Factors that affect an individual's well-being are multiple, originating from both home and work (Badri, 2019). Thus, while addressing their employees' well-being and related mental health, leaders should holistically consider the phenomenon, because what happens at home influences emotions that they feel while at work, and vice versa. Indeed, the lack of consistent social and emotional support would contribute to feelings of isolation and poor mental health that were enhanced during the COVID-19 pandemic, as noted in the academic sector during that period (Yong, Chikwa, & Rehman, 2026).

Strategies that promote workplace well-being must address multiple health dimensions such as schedule flexibility and employee control over their performed daily tasks (Biggart, Cook, & Carder, 2020). The stigmas associated with mental health challenges should be addressed through dedicated training programmes company-wide that offer psychological assistance for both personal and occupational challenges, whilst well-being conversations should be normalised (Spilg, et al., 2022). In addition, employers should ensure that office spaces and remote workstations are ergonomic to prevent physical strain, whilst encouraging physical activity, particularly through subsidised gym memberships, scheduling dedicated meditation time, and promoting the taking of breaks either for lunch or merely to step away from their desktops; these are valuable activities, which would promote workplace well-being (Griffin, et al., 2019).

In their quest to address mental health and well-being at work through the design of effective intervention programmes and policies, organisations should measure workers' well-being levels. It is worth noting that Jarden *et al.'s* (2023) systematic and methodical review of existing instruments revealed that from 18 newly developed scales, only three had the greatest number of positively rated measurement properties. This concerns the Personal Growth and Development Scale, the University of Tokyo's Occupational Mental Health well-being 24 scale, and the Employee Well-being scale; however, none of them met the criteria for adequate instrument design. Hence, they relied on the well-known Job-related Affective Wellbeing Scale (JAWS), based on Warr's model of affective well-being at work, which measures an individual's specific emotions and moods, as experienced directly as a result of their work (Looti, 2025). The present study opted for its shortest form, which assessed negative effects, depression and anxiety, positive effects, and enthusiasm and comfort, using 20 items that were evenly distributed in order of five for each component.

The use of JAWS indicates that the theoretical perspectives of this research are basically anchored in the Circumplex Model of Affect - CMA, first developed by James Russell, and the Job Stress Model - JSM, often associated with Paul Spector and Suzy Fox (Laguna, Mielniczuk, & Razmus, 2019). Among both frameworks, CMA is the one that posits clearly the non-discrete and interrelated nature of human emotions, which it believes are systematically interconnected along a circular continuum based on two independent neurophysiological dimensions: pleasure/valence (unpleasant to pleasant) and arousal/activation (low to high) (Van Katwyk, Fox, Spector, & Kelloway, 2000). JSM, also labelled the Stress-Strain-Emotion model, assumes that an individual's emotional states mediate the effects between objective or perceived job stressors (e.g., heavy workload, interpersonal conflict) and negative behavioural or health outcomes (e.g., burnout, counterproductive behaviour) (Van Katwyk, Fox, Spector, & Kelloway, 2000). Under this framework, causal relationships between specific workplace characteristics and emotional "strains" are measured through JAWS, whose negative emotions often track stress and burnout processes, whereas positive emotions capture engagement and motivation (Jarden, Siegert, Koziol-McLain, Bujalka, & Sandham, 2023). Thus, both CMA and JSM justify the

relevance of the adopted approach of this study based on the JAWS model in its quest to improve mental health for a more productive work environment for the Congolese higher education staff.

Platforms used to report results from workplace well-being studies devoted to higher education staff across the African continent revealed that the issue is under-researched. However, studies conducted in South Africa by Abraham *et al*. (2025) and Van Niekerk *et al*. (2021) found that over a quarter of university staff members reported severe psychological distress strongly correlated with mental well-being and high levels of burnout. Female staff members, staff members with comorbidities, and workers in the administration and service sections were significantly more likely to report psychological distress. Age was inversely correlated with psychological distress and positively correlated with mental well-being. Both studies concluded that the mental health and well-being of university staff were at an increased risk, justifying their expressed dissatisfaction with their institutional support, hence the appeal for strategies, policies and practices that are culturally and contextually tailored to promote mental health. It is worth noting that both studies arrived at quite similar conclusions, though they have been conducted in different contexts, as Van Niekerk *et al*. (2021) investigation took place during the COVID-19 pandemic.

Job-related depression, anxiety, enthusiasm, and comfort differed from clinical corresponding mental health characteristics, as these captured specific transient and stable emotional states that are tied directly to the workplace (Laguna, Chilimoniuk, Purc, & Kulczycka, 2022). Feelings that display depression, discouragement, or gloom were generally indicative of negative high-arousal, while anxiety, fright, or tension demonstrated negative-low arousal anxiety (Laguna, Mielniczuk, & Razmus, 2019). Conversely, enthusiasm captured positive high-arousal, expressed through workers' feelings of being enthusiastic, excited, inspired, energetic, and elated, while emotions of being at ease, calm, or relaxed depicted positive low-arousal comfort.

To achieve its objectives, the present study sought to answer the research questions presented below.

- Do Congolese higher education staff members' depression, anxiety, comfort and enthusiasm levels correlate significantly with their bio-characteristics (gender, age, level of education, marital status, socio-professional category and area of residence)?
- What is the nature and strengths of these correlations?
- Do the expressed levels of Congolese higher education staff members' depression, anxiety, comfort and enthusiasm differ owing to their respective bio-characteristics?
- Which bio-characteristic elements differ from one another?
- What are the implications for management to implement prevention strategies and well-being policies within Congolese higher education institutions?

3. Research Design and Methodology

This study is epistemologically empirical and is best described as following a positivist paradigm that appeals to applying a quantitative method (Irwan, 2024). A job-related affective wellbeing scale (JAWS) was distributed to individuals who volunteered to participate in the survey, and they were all guaranteed anonymity in respect of their identity and survey responses. In addition to the 20 JAWS items, a closed-ended questionnaire was used to collect the respondents' biographical data.

Sampling method and size

The study targeted individuals who were affiliated to at least one of the 17 private and public higher education institutions, located in Kinshasa, and who were all selected randomly to form the research setting. The individuals that comprised the study's sample were included for their occupational status, regardless of the type of their organisational contract, their length of work tenure, and their position. No exclusion was applied based on any of the socio-demographic characteristics. To ensure representativeness across the selected higher education institutions, proportional stratified sampling was applied to afford staff members an equal opportunity to participate, allowing for generalisation of the findings (Makwana, Engineer, Dabhi, & Chudasama, 2023).

Firstly, the 65 private and 17 public higher education institutions were separated into two strata, and secondly, 20 percent of the higher education institutions within each constituted pool were selected randomly to reflect

their proportional weight of the 82 institutions in Kinshasa (Akilimali, 2021). Finally, trained interviewers were deployed to administer the questionnaire randomly to higher education staff members willing to participate in the study. After 10 working days of data collection, 948 completed questionnaires were encoded on an Excel spreadsheet and imported to SPSS 31 for statistical analysis.

The research study's participants' biographical characteristics, as captured in the completed questionnaires indicated that the majority of the sample comprised men (65.1%), staff who were over the age of 35 (57.9%), scientific staff members (39.8%), staff who held a master's degree (48.1%), those who are married (55.3%), and those who live in the Lukunga district (42.3%). Further details concerning the respondents' respective profiles are provided below in Table 1.

Table 1: **Biographical characteristics of the respondents (n = 948)**

Bio-characteristics	*Frequency*	*Percent*	*Bio-characteristics*	*Frequency*	*Percent*
Gender			Marital status		
Male	617	65.1	Single	246	25.9
Female	331	34.9	Married	524	55.3
Total	948	100.0	Live-in Partner	68	7.2
Age			Divorced	36	3.8
≤ 35 yrs old	399	42.1	Separated	36	3.8
> 35 yrs old	549	57.9	Widow[er]	38	4.0
Total	948	100.0	Total	948	100.0
Level of education			Area of residence		
Some primary schooling	2	0.2	Funa	177	18,7%
Standard 6/Grade 8	5	0.5	Lukunga	401	42,3%
Standard 8/Grade 10	18	1.9	Mont-Amba	243	25,6%
Matric	12	1.3	Tshangu	127	13,4%
Undergraduate degree	35	3.7	Total	948	100.0
Bachelor's degree	122	12.9	Socio-professional category		
Master's degree	456	48.1	Administrative staff	338	35.6
Doctoral degree	168	17.7	Scientific staff	377	39.8
Total	948	100.0	Academic staff	233	24.6
			Total	948	100.0

Instrumentation and data collection

This study used a closed-ended questionnaire, which comprised two sections to collect the data. The first section captured biographical characteristics that included age, area of residence, gender, level of education, marital status, and socio-professional category. The second section focused on the respondents' perceived well-being at work towards the 20 JAWS items, which were rated on a 5-point Likert scale, ranging from "never" to "extremely often" or "always".

JAWS refers to a psychometric instrument that was designed to measure employees' emotional reactions to their work environment, available in either a long or short version of 30 and 20 specific emotions, respectively (Van Katwyk, Fox, Spector, & Kelloway, 2000). Regardless of its version, it assesses specific positive and negative emotions, which employees experience frequently in their workplaces rather than focusing on general job satisfaction (Laguna, Mielniczuk, & Razmus, Test of the Bifactor Model of Job-Related Affective Well-Being, 2019). According to JAWS, emotions are grouped into four distinct affective quadrants in line with the factor structure that supports its theoretical foundation, translating into employees' enthusiasm, comfort, anxiety, and depression levels (Laguna, Chilimoniuk, Purc, & Kulczycka, 2022). The present study opted to use the short version of JAWS, whose reliability tests across identified primary subscales exhibited high levels of internal consistency with Cronbach's alpha coefficient, ranging from .80 to .90 (Looti, 2025).

Psychometric properties of JAWS in the context of the present study were tested, and estimates are shown in Table 2 below. Internal consistency reliability estimated in terms of composite reliability (CR) for the four constructs ranged from 0.73 to 0.78, well above the recommended 0.6 (Hair Jr, Black, Babin, & Anderson, 2018). However, though none of the AVEs reached the 0.5 cut-off, they were above the sometimes accepted 0.4,

confirming convergent validity. Finally, discriminant validity was determined using the Fornell-Larcker criterion, which demonstrated that all square roots of the AVE of constructs were greater than the correlations with the others (De Jager, Ayikwa, & Wannenburg, 2022).

Table 2: **Reliability, convergent validity and discriminant validity - Fornell-Larcker criterion**

	Reliability and convergent validity		Discriminant validity			
	CR	AVE	NHA	NLA	PHA	PLA
NHA	0.78	0.46	(0.68)			
NLA	0.74	0.47	0.24	(0.69)		
PHA	0.76	0.44	0.28	0.63	(0.66)	
PLA	0.77	0.47	0.61	0.20	0.21	(0.69)

NHA = Negative-High arousal; NLA = Negative-Low arousal; PHA = Positive-High arousal; PLA = Positive-Low arousal; CR = Composite reliability; AVE = Average variance extracted.
The square root of the AVE is shown diagonally in parentheses.

Analysis and reporting

The collected data were processed using the Statistical Package for the Social Sciences (SPSS) version 31. Relationship analyses were conducted using the Pearson product-moment correlation coefficient, often called Pearson's *r*. The latter measured the strength and direction of the association between biographical characteristics and workplace well-being subscales (Faizi & Alvi, 2023). The statistical significance of the differences between the two groups was determined by the *t*-Test (Xu, et al., 2017), whereas ANOVA was applied to more than two groups (Kim, 2017).

Ethical considerations

The conduct and reporting of this study adhered to ethical principles, ensuring professional integrity, whilst duly signed informed consent was obtained, confirming the anonymity and confidentiality of the research participants' responses. The Protestant University of the Congo's Research Ethics Committee granted ethical clearance, allowing the survey to be conducted.

4. Empirical Findings

Descriptive statistics

Descriptive statistics for the four-dimensional job-related affective well-being elements are presented in Table 3 below. Higher education staff members reported relatively low levels of negative affect, with depression having a mean of 2.43 (SD = 0.71) and anxiety averaging 2.45 (SD = 0.77), indicating relatively infrequent negative emotional responses to the job. These results rule out the possibility of an ongoing psychological or emotional issue at the workplace. (Basińska, Gruszczyńska, & Schaufeli, 2014). Positive affect was moderate, with enthusiasm scoring an average of 3.32 (SD = 0.86) and comfort an average of 3.27 (SD = 0.80). Although these results do not show that higher education staff consider themselves to be performing in a healthy and fulfilling work environment, as they were rather indecisive (Looti, 2025), it nevertheless describes a psychologically stable cohort.

Table 3: **Descriptive statistics**

	Mean	**Std. Deviation**	**Minimum**	**Maximum**
Negative-High arousal	2.43	0.71	1.00	5.00
Negative-Low arousal	2.45	0.77	1.00	5.00
Positive-High arousal	3.32	0.86	1.00	5.00
Positive-Low arousal	3.27	0.80	1.00	5.00

Correlational relationships analysis

A Pearson correlation revealed a highly statistically significant and low positive association between gender and the relatively low levels of depression ($r = .10$, $p < .01$) and anxiety ($r = .11$, $p < .01$), unveiling that men were more likely to express relatively low negative affect than women. Likewise, age was statistically significant, correlating weakly and positively with lower reported depression ($r = .06$, $p < .05$), suggesting that elderliness

is slightly associated with lower depression. Contrarily, age was highly statistically significant and correlated weakly and negatively with moderate enthusiasm (r = -.09, p < .01), indicating that lower enthusiasm was slightly associated with youthfulness. All other Pearson correlation coefficients were insignificant, as shown below in Table 4.

Table 4: **Correlation**

		Negative-High arousal	Negative-Low arousal	Positive-High arousal	Positive-Low arousal
Gender	*r*	.103**	.106**	-0.041	-0.058
	Sig.	0.002	0.001	0.212	0.076
Age	*r*	.064*	0.041	-.092**	0.026
	Sig.	0.048	0.204	0.005	0.416
Level of study	*r*	-0.029	-0.014	0.052	0.029
	Sig.	0.370	0.656	0.112	0.377
Marital status	*r*	-0.041	-0.039	0.000	0.033
	Sig.	0.204	0.232	0.995	0.312
Socio-professional category	*r*	0.033	0.057	-0.017	-0.015
	Sig.	0.310	0.082	0.595	0.636
Area of residence	*r*	0.037	-0.008	0.025	0.020
	Sig.	0.257	0.800	0.434	0.535

*. Correlation is significant at the 0.05 level (2-tailed)
**. Correlation is significant at the 0.01 level (2-tailed)

Group differences

An independent-samples t-test was conducted to compare the four job-related well-being dimensional effects between women and men. A significant difference was reported between the two genders in this regard: relatively low depression for men (M = 2.38, SD = 0.69); and for women (M = 2.53, SD = 0.74), t (946) = -0.63, p = 0.002. Likewise, there was a difference between men (M = 2.39, SD = 0.77) and women (M = 2.56, SD = 0.76) in terms of the relatively low level of anxiety, which was significant, t (946) = -0.65, p = 0.001. These results suggest that women expressed more frequent negative emotional responses to the job than men. There was no significant difference in the reported moderate levels of enthusiasm between men (M = 3.34, SD = 0.86) and women (M = 3.27, SD = 0.85), t(946) = 0.25, p = 0.212. Similarly, the difference between men (M = 3.30, SD = 0.81) and women (M = 3.21, SD = 0.78) was insignificant, t (946) = 0.36, p = 0.080. Further, Cohen's d effect size confirmed the small effect size of the significant relationship between gender groups and considered well-being dimensional effects. Details of both descriptive group statistics and the *t*-Test results are provided below in Tables 5 and 6.

Table 5: **Descriptive Gender Group Statistics**

	Gender	N	Mean	Std. Deviation	Std. Error Mean
Negative-High arousal	Male	617	2.38	0.69	0.03
	Female	331	2.53	0.74	0.04
Negative-Low arousal	Male	617	2.39	0.77	0.03
	Female	331	2.56	0.76	0.04
Positive-High arousal	Male	617	3.34	0.86	0.03
	Female	331	3.27	0.85	0.05
Positive-Low arousal	Male	617	3.30	0.81	0.03
	Female	331	3.21	0.78	0.04

Table 6: **t-Test Independent Samples Test/ Gender**

			t-test for Equality of Means						
		Cohen d	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Negative-High arousal	EVA	-0.22	-0.63	946	0.002	-0.15	0.05	-0.25	-0.06
	EVNA		-0.62	630.96	0.002	-0.15	0.05	-0.25	-0.06
Negative-Low arousal	EVA	-0.22	-0.65	946	0.001	-0.17	0.05	-0.272	-0.07
	EVNA		-0.66	683.26	0.001	-0.17	0.05	-0.272	-0.07
Positive-High arousal	EVA	0.09	0.25	946	0.212	0.07	0.05	-0.042	0.19
	EVNA		0.25	680.26	0.211	0.07	0.05	-0.042	0.19
Positive-Low arousal	EVA	0.12	0.36	946	0.080	0.10	0.05	-0.01	0.20
	EVNA		0.36	694.23	0.070	0.10	0.05	-0.008	0.20

EVA: Equal variances assumed; EVNA: Equal variances not assumed

An independent-samples t-test was conducted to compare the four job-related well-being dimensions between higher education staff, aged 35 years or younger, and those aged over 35 years. A significant difference was reported, as follows: relatively low depression for staff aged over 35 years (M = 2.40, SD = 0.73) and those aged 35 years or younger (M = 2.50, SD = 0.74), t (946) = -0.40, p = 0.048. These results suggest that higher education staff, aged 35 years or younger, expressed more frequent depressive emotional responses to the job than those who were over 35 years old. Likewise, there was a difference between staff who were over 35 years old (M = 3.37, SD = 0.85) and those who were 35 years old or younger (M = 3.20, SD = 0.85), where moderate levels of enthusiasm were reported to be significant, namely t (946) = 0.57, p = 0.005. These results indicate that higher education staff, who were over 35 years old, expressed more frequent enthusiastic emotional responses to the job than those who were 35 years old or younger. Further, Cohen's d effect size confirmed the small effect size of the significant relationship between age groups and considered well-being dimensional effects. There was no significant difference between the two age groups in terms of anxiety and comfort, as shown in Tables 7 and 8 below.

Table 7: **Descriptive Age group Statistics**

	Age	N	Mean	Std. Deviation	Std. Error Mean
Negative-High arousal	> 35 yrs old	549	2.40	0.73	0.03
	≤ 35 yrs old	399	2.50	0.67	0.04
Negative-Low arousal	> 35 yrs old	549	2.42	0.78	0.03
	≤ 35 yrs old	399	2.49	0.74	0.04
Positive-High arousal	> 35 yrs old	549	3.37	0.85	0.03
	≤ 35 yrs old	399	3.20	0.85	0.05
Positive-Low arousal	> 35 yrs old	549	3.26	0.80	0.03
	≤ 35 yrs old	399	3.30	0.81	0.05

Table 8: **t-Test Independent Samples Test/ Age**

			t-test for Equality of Means						
		Cohen d	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Negative-High arousal	EVA	-0.14	-0.40	946	0.048	-0.10	0.05	-0.19	0.00
	EVNA		-0.41	658.14	0.042	-0.10	0.05	-0.19	0.00
Negative-Low arousal	EVA	-0.09	-0.25	946	0.204	-0.07	0.05	-0.17	0.04
	EVNA		-0.26	636.89	0.196	-0.07	0.05	-0.17	0.04
Positive-High arousal	EVA	-0.20	0.57	946	0.005	0.17	0.06	0.05	0.28
	EVNA		0.57	607.14	0.005	0.17	0.06	0.05	0.28
Positive-Low arousal	EVA	-0.7	-0.16	946	0.416	-0.05	0.06	-0.15	0.06
	EVNA		-0.16	602.77	0.418	-0.05	0.06	-0.15	0.06

EVA: Equal variances assumed; EVNA: Equal variances not assumed

A one-way analysis of variance was conducted to examine whether the four job-related well-being dimensions differed in terms of higher education staff members' level of education. The analysis revealed a statistically significant difference in the reported moderate enthusiasm of staff in relation to their level of education, namely $F(3, 944) = 1.18$, $p = .004$, as shown in Table 9 below. No statistically significant differences were observed between the reported relatively low negative affect elements, depression and anxiety, and the moderate positive affect, comfort.

Table 9: **ANOVA/ Level of education**

		Sum of Squares	df	Mean Square	F	Sig.
Negative-High arousal	Between groups	44.57	3	14.86	1.18	0.316
	Within groups	11873.75	944	12.58		
	Total	11918.32	947			
Negative-Low arousal	Between groups	16.22	3	5.41	0.36	0.779
	Within groups	14028.19	944	14.86		
	Total	14044.41	947			
Positive-High arousal	Between groups	238.40	3	79.47	4.39	0.004
	Within groups	17102.83	944	18.12		
	Total	17341.22	947			
Positive-Low arousal	Between groups	92.45	3	30.82	1.92	0.125
	Within groups	15153.87	944	16.05		
	Total	15246.33	947			

To determine which specific group means differed, post-hoc comparisons, using the Tukey HSD test, revealed that higher education staff who held a master's degree were more enthusiastic than those who had a bachelor's degree (p = .002). No statistically significant differences were observed between the remaining groups, as shown below in Table 10.

Table 10: Post-hoc Tests Tukey HSD/ Multiple comparisons (Level of study)

Dependent Variable	(I) Level of study	(J) Level of study	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Positive-High arousal	Undergraduate+	Bachelor's	0.20	0.49	0.180	-0.054	0.448
		Master's	-0.11	0.36	0.406	-0.296	0.074
		Doctorate	-0.03	0.44	0.980	-0.264	0.194
	Bachelor's	Undergraduate+	-0.20	0.49	0.180	-0.448	0.054
		Master's	-0.31*	0.43	0.002	-0.532	-0.086
		Doctorate	-0.23	0.51	0.101	-0.492	0.028
	Master's	Undergraduate+	0.11	0.36	0.406	-0.074	0.296
		Bachelor's	0.31*	0.43	0.002	0.086	0.532
		Doctorate	0.08	0.38	0.744	-0.12	0.276
	Doctorate	Undergraduate+	0.03	0.44	0.980	-0.194	0.264
		Bachelor's	0.23	0.51	0.101	-0.028	0.492
		Master's	-0.08	0.38	0.744	-0.276	0.12

*. The mean difference is significant at the 0.05 level;
Undergraduate+: individuals with, at most, an undergraduate degree.

A one-way analysis of variance was conducted to examine whether the four job-related well-being dimensional affects differed in respect of higher education staff members' marital status. The analysis revealed a statistically significant difference in all four well-being affective dimensions, as displayed below in Table 11. The relatively low negative affect differed respectively for depression, F(2, 945) = 3.99, p = .019, and anxiety, F(2, 945) = 3.74, p = .024. Conversely, the moderate positive affect differed respectively for enthusiasm, F(2, 945) = 6.46, p = .002, and comfort, F(2, 945) = 4.55, p = .011.

Table 11: **ANOVA/ Marital status**

		Sum of Squares	df	Mean Square	F	Sig.
Negative-High arousal	Between groups	99.77	2	49.89	3.99	0.019
	Within groups	11818.55	945	12.51		
	Total	11918.32	947			
Negative-Low arousal	Between groups	110.37	2	55.19	3.74	0.024
	Within groups	13934.04	945	14.75		
	Total	14044.41	947			
Positive-High arousal	Between groups	233.87	2	116.94	6.46	0.002
	Within groups	17107.35	945	18.10		
	Total	17341.22	947			

Positive-Low arousal	Between groups	145.33	2	72.66	4.55	0.011
	Within groups	15101.00	945	15.98		
	Total	15246.33	947			

To determine which specific group means differed, post-hoc comparisons were made, using the Tukey HSD test, revealing that higher education staff members who live alone were more depressed (p = .030) and more anxious (p = .039) than those who were legally married. Similarly, married staff reported that they felt more comfortable at work than those who lived alone (p = .031), while they were less enthusiastic compared to those who lived with a partner but who were not legally married (p = .003), as shown below in Table 12.

Table 12: **Post-hoc Tests Tukey HSD/ Multiple comparisons (Marital status)**

Dependent Variable	(I) Level of study	(J) Level of study	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Negative-High arousal	Single⁺	Married	.62*	0.24	0.030	0.05	1.19
		Live-in partner	-0.18	0.47	0.925	-1.28	0.92
	Married	Single⁺	-.62*	0.24	0.030	-1.19	-0.05
		Live-in partner	-0.79	0.46	0.190	-1.86	0.28
	Live-in partner	Single⁺	0.18	0.47	0.925	-0.92	1.28
		Married	0.79	0.46	0.190	-0.28	1.86
Negative-Low arousal	Single⁺	Married	.65*	0.26	0.039	0.03	1.26
		Live-in partner	-0.21	0.51	0.913	-1.40	0.99
	Married	Single⁺	-.65*	0.26	0.039	-1.26	-0.03
		Live-in partner	-0.85	0.49	0.198	-2.01	0.31
	Live-in partner	Single⁺	0.21	0.51	0.913	-0.99	1.40
		Married	0.85	0.49	0.198	-0.31	2.01
Positive-High arousal	Single⁺	Married	-0.64	0.29	0.073	-1.33	0.05
		Live-in partner	1.14	0.56	0.105	-0.18	2.47
	Married	Single⁺	0.64	0.29	0.073	-0.05	1.33
		Live-in partner	1.78*	0.55	0.003	0.50	3.07
	Live-in partner	Single⁺	-1.14	0.56	0.105	-2.47	0.18
		Married	-1.78*	0.55	0.003	-3.07	-0.50
Positive-Low arousal	Single⁺	Married	-.70*	0.27	0.031	-1.34	-0.05
		Live-in partner	0.41	0.53	0.720	-0.83	1.65
	Married	Single⁺	.70*	0.27	0.031	0.05	1.34
		Live-in partner	1.10	0.52	0.082	-0.11	2.31
	Live-in partner	Single⁺	-0.41	0.53	0.720	-1.65	0.83
		Married	-1.10	0.52	0.082	-2.31	0.11

*. The mean difference is significant at the 0.05 level;
Single⁺: groups together all individuals who do not share a common dwelling with a partner.

A one-way analysis of variance was conducted to examine whether the four job-related well-being dimensions differed in terms of higher education staff's socio-professional category. The analysis revealed a statistically significant difference in the reported relatively low anxiety of staff in relation to their socio-professional category, namely $F(2, 945) = 6.21$, $p = .002$. No statistically significant differences were observed in the reported relatively low depression and the moderate positive affect elements, namely comfort and enthusiasm, as shown below in Table 13.

Table 13: **ANOVA/ Socio-professional category**

		Sum of Squares	df	Mean Square	F	Sig.
Negative-High arousal	Between groups	69.08	2	34.54	2.76	0.064
	Within groups	11849.24	945	12.54		
	Total	11918.32	947			
Negative-Low arousal	Between groups	182.23	2	91.11	6.21	0.002
	Within groups	13862.18	945	14.67		
	Total	14044.41	947			
Positive-High arousal	Between groups	63.12	2	31.56	1.73	0.179
	Within groups	17278.11	945	18.28		
	Total	17341.22	947			
Positive-Low arousal	Between groups	7.06	2	3.53	0.22	0.803
	Within groups	15239.26	945	16.13		
	Total	15246.33	947			

To determine which specific group means differ, post-hoc comparisons were made, using the Tukey HSD test, which revealed that academic staff members were more anxious than both administrative staff ($p = .003$) and scientific staff ($p = .009$). No statistically significant differences were observed between the administrative staff and scientific staff, as shown below in Table 14.

Table 14: **Post-hoc Tests Tukey HSD/ Multiple comparisons (Socio-professional category)**

Dependent Variable	(I) Level of study	(J) Level of study	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
Negative-Low arousal	Administrative staff	Scientific staff	-0.14	0.29	0.874	-0.82	0.53
		Academic staff	-1.08*	0.33	0.003	-1.85	-0.32
	Scientific staff	Administrative staff	0.14	0.29	0.874	-0.53	0.82
		Academic staff	-.94*	0.32	0.009	-1.69	-0.19
	Academic staff	Administrative staff	1.08*	0.33	0.003	0.32	1.85
		Scientific staff	.94*	0.32	0.009	0.19	1.69

*. The mean difference is significant at the 0.05 level.

A one-way analysis of variance was conducted to examine whether the four job-related well-being dimensions differed in terms of higher education staff's area of residence. No statistically significant differences were observed in both reported relatively low negative and positive affect elements, as shown in Table 15 below.

Table 15: ANOVA/ Area of residence

		Sum of Squares	df	Mean Square	F	Sig.
Negative-High arousal	Between groups	23.43	3	7.81	0.62	0.602
	Within groups	11894.89	944	12.60		
	Total	11918.32	947			
Negative-Low arousal	Between groups	1.58	3	0.53	0.04	0.991
	Within groups	14042.83	944	14.88		
	Total	14044.41	947			
Positive-High arousal	Between groups	20.13	3	6.71	0.37	0.778
	Within groups	17321.09	944	18.35		
	Total	17341.22	947			
Positive-Low arousal	Between groups	18.94	3	6.32	0.39	0.759
	Within groups	15227.38	944	16.13		
	Total	15246.33	947			

Discussion

The objective of this study was to investigate the existence and extent of correlational relationships between biographical characteristics and the four-dimensional job-related affective well-being elements, and to compare differences between the respective groups to promote a policy design for workplace well-being.

Before conducting inferential analysis, descriptive statistics revealed that the participants scored relatively low in the negative affect elements of depression and anxiety, displaying a lower burden of mental health in the workplace and the respondents' psychological resilience (Malebari, et al., 2024). Their assessment regarding the positive affect indicated moderate levels for enthusiasm and comfort, suggesting a healthy psychological reserve, as reported by Xie *et al*. (2025) and Kandasamy *et al*. (2025).

The correlation results indicated low Pearson coefficients for depression ($r = .10$) and anxiety ($r = .11$) despite being highly statistically significant ($p < .01$), revealing that men were slightly more likely than women to report the lower negative affect. These findings aligned with global general observations in broader psychological research (Gkouletsa, et al., 2025) such as studies on Sex Differences in Anxiety and Depression (McHenry, Carrier, Hull, & Kabbaj, 2014), where men frequently reported or expressed lower baseline levels of the negative affect (Gibeau, et al., 2023).

The statistically significant and positive correlation ($r = 0.06$, $p < 0.05$) indicated that as age increases, reported depression decreases slightly, though the strength of this relationship is weak. In short, older adults reported marginally lower levels of depression, as noted by Fiske *et al*. (2009), Economou *et al*. (2024) and Chao *et al*. (2025), though age alone explains little about this difference. Contrarily, the highly statistically significant and negative correlation ($r = -0.09$, $p < 0.01$) means that as age increased, enthusiasm tended to drop. Being younger is associated with higher moderate enthusiasm, as observed by Choi *et al*. (2023), while the effect size remains quite small.

The statistically significant difference between the two genders in terms of depression (t (946) = -0.63; p = 0.002) and anxiety (t (946) = -0.65; p = 0.001), as revealed by the *t*-Test results, was consistent with the large number of epidemiological and clinical research studies, which confirmed that women are twice as likely as men to experience depression and anxiety disorders, as found by Shawon *et al*. (2024) and Lkr *et al*. (2025). Although the difference between the older and younger groups was significant for depression (t (946) = -0.40; p = 0.048), suggesting that younger staff generally reported significantly higher mean levels of depression than older staff, as observed by Collier Villaume *et al*. (2023). Unlike studies that revealed that older staff experienced less high-arousal excitement (enthusiasm) than younger staff, as pointed out by Choi *et al*. (2023), the present study found the contrary.

A broader investigation of published papers on differences in enthusiasm regarding level of education was unfruitful. However, the present study results indicating that higher education staff holding a master's degree are more enthusiastic than those with a bachelor's degree (p = .002) can be understood by the fact that this category is composed of people aspiring to become academic staff. Thus, obtaining a master's degree serves as a bridge, opening the doors to authoring their theses, which prove to be their key to becoming academic staff.
The study's findings indicate that higher education staff who live alone are more depressed (p = .030) and more anxious (p = .039) than those who are legally married, aligning with other research studies in the field (Serapinas & Narbekovas, 2022). However, these results should be interpreted with caution, as the differences between married couples and those who live with a partner were not significant, unlike in other studies. Similarly, legally married staff reported that they felt more comfortable at work than those who live alone (p = .031), while those who live with a partner, unmarried, were more enthusiastic. Finally, the results demonstrate that academic staff were more anxious than both administrative staff (p = .003) and scientific staff (p = .009).

5. Conclusion and Recommendations

Managerial Implications

A training programme is required for higher education leaders to empower management with sufficient skills to recognise mental distress. Gender-responsive policies should be enforced to lower depression and anxiety among female employees by creating women-focused Employee Resource Groups (ERGs). Further actions include struggling intimidations and harassment at work, supporting life-stage challenges such as menopause, and flexible work arrangements for caregiving (Meng & Yang, 2023). Likewise, age-inclusive mental health policies should be implemented and tailored for younger employees who thrive on transparent communication and autonomy, whilst expecting their employers to view mental health as a core workforce strategy (El-Qebaisi, 2025). Actionable policies could include prohibiting after-hours messaging, offering hybrid setups to help employees navigate personal commitments, therapy appointments, and burnout recovery (Çemberci, Civelek, Ertemel, & Cömert, 2022). Conversely, older employees need to feel valued, where they share their institutional knowledge with younger employees, whilst performing in an ergonomic workspace to reduce physical strain and improve daily comfort to enhance their enthusiasm at work (Jarden, Siegert, Koziol-McLain, Bujalka, & Sandham, 2023). Phased retirement and reskilling programmes that reduce their working hours and enable them to gravitate towards roles that they are passionate about would reduce burnout, providing a smoother, more enthusiastic transition towards retirement (Caponecchia, Neto, O'Neill, & C, 2023). Employees with lower educational levels require clear communication and to be listened to so that they perceive themselves to be valued. Congolese higher education institutions should implement guidelines to ensure that all employees receive equal career opportunities, unbiased compensation, and supportive benefits regardless of their marital status (Viernes & Velasco, 2025). Therefore, they must commit to fostering work-life balance and pay equity while prohibiting unlawful discrimination, often oriented towards single, divorced, and widowed staff (Çemberci, Civelek, Ertemel, & Cömert, 2022). Finally, Congolese higher education institutions should implement proper policies that address distinct occupational risks, whilst accommodating different socio-professional categories by encompassing the health's five pillars of modern well-being programmes comprising physical, emotional, financial, social and occupational health (El-Qebaisi, 2025).

Conclusion

Overall, despite the descriptive statistics above, it is premature to assert that Congolese higher education staff perform in a conducive and wellness-oriented environment. In need, the relatively low negative affect showed a situation of fragile well-being, given that the mean scores tended to be closer to moderate. Furthermore,

deeper investigation through correlation, the *t-test,* and the ANOVA tests unveiled disparities that should be addressed to promote well-being within these organisations by implementing policies that will sustain a conducive and ergonomic environment that promotes mental health in the workplace. Thus, managerial leaders within Congolese higher education should design contextualised well-being-oriented policies that consider the present study's findings. In addition, other researchers should extend the study beyond Kinshasa and replicate it over time, as its cross-sectional design prevents causal conclusions.

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The Moderating Role of Health Centre Characteristics in the Relationship between Psychosocial Work Environment and Quality of Health Care in Health Centre IVs in South Western Uganda

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Abstract: This study examined the moderating role of health centre characteristics in the relationship between psychosocial work environment and quality of health care in Health Centre IVs in South Western Uganda. The study adopted a mixed-methods cross-sectional design grounded in a critical realist philosophical orientation. Data were collected from 35 Health Centre IVs in Southwestern Uganda, involving 238 healthcare workers, 172 health service recipients, and six District Health Officers. Quantitative data were analyzed using descriptive statistics, Pearson correlation analysis, hierarchical regression, and Structural Equation Modelling (SEM), while qualitative data were analyzed using thematic content analysis. Pearson correlation analysis revealed a positive and statistically significant relationship between psychosocial work environment and quality of health care ($r = .496^{**}$, $p < .01$). SEM results indicated that psychosocial work environment was positively and significantly associated with quality of health care ($\beta = .507$, $p < .001$), while health centre characteristics were also positively and significantly associated with quality of health care ($\beta = .161$, $p < .001$). More importantly, the interaction between psychosocial work environment and health centre characteristics was positive and statistically significant ($\beta = .235$, $p < .001$), indicating that favorable health centre characteristics strengthened the positive relationship between psychosocial work environment and quality of health care. These findings suggest that improving workplace conditions alone may not achieve optimal service quality unless supported by favorable organizational and structural conditions within Health Centre IVs. This study extends the literature by demonstrating that health centre characteristics significantly moderate the relationship between psychosocial work environment and quality of health care.

Keywords: *Psychosocial Work Environment; Quality of Health Care; Health Centre Characteristics; Moderation; Health Centre IVs; Uganda.*

1. Introduction

Quality of health care remains a central concern for health systems globally because it directly influences patient outcomes, population health, and health system performance. The World Health Organization defines quality of health care as the extent to which health services increase the likelihood of desired health outcomes and are consistent with current professional knowledge (World Health Organization, 2022). Despite substantial investments in health infrastructure, technology, and workforce development, poor-quality health care continues to contribute to avoidable morbidity and mortality worldwide. Kruk et al. (2018) estimated that poor-quality care accounts for more deaths annually than lack of access to health services in many low- and middle-income countries. Globally, increasing attention has therefore shifted from expanding access to ensuring that health services are effective, patient-centred, safe, timely, efficient, and equitable (World Health Organization, 2022).

The quality of health care delivered within health facilities is influenced by multiple organizational factors, among which the psychosocial work environment has gained increasing scholarly attention. The psychosocial work environment refers to the social, organizational, and psychological conditions under which employees perform their work and includes dimensions such as work-life balance, workplace climate, interpersonal relationships, organizational support, and reward systems (Aust et al., 2023). Research has shown that supportive psychosocial work environments improve employee well-being, job satisfaction, motivation, and organizational commitment, which subsequently enhance service quality and organizational performance (Bakker & Demerouti, 2017). Conversely, poor psychosocial conditions contribute to burnout, absenteeism, turnover intentions, emotional exhaustion, and reduced productivity among employees (Schaufeli, 2017).

In the health sector, the psychosocial work environment is particularly important because health care professionals operate in demanding environments characterized by high workloads, emotional labor, time pressure, and increasing service demands. Studies conducted in Europe, North America, and Asia indicate that supportive work environments improve communication, teamwork, patient safety, and patient satisfaction while reducing medical errors and staff turnover (Rosen et al., 2018; Salas et al., 2018). Health facilities that provide supportive leadership, recognition systems, and positive workplace climates often report better patient experiences and improved quality indicators compared to facilities characterized by workplace stress and poor organizational support (Aiken et al., 2018).

In Africa, efforts to improve the quality of health care continue to face challenges associated with workforce shortages, limited resources, weak health systems, and increasing disease burdens. Although many African countries have implemented reforms aimed at strengthening health systems and improving service delivery, quality of care remains inconsistent across health facilities (Hategeka et al., 2020). The World Health Organization (2021) reports that health systems across sub-Saharan Africa continue to experience significant challenges related to staffing adequacy, employee well-being, and workplace support mechanisms. These challenges affect health worker motivation and consequently influence patient outcomes and service quality.
Several studies conducted within African health systems have highlighted the importance of psychosocial workplace conditions in shaping health service delivery outcomes. For example, Apiyo et al. (2022) found that workplace support, communication, and employee well-being significantly influenced health worker performance and patient care outcomes in East African health facilities. Similarly, Atumanya et al. (2024) reported that occupational stress, emotional exhaustion, and inadequate organizational support negatively affected the performance of health workers and the quality of services provided. Despite these findings, evidence regarding how psychosocial work environments influence the quality of health care within primary health care facilities remains limited, particularly in rural and resource-constrained settings.

Uganda has undertaken numerous health sector reforms aimed at improving access to and quality of health care services. The Ministry of Health has implemented various strategies focusing on workforce development, service delivery improvement, digital health systems, and health facility strengthening (Ministry of Health Uganda, 2023). Health Centre IV facilities represent a critical component of Uganda's health system because they provide comprehensive primary health care services, including inpatient care, emergency surgery, maternal health services, laboratory services, and referral support for lower-level facilities. These facilities, therefore, play a pivotal role in determining the quality of health care experienced by large segments of the population, particularly in rural and semi-urban areas.

Despite these efforts, quality of health care challenges persist within many Health Centre IV facilities. Ministry of Health reports indicate that several facilities continue to experience problems related to patient satisfaction, long waiting times, communication gaps, workforce shortages, and staff burnout (Ministry of Health Uganda, 2024/2025). Furthermore, only a proportion of health facilities consistently meet national service quality standards, suggesting that organizational and contextual factors continue to influence service delivery outcomes. Among these factors, the psychosocial work environment has emerged as a potentially important determinant of quality of health care because it affects health worker motivation, commitment, and service delivery behavior.

South Western Uganda presents a particularly important context for examining these relationships. The region contains a mixture of rural, peri-urban, and semi-urban Health Centre IV facilities that operate under varying resource conditions. Previous studies have reported challenges related to staffing shortages, workload pressures, limited psychosocial support, inadequate infrastructure, and workforce instability within health facilities across the region (Apiyo et al., 2022). These challenges create workplace conditions that may influence health workers' well-being and ultimately affect the quality of health care delivered to patients.

However, the influence of the psychosocial work environment on the quality of health care may not occur uniformly across all health facilities. According to Aust et al. (2023), organizational context plays a critical role in determining whether positive workplace conditions translate into improved organizational outcomes. Health centre characteristics such as years of operation, staffing composition, and facility location influence institutional capacity, workforce availability, organizational maturity, and access to operational support

systems. Consequently, the effect of the psychosocial work environment on the quality of health care may vary depending on the characteristics of individual health facilities.

Although previous studies have examined psychosocial workplace conditions and employee outcomes, limited empirical evidence exists regarding the moderating role of health centre characteristics in the relationship between psychosocial work environment and quality of health care, particularly within primary health care facilities in developing countries. Existing studies have largely examined direct effects while overlooking the contextual conditions that may strengthen or weaken these relationships. This knowledge gap remains particularly evident within Uganda's Health Centre IV facilities, where empirical evidence on psychosocial work environments and quality of health care remains limited.

Therefore, this study examined the influence of psychosocial work environment on quality of health care in Health Centre IVs in South Western Uganda and assessed the moderating role of health centre characteristics in this relationship. Specifically, the study focused on work-life balance, workplace climate, and reward systems as dimensions of psychosocial work environment and examined their influence on effectiveness, patient-centredness, patient safety, and patient satisfaction. The study contributes to the health care management literature by providing empirical evidence on how workplace conditions and contextual facility characteristics jointly influence the quality of health care in primary health care settings.

2. Literature Review and Hypothesis Development

Theoretical Foundation

This study was anchored on the Donabedian Model of Quality of Health Care (Donabedian, 1988), which conceptualizes quality of care through three interrelated dimensions: structure, process, and outcome. The model proposes that the structural attributes of health facilities influence healthcare delivery processes, which subsequently determine the quality of healthcare outcomes. Structural attributes include both the physical and organizational conditions under which healthcare services are delivered, whereas processes refer to the interactions between healthcare providers and patients that ultimately influence service outcomes.

In the present study, the psychosocial work environment represents an important organizational structural condition because it shapes the psychological, social and organizational context within which healthcare workers perform their duties. A favorable psychosocial work environment characterized by a supportive workplace climate, work-life balance and effective reward systems is expected to facilitate effective care processes through improved staff motivation, communication, collaboration and commitment. Quality of health care, reflected through effectiveness, patient-centredness, patient safety and patient satisfaction, represents the outcome component of the Donabedian Model.

The study further conceptualizes health centre characteristics, including staffing composition, years of operation and facility location, as contextual structural conditions that influence how effectively psychosocial work environments translate into quality healthcare outcomes. Rather than functioning as direct antecedents of the psychosocial work environment, these characteristics provide the organizational context within which workplace conditions operate. Consequently, the relationship between psychosocial work environment and quality of health care is expected to vary according to differences in health centre characteristics, making these characteristics conceptually appropriate as a moderating variable.

The theoretical contribution of this study lies in integrating the Donabedian Model with the psychosocial work environment perspective to explain not only whether the psychosocial work environment is associated with the quality of health care, but also the organizational conditions under which this relationship becomes stronger or weaker. While previous studies have largely examined the direct association between psychosocial work environment and healthcare outcomes, they have given limited attention to the contextual role of organizational characteristics. By introducing health centre characteristics as a moderator, this study extends the Donabedian framework by demonstrating that structural organizational conditions influence the strength of the relationship between psychosocial work environment and quality of health care rather than merely exerting independent effects. This integration provides a more comprehensive understanding of quality improvement within primary healthcare facilities, particularly in resource-constrained settings.

The Donabedian Model has been widely applied to evaluate organizational determinants of healthcare quality and patient outcomes (McCullough et al., 2023; Tossaint-Schoenmakers et al., 2021). However, few studies have integrated it with psychosocial work environment theory to explain how organizational context shapes the effectiveness of workplace interventions. The present study addresses this gap by proposing that favorable health centre characteristics strengthen the positive relationship between psychosocial work environment and quality of health care.

Psychosocial Work Environment and Quality of Health Care

Psychosocial work environment refers to the psychological, social and organizational conditions under which employees perform their work. It encompasses workplace climate, work-life balance, organizational support, communication, employee recognition and reward systems (Aust et al., 2023). Within healthcare settings, the psychosocial work environment influences employee wellbeing, motivation, commitment and job satisfaction, which subsequently shape service delivery processes and healthcare quality.

Globally, empirical evidence consistently demonstrates that supportive psychosocial work environments are associated with higher quality of health care. Aiken et al. (2018) found that hospitals characterized by positive work environments reported lower patient mortality, higher patient satisfaction and better patient safety outcomes. Similarly, Rosen et al. (2018) observed that collaborative workplace climates and supportive leadership enhanced teamwork, communication and coordination, leading to improved patient care experiences. Bakker and Demerouti (2017), through the Job Demands–Resources Theory, further argued that organizational resources such as supportive supervision, recognition and positive workplace relationships enhance employee engagement and performance while reducing the adverse effects of workplace demands.

Evidence from African healthcare systems also supports these findings. Atumanya et al. (2024) reported that occupational stress and emotional exhaustion were associated with reduced health worker performance and poorer service delivery outcomes within public health facilities. Likewise, Apiyo et al. (2022) found that supportive workplace environments improved employee motivation, teamwork and patient care outcomes in East African health facilities. These findings suggest that healthcare workers operating within favorable psychosocial work environments are more likely to demonstrate commitment, responsiveness and patient-centred behavior than those working under stressful organizational conditions.

Within Uganda, healthcare workers frequently operate under conditions characterized by heavy workloads, staffing shortages, limited resources and inadequate psychosocial support systems. These conditions often contribute to burnout, absenteeism and reduced morale, thereby compromising the quality of healthcare services delivered to patients. Conversely, facilities that promote work-life balance, supportive workplace climates and effective reward systems are more likely to create conditions that enable healthcare workers to provide safe, responsive and patient-centred care. Although existing studies have established a direct relationship between psychosocial work environment and healthcare quality, limited evidence exists regarding whether this relationship varies according to differences in organizational context, particularly within Health Centre IVs operating under diverse structural conditions in Uganda. Addressing this gap provides the basis for examining the moderating role of health centre characteristics in the present study. Based on the foregoing literature, the study hypothesized that:

H1: Psychosocial work environment has a positive and significant relationship with the quality of health care in Health Centre IVs in South Western Uganda.

Health Centre Characteristics as a Moderator of the Relationship between Psychosocial Work Environment and Quality of Health Care

The relationship between the psychosocial work environment and quality of health care may not be uniform across health facilities because organizational and structural characteristics differ considerably. The Donabedian Model posits that structural characteristics provide the context within which healthcare processes operate to produce quality outcomes (Donabedian, 1988). Accordingly, health centre characteristics such as staffing composition, years of operation, and facility location are expected to shape the extent to which supportive psychosocial work environments are associated with quality of health care. Rather than acting as direct determinants alone, these characteristics may strengthen or weaken the relationship between

workplace conditions and healthcare quality by influencing organizational capacity, availability of resources, and service delivery processes.

Empirical evidence supports the view that organizational characteristics modify the effectiveness of workplace and quality improvement initiatives. Brand et al. (2012) reported that hospital characteristics, including workforce design, leadership, financial incentives, and health information systems, were associated with differences in organizational performance and patient safety. Similarly, Vanichchinchai (2021) found that hospitals with higher organizational readiness, smaller size, and quality certification achieved better service quality outcomes from lean management initiatives than hospitals with weaker organizational structures. These findings suggest that organizational interventions are more likely to achieve favorable outcomes where institutional conditions support their implementation.

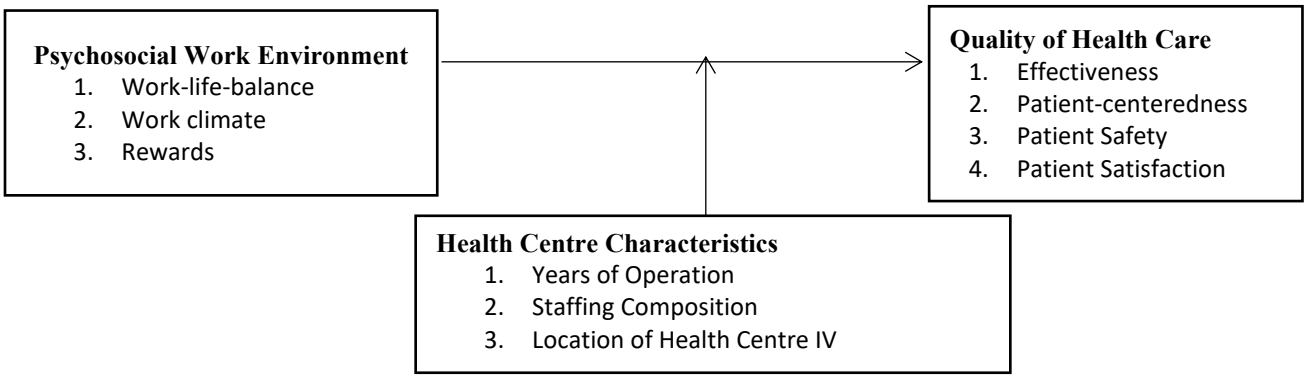
Evidence also demonstrates that specific structural characteristics alter the relationship between organizational practices and healthcare outcomes. Silvera (2017) found that hospital size moderated the relationship between patient experience and patient safety, with the positive relationship becoming weaker as hospital size increased because of greater organizational complexity. Likewise, Hussein et al. (2021) established that accreditation and institutional standards strengthened safety culture, operational efficiency, and quality improvement processes, although evidence regarding patient experience and employee satisfaction remained mixed. Vaughn et al. (2019) similarly identified organizational culture, staffing adequacy, leadership, and infrastructure as important contextual factors associated with healthcare quality, suggesting that deficiencies in these structural characteristics may limit the effectiveness of organizational improvement initiatives.

Although previous studies generally suggest that favorable organizational characteristics strengthen healthcare performance, the findings are not entirely consistent. While accreditation, organizational readiness, and supportive leadership have been associated with improved service quality (Hussein et al., 2021; Vanichchinchai, 2021), other studies reported that organizational complexity associated with larger institutions reduced the effectiveness of quality improvement efforts (Silvera, 2017). These contrasting findings indicate that institutional characteristics do not operate uniformly across healthcare settings and that their role depends on the organizational context within which health services are delivered.

Within Uganda, Health Centre IVs operate under diverse organizational conditions characterized by differences in staffing composition, operational experience, infrastructure, and geographical location. These differences are likely to influence how psychosocial work environments are associated with the quality of health care. For example, supportive workplace climates, effective reward systems, and favorable work-life balance may be more strongly associated with quality of health care in facilities with adequate staffing and organizational capacity than in facilities experiencing severe workforce shortages or limited operational resources. Despite this theoretical expectation, limited empirical evidence has examined whether health centre characteristics moderate the relationship between psychosocial work environment and quality of health care within Uganda's primary healthcare system. Most previous studies have examined direct relationships between workplace conditions and healthcare quality without considering the contextual role of organizational characteristics. This study, therefore, addresses this gap by examining whether health centre characteristics strengthen or weaken the relationship between psychosocial work environment and quality of health care in Health Centre IVs in South Western Uganda. Accordingly, the study hypothesized that:
H_2: Health centre characteristics significantly moderate the relationship between psychosocial work environment and quality of health care in Health Centre IVs in South Western Uganda.

Conceptual Framework

Figure 4: Conceptual Framework



Source: Literature review of (Aust et al., 2023; Kruk et al., 2018; Meath et al., 2022; Rosen et al., 2018; Salas et al., 2018; Yang et al., 2025)

3. Method

Research Design

This study adopted a mixed-methods cross-sectional design to examine the influence of psychosocial work environment on the quality of health care in Health Centre IVs in South Western Uganda and the moderating role of health centre characteristics. Quantitative methods generated the primary data, while qualitative methods provided contextual explanations for the quantitative findings.

Study Population and Sampling

The study was conducted in 43 government-owned Health Centre IVs in South Western Uganda. The unit of analysis was the Health Centre IV, while the units of inquiry were health care workers, health service recipients, and District Health Officers. Health care workers provided information on psychosocial work environment and health centre characteristics, whereas health service recipients assessed the quality of health care received. District Health Officers served as key informants, as shown in Table 1.

The sample size was determined using the Krejcie and Morgan (1970) table. A total of 38 Health Centre IVs were selected using simple random sampling. Health care workers were selected purposively, health service recipients were selected through quota sampling, and six District Health Officers were purposively selected as key informants.

Table 7: Study population and sample

Category	Population	Sample	Sampling Technique
Health Centre IVs	43	38	Simple random
Health care workers	1,008	278	Purposive
Health service recipients		190	Quota
District Health Officers	19	6	Purposive
Total quantitative respondents		**468**	

Data Collection Methods

Data were collected using questionnaires, key informant interviews, and document review. The questionnaires were developed by the researcher based on an extensive review of the literature and existing theoretical and empirical studies related to psychosocial work environment, health centre characteristics, and quality of health care. The questionnaire for health care workers was used to collect data on psychosocial work environment and health centre characteristics, while the questionnaire for health service recipients was used to obtain data on quality of health care. The questionnaire items were developed to reflect the dimensions of the respective study constructs and were subjected to expert review and pre-testing to ensure their relevance, clarity, and

suitability for the study. Key informant interviews were conducted with District Health Officers to obtain managerial perspectives on psychosocial work environment and quality of health care, while document review provided information on staffing composition, years of operation, and facility location.

Measurement of Variables

The study measured psychosocial work environment as the independent variable, quality of health care as the dependent variable, and health centre characteristics as the moderating variable. The psychosocial work environment was measured using work-life balance, workplace climate, and reward systems. Quality of health care was measured using effectiveness, patient-centredness, patient safety, and patient satisfaction, while health centre characteristics were measured using years of operation, staffing composition, and facility location. The psychosocial work environment was assessed from the perspective of health care workers, while the quality of health care was assessed by health service recipients. Health centre characteristics were obtained from health care workers and verified through document review. All questionnaire items were measured on a five-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree).

Table 8: Measurement of Study Variables

Variables	Dimensions	Respondent
Psychosocial work environment	Work-life balance, workplace climate, reward systems	Health care workers
Quality of Health Care	Effectiveness, patient-centredness, patient safety, patient satisfaction	Health service recipients
Health Centre Characteristics	Years of operation, staffing composition, facility location	Health care workers and document review

Table 2 summarizes the variables investigated in the study, their respective dimensions, and the sources from which data were obtained. The use of multiple respondent groups enabled the collection of information from individuals best placed to assess each construct.

Validity and Reliability

Before the main survey, the questionnaire for health care workers and the questionnaire for health service recipients were pre-tested among respondents within the study area who possessed characteristics comparable to those of the target population. Since the questionnaires were administered in Runyankore, the pre-test was conducted within the same geographical context to ascertain the clarity, relevance, appropriateness, and comprehensibility of the translated items. Measures were undertaken to ensure that respondents who participated in the pre-test did not participate in the main study. Construct validity was assessed using the Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy and Bartlett's Test of Sphericity, while the internal consistency of the measurement scales was assessed using Cronbach's Alpha coefficient.

Table 9: Validity Results

Construct	Number of Items	KMO	Bartlett's Test (Sig.)
Psychosocial work environment	18	0.792	0.000
Quality of Health Care	40	0.836	0.000

The results presented in Table 3 indicate that the KMO values for all constructs exceeded the recommended threshold of 0.70, while Bartlett's Test of Sphericity was statistically significant ($p < 0.001$). These findings confirmed that the measurement items were suitable for factor analysis and adequately represented the study constructs.

The reliability of the measurement scales was subsequently assessed using Cronbach's Alpha coefficient. Values of 0.70 and above were considered acceptable for establishing internal consistency.

Table 10: Reliability Results

Construct	Number of Items	Cronbach's Alpha (α)
Psychosocial work environment	18	0.811
Quality of Health Care	40	0.884

As shown in Table 4, all study constructs attained Cronbach's Alpha coefficients above the recommended threshold of 0.70, indicating satisfactory internal consistency. The questionnaire was therefore considered reliable for the main data collection exercise.

Measurement Model Assessment

Before testing the structural model, Confirmatory Factor Analysis (CFA) was conducted using AMOS to assess the validity and reliability of the measurement model. The assessment was based on standardized factor loadings, Composite Reliability (CR), Average Variance Extracted (AVE), and model fit indices. Standardized factor loadings of 0.50 and above, Composite Reliability values of 0.70 and above, and Average Variance Extracted values of 0.50 and above were considered acceptable (Hair et al., 2019; Kline, 2016). The CFA results confirmed that all retained indicators adequately represented their respective latent constructs, thereby establishing satisfactory convergent validity before testing the structural relationships.

Table 11: Summary of Measurement Model Assessment

Construct	Standardized Factor Loadings	CMIN/DF	RMSEA	GFI	CFI	TLI	NFI
Psychosocial Work Environment	0.73–0.89	1.487	0.044	0.951	0.968	0.956	0.939
Health Centre Characteristics	0.70–0.87	1.604	0.046	0.946	0.961	0.950	0.932
Quality of Health Care	0.72–0.91	1.955	0.049	0.942	0.961	0.949	0.931

Source: Primary Data (2025).

The results presented in Table 5 indicate that all retained indicators recorded standardized factor loadings above the recommended threshold of 0.50, confirming that the observed indicators adequately measured their respective latent constructs. In addition, all measurement models demonstrated acceptable goodness-of-fit, with CMIN/DF values below 3.00, GFI, CFI, TLI, and NFI values above 0.90, and RMSEA values below 0.08. These findings confirmed that the measurement model exhibited satisfactory construct validity and was appropriate for subsequent structural model estimation.

Data Analysis

Quantitative data were coded, cleaned, and analyzed using IBM SPSS Statistics Version 27, while Structural Equation Modelling (SEM) was performed using AMOS. Two separate questionnaires were administered to different respondent groups. Health care workers provided information on psychosocial work environment and health centre characteristics, whereas health service recipients assessed the quality of health care.

Following data collection, responses from the two questionnaires were matched using the respective Health Centre IV as the common unit of analysis. Mean scores for the study variables were then computed and merged to generate a single facility-level dataset for analysis. Since the Health Centre IV was the unit of analysis, responses obtained from health care workers and health service recipients within each Health Centre IV were aggregated by computing mean scores for the respective study variables to generate facility-level data. This enabled each Health Centre IV to contribute a single observation to the statistical analyses, thereby ensuring consistency between the unit of inquiry and the unit of analysis. The use of separate respondent groups to measure the independent, moderating, and dependent variables reduced the likelihood of common method bias arising from collecting data from a single source. Descriptive statistics were computed to summarize the characteristics of the respondents and the distribution of the study variables. Pearson correlation analysis was conducted to determine the strength and direction of the relationships among psychosocial work environment, health centre characteristics, and quality of health care. Hierarchical regression analysis was performed to examine the predictive relationship between psychosocial work environment and quality of health care. The moderating role of health centre characteristics was examined using SEM by estimating the interaction effect

between psychosocial work environment and health centre characteristics. Statistical significance was evaluated at the 5% level.

Qualitative data obtained from key informant interviews were transcribed and analyzed using thematic analysis. Emerging themes were compared with the quantitative findings to provide contextual explanations and strengthen the interpretation of the results. Documentary evidence was analyzed using content analysis to corroborate information obtained from questionnaires and interviews.

Ethical Considerations

Ethical approval was obtained from the Mbarara University of Science and Technology Research Ethics Committee before data collection. Administrative permission was subsequently obtained from the Ministry of Health, District Health Offices, and the management of the participating Health Centre IVs. Participation was voluntary, and written informed consent was obtained from all respondents before their involvement in the study. Confidentiality and anonymity were maintained by assigning identification codes instead of participants' names, and the information collected was used solely for research purposes.

4. Results and Discussion

This section presents and discusses the findings on the relationship between psychosocial work environment and quality of health care, as well as the moderating role of health centre characteristics. The findings are presented using correlation analysis, regression analysis, and Structural Equation Modelling (SEM). The discussion focuses on the implications of the findings within the context of Health Centre IVs in South Western Uganda and existing literature.

Response Rate

The study targeted 38 Health Centre IVs, 278 health care workers, and 190 health service recipients, giving a planned quantitative sample of 468 respondents. A total of 35 Health Centre IVs participated in the study, from which 238 health care workers and 172 health service recipients returned completed questionnaires, representing an overall response rate of 87.6%. In addition, six District Health Officers participated in the key informant interviews. According to Baruch and Holtom (2008), response rates above 70% are considered adequate for organizational research, suggesting that the achieved response rate was sufficient to support reliable statistical analysis.

Table 12: Response Rate

Category	Planned Sample	Achieved Sample	Response Rate (%)
Health Centre IVs	38	35	92.1
Health care workers	278	238	85.6
Health service recipients	190	172	90.5
Total quantitative respondents	468	410	87.6
District Health Officers	6	6	100.0

Relationship between Psychosocial Work Environment and Quality of Health Care

To determine whether the psychosocial work environment is associated with the quality of healthcare, a Pearson correlation analysis was conducted. The results are presented in Table 7.

Table 13: Correlation Analysis Results (n=35)

Variable	1	2	3	4	5	6	7	8	9
Work-life Balance-1	1								
Workplace Climate-2	.634**	1							
Rewards-3	.400**	.549**	1						
Psychosocial Work Environment-4	.497**	.639**	.519**	1					
Effectiveness-5	.170	.189	.186	.419**	1				

Patient-Centred Care-6	.370*	.374*	.337*	.467**	.662**	1			
Patient Safety-7	.553**	.400**	.340*	.456**	.646**	.761**	1		
Patient Satisfaction-8	.169	.118	.134	.305*	.512**	.481**	.402**	1	
Quality of Health Care-9	.383*	.323*	.298*	**.496****	.851**	.864**	.850**	.739**	1

**. Correlation is significant at the 0.01 level (1-tailed).
*. Correlation is significant at the 0.05 level (1-tailed).

The results presented in Table 7 reveal a positive and statistically significant relationship between psychosocial work environment and quality of health care ($r = .496$, $p < .01$). The correlation coefficient of .496 indicates a moderate positive relationship between the two variables, suggesting that Health Centre IVs characterized by more favorable psychosocial work environments were generally associated with higher levels of quality of health care. The statistical significance indicates that the observed relationship was unlikely to have occurred by chance.

The observed relationship may be explained by the nature of health service delivery, which depends largely on the working conditions experienced by health care workers. Health workers operating in environments characterized by supportive workplace climates, manageable work demands, and appropriate recognition are more likely to communicate effectively, collaborate with colleagues, and respond promptly to patients' needs. Within the Ugandan Health Centre IV context, where health facilities frequently experience staffing shortages, heavy workloads, and resource constraints, supportive psychosocial work environments may help health workers maintain motivation and professionalism, thereby promoting effectiveness, patient-centredness, patient safety, and patient satisfaction.

The findings further suggest that favorable psychosocial work environments are associated with organizational conditions that enable health workers to perform their responsibilities more effectively. However, because the study adopted a cross-sectional design, the findings demonstrate an association rather than a causal relationship. Other organizational factors, including leadership practices, resource availability, and management support, may also be associated with the quality of health care and therefore provide alternative explanations for the observed relationship.

The findings are consistent with Aust et al. (2023), who reported that supportive psychosocial work environments were associated with improved employee performance and organizational effectiveness. Similarly, Apiyo et al. (2022) found that favorable workplace conditions were associated with higher levels of health worker motivation and improved service delivery in health facilities. The findings also align with those of Atumanya et al. (2024), who reported that workplace stress and poor psychosocial conditions were associated with reduced health worker performance and poorer quality of healthcare.

Regression Analysis

To further determine the extent to which the psychosocial work environment influences the quality of health care, regression analysis was conducted. The results are presented in Table 8.

Table 14: Regression Results for Psychosocial Work Environment and Quality of Health Care

	Coffiencients				
Predictor	**B**	**Std. Error**	**Beta**	**t**	**p-value**
Constant	.884	.405		2.183	.031
Psychosocial Work Environment	.388	.091	.263	4.264	.000
Model Summary					
Statistic		**Value**			
R		.704			
R Square		.496			
Adjusted R-Square		.464			
F Statistic		15.721			
Significance		.000			

Source: Primary Data (2025)

The regression results indicate that the psychosocial work environment had a positive and statistically significant relationship with quality of health care ($\beta = .263$, $t = 4.264$, $p < .001$). The positive beta coefficient indicates that higher levels of psychosocial work environment were associated with higher levels of quality of health care. The significance level suggests that the observed relationship was unlikely to have occurred by chance.

The findings further indicate that the psychosocial work environment was associated with variations in the quality of health care across Health Centre IV facilities. The adjusted coefficient of determination (Adjusted $R^2 = .464$) indicates that the psychosocial work environment accounted for 46.4% of the variation in quality of health care, suggesting that workplace conditions are closely associated with the quality of services delivered in the participating Health Centre IVs.

The observed relationship may be explained by the nature of healthcare service delivery, which depends largely on the interactions between health workers and patients. Health workers operating in environments characterized by supportive workplace climates, balanced work demands, and appropriate recognition are more likely to remain motivated, communicate effectively, collaborate with colleagues, and respond promptly to patients' needs. Within the Ugandan Health Centre IV context, where health facilities frequently experience staffing shortages, heavy workloads, and resource constraints, favorable psychosocial work environments may help health workers cope with workplace challenges and maintain acceptable standards of patient care. Consequently, facilities that promote supportive psychosocial conditions are more likely to be associated with higher levels of effectiveness, patient-centredness, patient safety, and patient satisfaction.

The findings are consistent with the Donabedian Model, which suggests that organizational conditions within health facilities are associated with the quality of healthcare services delivered. The findings are also consistent with Aiken et al. (2018), who reported that positive workplace environments were associated with improved patient safety, patient-centred care, and effectiveness of health services. Similarly, Rosen et al. (2018) found that supportive workplace climates were associated with improved teamwork and communication, which are important elements of quality health care.

The results therefore provide support for Hypothesis 1, which stated that the psychosocial work environment has a positive and significant influence on the quality of health care in Health Centre IVs in South Western Uganda.

Moderating Effect of Health Centre Characteristics on the Relationship between Psychosocial Work Environment and Quality of Health Care.

Structural Equation Modelling (SEM) was performed using AMOS to examine the moderating role of health centre characteristics in the relationship between psychosocial work environment and quality of health care. The structural model comprised direct paths from psychosocial work environment and health centre characteristics to quality of health care together with an interaction construct representing the moderating effect of health centre characteristics. The significance of the interaction path was used to determine whether moderation existed. Before interpreting the structural relationships, the adequacy of the model was assessed using the χ^2/df ratio, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Goodness-of-Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). The structural model included direct paths from psychosocial work environment and health centre characteristics to quality of health care together with an interaction term representing the moderating effect of health centre characteristics. Moderation was assessed by examining the statistical significance of the interaction path. Before interpreting the structural relationships, model fit indices were examined to determine whether the proposed model adequately represented the observed data. The results are presented in Table 9.

Table 15: Structural Model Results

Structural Path	Beta	C.R.	p-value
Psychosocial Work Environment → Quality of Health Care	.507	1.798	.000
Health Centre Characteristics → Quality of Health Care	.161	1.130	.000
Psychosocial Work Environment × Health Centre Characteristics → Quality of Health Care	.235	1.405	.000
Model Fit Statistics			
Fit Index	**Value**	**Recommended Threshold**	
χ^2	50.1	Lower values preferred	
df	42	-	
χ^2/df	1.19	< 3.00	
CFI	.961	> .90	
TLI	.953	> .90	
GFI	.941	> .90	
RMSEA	.036	< .08	
SRMR	.041	< .08	
R Square	.338		

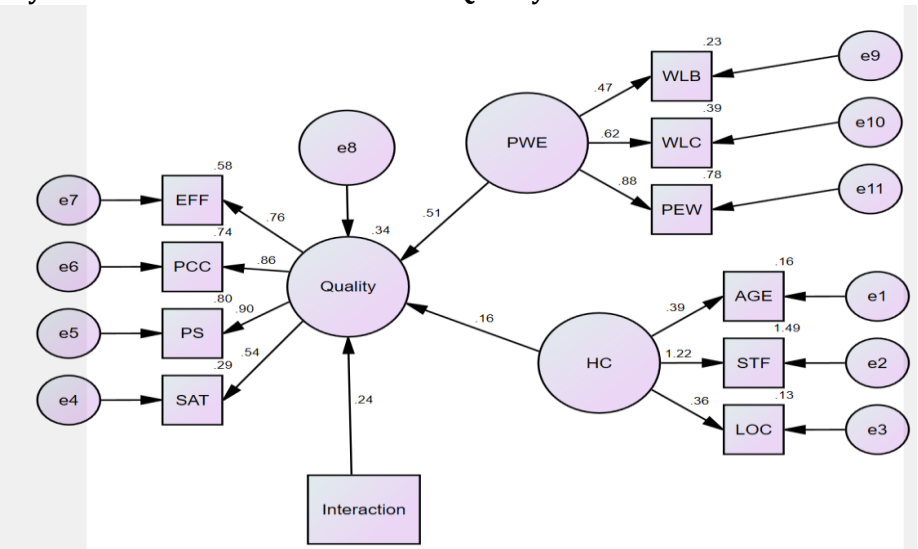
Source: Primary Data (2025)

The model fit statistics indicate that the structural model adequately represented the observed data. The χ^2/df ratio of 1.19 was below the recommended threshold of 3.00, while the Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Goodness-of-Fit Index (GFI) exceeded the recommended threshold of .90. Similarly, the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Square Residual (SRMR) were below .08, indicating that the proposed structural model adequately represented the observed data. The structural model revealed that the psychosocial work environment had a positive and statistically significant relationship with quality of health care ($\beta = .507$, $p < .001$). Health centre characteristics also had a positive and statistically significant relationship with quality of health care ($\beta = .161$, $p < .001$).

Most importantly, the interaction term between psychosocial work environment and health centre characteristics was positive and statistically significant ($\beta = .235$, $p < .001$). The statistically significant interaction coefficient confirmed that health centre characteristics moderated the relationship between psychosocial work environment and quality of health care. The positive interaction coefficient indicates that the positive relationship between the psychosocial work environment and the quality of health care became stronger as health centre characteristics became more favorable. These findings suggest that improvements in the psychosocial work environment are more strongly associated with quality of health care in Health Centre IVs characterized by favorable staffing composition, years of operation, and facility location than in facilities with less favorable characteristics.

The finding is consistent with Meath et al. (2022), who observed that organizational context influences the relationship between workplace conditions and quality of health care. Similarly, Aust et al. (2023) reported that supportive psychosocial work environments are more strongly associated with improved service quality where organizational conditions facilitate employee performance. The results therefore supported Hypothesis 2**,** which stated that health centre characteristics significantly moderate the relationship between psychosocial work environment and quality of health care in Health Centre IVs in South Western Uganda. The structural model illustrating the moderating relationship is presented in Figure 2**.**

Figure 5: Moderating role of Health Centre Characteristics moderating the relationship between Psychosocial Work Environment and Quality of Health Care



5. Conclusion and Recommendations

This study examined the influence of psychosocial work environment on quality of health care and assessed the moderating role of health centre characteristics in Health Centre IVs in South Western Uganda. The findings established that the psychosocial work environment has a positive and significant influence on the quality of health care. Facilities characterized by a favorable workplace climate, effective work-life balance practices, and appropriate reward systems were more likely to report higher levels of effectiveness, patient-centred care, patient safety, and patient satisfaction.

The study further established that health centre characteristics significantly moderate the relationship between psychosocial work environment and quality of health care. The positive interaction effect indicates that the contribution of the psychosocial work environment to the quality of health care becomes stronger in facilities with favorable staffing composition, operational experience, and supportive facility conditions. The findings demonstrate that workplace conditions and health centre characteristics jointly influence the quality of health care in Health Centre IV facilities.

The study concludes that the psychosocial work environment is an important organizational factor in improving the quality of health care. The findings further indicate that improvements in workplace conditions are more likely to produce greater improvements in the quality of health care when supported by favorable health centre characteristics.

Recommendations

Health Centre IV management should strengthen the psychosocial work environment through initiatives that promote positive workplace climate, supportive supervision, effective communication, and teamwork among health workers. Creating an environment where employees feel supported and valued may enhance their commitment to service delivery and improve the quality of health care. Health facility administrators should develop strategies that promote work-life balance among health workers. These strategies may include equitable workload distribution, adequate staffing arrangements, flexible scheduling where feasible, and mechanisms for addressing workplace stress. Such interventions may contribute to improved employee well-being and enhance the quality of care provided to patients.

The Ministry of Health and district health authorities should strengthen reward and recognition systems within Health Centre IV facilities. Formal recognition of employee contributions, opportunities for professional growth, and performance-based incentives may improve staff motivation and encourage behaviors that

support the quality of health care. Health sector managers should address structural conditions within Health Centre IV facilities by improving staffing composition, strengthening operational support systems, and addressing facility-level constraints that may limit service delivery. Improvements in health centre characteristics will enhance the ability of psychosocial workplace initiatives to contribute to the quality of health care.

Future interventions aimed at improving the quality of health care should integrate both psychosocial and structural dimensions of health facility management. Focusing on the psychosocial work environment alone may not yield maximum benefits if facility characteristics remain constrained. A combined approach is therefore necessary to strengthen the quality of health care within Health Centre IV facilities in South Western Uganda.

Contribution to Knowledge

This study contributes to the existing literature by providing empirical evidence that the psychosocial work environment significantly influences the quality of health care in Health Centre IV facilities. The study further extends existing knowledge by demonstrating that health centre characteristics significantly moderate the relationship between psychosocial work environment and quality of health care. These findings contribute to a better understanding of how workplace conditions and facility characteristics interact in influencing the quality of health care within primary health care facilities in developing country settings.

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Data Availability Statement: The data supporting the findings of this study are available from the author upon reasonable request.