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From the Editorial Committee

We are giving you the next Vol. 30, No. 2(2025) issue of the Quarterly of the Faculty of Management of the Rzeszow University of Technology entitled “Modern Management Review”.

The primary objective of the Quarterly is to promote publishing of the results of scientific research within economic and social issues in economics, law, finance, management, marketing, logistics, as well as politics, corporate history and social sciences.

Our aim is also to raise the merits and the international position of the Quarterly published by our Faculty. That is why we provided foreign Scientific Council, as well as an international team of Reviewers to increase the value of the scientific publications.

The works placed in this issue include many assumptions and decisions, theoretical solutions as well as research results, analyses, comparisons and reflections of the Authors.

We would like to thank all those who contributed to the issue of the Quarterly and we hope that you will enjoy reading this issue.

With compliments
Editorial Committee

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DETERMINANTS OF PUBLIC EXPENDITURE IN ALGERIA: A MACROECONOMIC PERSPECTIVE

This article analyzes the determinants of public spending in Algeria over the period 1980––2023, using a Vector Error Correction Model (VECM) to assess the short- and long-term relationships between public spending, gross domestic product (GDP), inflation rate, exchange rate, unemployment rate, external debt, and oil-related taxation. The long-term results reveal a significant positive relationship between public spending and GDP as well as the unemployment rate. In contrast, inflation, the exchange rate, and oil taxation have a negative impact on public spending. In Algeria, the national economy heavily depends on the hydrocarbon sector; revenues from oil exports enable the country to meet growing social needs. This dependence exposes the economy to inflationary pressures, particularly during periods of falling commodity prices and depreciation of the national currency. In the short term, the model shows that only oil-related taxation and GDP have a significant influence on public spending. This situation calls for an urgent revision of Algeria's economic policy.

Keywords: public expenditures, macroeconomic determinants, Algeria, hydrocarbon sector.

1. INTRODUCTION

In the face of globalization, all countries must demonstrate their power as well as their economic growth. Generally, macroeconomic imbalances originate from situations in which domestic demand does not match the production capacity of the economy, which leads to economic needs. To ensure the coverage and satisfaction of these needs, human societies have always relied on resources in general, and financial resources in particular. As a result, public finance occupies a significant place in the functioning and survival of human communities.

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The State, in order to achieve its public, social, economic, and health objectives, needs various means. For this purpose, it relies on public finances and the different sources of public revenue to cover public spending. Public finances were originally dedicated to supporting public services, and public expenditure was not considered a variable capable of influencing the economic situation. However, the economic difficulties of the past favored the emergence of new theoretical approaches, particularly the "Keynesian revolution".

Public spending is used as one of the tools to enhance economic growth and development capacity, as it serves as a fiscal policy instrument managed by the State to intervene in the economy to achieve its desired objectives. Public expenditures can have a direct impact on capital formation, income generation, and consumption processes. Moreover, experience shows that economic growth is heavily dependent on the capacity of public spending in various sectors.

Algeria, like any country seeking to promote its economic growth, attaches great importance to public spending and its evolution. However, the relationship between public spending, public revenues, and gross domestic product is one of the main topics in macroeconomics. This debate has recently intensified, especially with the increase in public budget deficits. And since Algeria is a country highly dependent on hydrocarbons, understanding the composition of public expenditures and their determinants is a critical challenge that it must master. This is particularly true because public spending, in the Algerian context, is considered a key tool of fiscal policy.

Therefore, knowing and understanding the determinants of public expenditure in general, and particularly in Algeria, is essential and requires an in-depth study to improve the distribution of resources.

Through the literature review, several determinants of public expenditure have been identified, such as inflation, the unemployment rate, the exchange rate, external debt, oil taxation, and gross domestic product.

Our study aims to examine the impact of macroeconomic variables on public expenditures to validate the determinants of the latter and assess their impact on financial stability and economic growth. The study also contributes to improving existing research on the subject and proposes recommendations to improve the state of the Algerian economy.

2. LITERATURE REVIEW

The analysis of public expenditures is a central issue in the literature on public sector economics and public finance. Several questions arise when examining public spending on goods and services provided by the government, as well as other forms of public expenditures. Numerous empirical studies have analyzed the importance of the optimal use of public spending in enhancing economic growth and development capacity. In this section, we present some studies in this context.

Gábor Kutasi and Ádám Marton (2020), in their study "The Long-Term Impact of Public Expenditures on GDP Growth", examine the relationship between public expenditures and economic growth using data from the Classification of the Functions of Government (COFOG) for 25 European Union countries over the period 1996–2017. By applying three econometric methods (GMM, panel fixed effects, and OLS), they find that expenditures on social protection and general public services have a significantly negative effect on GDP growth, suggesting that inefficient allocation of public resources can hinder

economic development. In contrast, expenditures on education and health have a positive long-term impact on growth, indicating that strategic investment in these sectors can stimulate the economy. These results highlight the importance of the structure of public expenditures in supporting economic growth.

Fatima Zohra Hammadouche (2024) analyzes the effect of public spending on inflation in Algeria over the period 1973–2022. The data comes from the World Bank and the Algerian Ministry of Finance. Using the Autoregressive Distributed Lag (ARDL) model, the author finds a cointegration relationship between public spending and inflation, indicating a long-term link between these variables. The results suggest that public expenditures significantly impact inflation in Algeria, emphasizing the importance of prudent fiscal management to control inflationary pressures.

Sheilla Nyasha and Nicholas M. Odhiambo (2019) provide a detailed analysis of theoretical and empirical studies concerning the relationship between public expenditures and economic growth. The authors review previous research assessing the impact of government spending on economic growth. The findings of this review indicate that the effect of public spending on economic growth is not clearly defined. Some studies show a positive impact, others a negative impact, and some find no significant effect. This lack of consensus is attributed to factors such as differences in study samples, study periods, methodologies employed, and types of public expenditures analyzed. Despite this heterogeneity, most studies tend to support a positive impact of public expenditures on economic growth. The authors emphasize the importance of the composition of public expenditures, suggesting that different categories of spending may have varying effects on growth. They recommend further analysis to determine which types of expenditures are most beneficial for stimulating economic growth.

Radica Dishlieska-Gramatikova (2023) explores the impact of public expenditures on inflation and economic growth. The author highlights that public spending influences inflation by increasing the overall demand for goods and services, which can lead to demand-pull inflation. To counter this inflation, governments often adopt restrictive fiscal policies, such as reducing public expenditures, increasing taxes, and decreasing transfers, to limit overall demand. Regarding economic growth, the article suggests that public spending can stimulate the economy by increasing overall demand, but this effect depends on the nature and efficiency of expenditures. The author suggests that well-targeted public investments can foster economic growth, while inefficient spending can have negative effects. She concludes by stressing the importance of determining the impact of public expenditures on inflation and economic growth, as these macroeconomic indicators are essential for formulating effective economic policies.

Guillermo Peña (2023) examines the influence of interest rates on public expenditure growth, reversing the traditional perspective that typically analyzes the impact of public spending on interest rates. The author analyzes an extensive dataset covering 216 countries from 1972 to 2021, using generalized method of moments (GMM) models to ensure the robustness of results. The study's main findings reveal that lower interest rates are associated with, and in some cases lead to, a decrease in the growth of per capita public expenditures. This relationship is interpreted through two main mechanisms :

- Fiscal illusion: Lower interest rates may create the impression that borrowing costs are low, encouraging governments to increase spending without fully perceiving the long-term financial implications.

- Crowding-out effect: Lower interest rates can reduce private savings incentives, potentially limiting available resources for the private sector and restraining private investment.

The author suggests that these mechanisms help explain how interest rate variations can influence public spending decisions. He recommends that policymakers consider these effects when formulating fiscal policies, taking into account the potential impact of interest rates on public expenditure growth and the economy in general.

Belarbi et al. (2017) conducted an empirical study titled "The Impact of Public Expenditure on Employment and Income in Algeria: An Empirical Investigation" to assess the impact of public spending on employment and income in Algeria. Using panel data covering the period 2000–2015, the study focused particularly on the infrastructure sector. The authors applied econometric methods, including multiple regressions, to control for various factors influencing outcomes such as GDP and inflation rates. The results revealed that increasing public expenditures has significant positive effects on employment, particularly in infrastructure projects, highlighting the crucial role of public investment in economic development. This study demonstrates that public spending, when directed toward infrastructure projects, can not only create jobs but also increase household income, emphasizing the importance of effective public resource management.

In their study on Nigeria, Adamu J. and Chandana A. (2019) used an econometric modeling approach to analyze the main determinants of public expenditures. Their sample was based on time-series data specific to the Nigerian economy. The results showed that GDP, government revenues, inflation, and economic openness are the primary factors influencing public spending in the country. In particular, GDP growth and increased tax revenues lead to higher public spending, while inflation has variable effects. These findings highlight the importance of economic stability and revenue management in controlling public expenditures.

David K. I. (2017) conducted an in-depth analysis of the determinants of public education expenditures in Kenya in his study titled "The Determinants of Public Education Expenditures: An Empirical Analysis of Changing Patterns and Growth of Public Expenditure on Education in Kenya". The study used panel data covering several years, allowing an examination of variations in education spending over time and across regions. The study's findings reveal that public education expenditures in Kenya are primarily influenced by several key factors, including national income levels, government policy priorities, and unemployment rates. Specifically, an increase in national income is associated with higher education spending, highlighting the link between economic development and investment in education. Governments seeking to improve the quality of life for their citizens tend to prioritize education expenditures, particularly when economic resources allow it. Furthermore, the study highlights the impact of political priorities on education expenditures. Budgetary decisions made by governments, influenced by social and political pressures, determine the extent to which resources are allocated to education. Thus, governments that recognize education as a driver of economic growth tend to invest more in this sector. Finally, unemployment rates play a significant role in determining education expenditures. When unemployment is high, there is often increased pressure to boost education spending to train a skilled workforce that can meet labor market demands and reduce long-term unemployment rates. This relationship underscores the importance of education not only as a fundamental right but also as a crucial tool for sustainable economic development.

The study by Dermichi attempts, in the first step, to analyze the implicit taxes generated by financial repression as the cost of total public spending. In the second stage, the impact of the degree of repression of the financial system on the disaggregated size of public expenditure – namely capitalized public expenditure and current public expenditure – is discussed. The third step consists of analyzing all the factors influencing public spending in Algeria by introducing the financial repression index. The significance of the causal and cointegration relationships supports the hypothesis that financial repression determines the level of overall public spending in the short and long term in Algeria. In particular, Gross Domestic Product, trade openness, public debt, as well as the urban population.

The purpose of the article by Facchini (2018) is to present and assess the literature on the determinants of public spending. Its originality lies in the adoption of a methodological perspective. Does econometrics allow economists to discover universal constants for public spending, or is it only another way of writing the history of public finance? The economic theory of the size of government includes 23 explanations and 78 explanatory variables. The size of government reflects the preferences of citizens (demand model), the power of politicians and bureaucrats to impose their interests against those of the citizens (supply model), and the constitutional design that governments face in raising revenue. Gift Mbewe (2024) examined the relationship between public debt service and education expenditure in 15 Sub-Saharan and South American countries from 1995 to 2022. Utilizing the Pooled Mean Group (PMG) estimation method within an Auto Regressive Distributed Lag (ARDL) framework, evidence of cointegration between public debt service and education expenditure is presented. PMG regression results indicate that, in the short run, public debt service does not have a statistically significant impact on education expenditure per student. However, in the long run, an increase in government debt service exerts a significant negative effect on education expenditure. This result aligns with existing literature, which argues that increased debt obligations divert financial resources away from essential public services, including education. The Hausman test confirmed that the PMG estimator was more efficient than the Mean Group (MG) and Dynamic Fixed Effect (DFE) estimators. These findings suggest that maintaining low debt levels is crucial to prevent adverse impacts on educational funding, which is vital for long-term economic development.

The cited studies confirm the relevance of our work by demonstrating that GDP, inflation, exchange rates, unemployment, oil taxation, and external debt service are key determinants of public expenditures. Economic growth influences the state's ability to finance its policies. Unemployment generates social pressure for increased public investment, and dependence on oil revenues exposes public finances to external shocks. Furthermore, the burden of external debt service affects fiscal space and the sustainability of public finances. The interaction of these factors within the specific economic context of Algeria justifies an in-depth analysis to guide fiscal policy toward more effective, resilient, and sustainable management.

3. METHODOLOGY

The main objective of our study is to estimate a macroeconomic model to analyze the impact of key variables on public expenditures in Algeria. To achieve this, we employed the Vector Error Correction Model (VECM). This approach allows us to model both the short-term dynamics and the adjustments toward long-term equilibrium among the

variables. The implementation of the VECM is based on the following econometric procedure:

- **Stationarity Test**: To verify the stationarity of the time series, we use the Augmented Dickey-Fuller (ADF) unit root test to determine the order of integration.
- **Optimal Lag Length Selection**: The number of lags is determined using the Akaike Information Criterion (AIC) and the Schwarz Bayesian Criterion (BIC).
- **Cointegration Test and VECM Estimation**: To confirm the existence of a long-term equilibrium relationship, Johansen's cointegration test is applied.
- **Model Estimation**: Once the presence of at least one cointegration relationship is confirmed, the model is estimated. The cointegration coefficient must be negative and statistically significant at the 10% level.
- **Model Validation**: To ensure the robustness of the model, a series of residual diagnostic tests are applied, including tests for autocorrelation and stationarity.
- **Impulse Response Function**: This is used to understand the effect of shocks on the different variables and to help policymakers plan future management strategies.

The selection of model variables is based on empirical studies linking public expenditures in Algeria to GDP, inflation, unemployment rate, debt service, exchange rate, and tax revenues. The data covers the annual period from 1980 to 2023. Data sources include the World Bank, the Ministry of Finance, the National Center for Statistical Information (CNIS), and the National Office of Statistics (ONS).

$$PE = \alpha 0 + \alpha 1\ GDP + \alpha 2\ INF + \alpha 3\ TAX + \alpha 4\ UR + \alpha 5\ ER + \alpha 6\ DS + \varepsilon t \qquad (1)$$

Where:

- PE: Logarithm of public expenditures, expressed in Algerian Dinars.
- GDP: Logarithm of Gross Domestic Product, expressed in Algerian Dinars.
- INF: Logarithm of the inflation rate, expressed as a percentage.
- TAX: Logarithm of oil taxation, expressed in millions of Algerian Dinars.
- UR: The unemployment rate represents the proportion of the labor force that is unemployed and actively seeking work, expressed as a percentage.
- DS: Total debt service, expressed as a percentage.
- ER: Official exchange rate.

Based on the literature review, the expected signs of our independent variables are as follows:

Variables	GDP	INF	TAX	ER	UR	DS
Expected signs	+	-	+	-	+	+

4. DISCUSSION OF RESULTS

In this section, we will apply econometric tests to determine the relationship between the endogenous variable and the exogenous variables and provide the necessary economic comments.

4.1. Descriptive Analysis of the Series

Descriptive statistics of the data allow us to gain insight into the level of risk and the evolution of these data over time. The Skewness, Kurtosis, and Jarque-Bera test statistics enable us to test the normality of the studied series. The following table presents the descriptive statistics of the series analyzed over the period (1980–2023):

Table 1. Descriptive Statistics of the Studied Series

Statistiques	LN_EP	LN_GDP	DETTE	LN_ER	LN_INF	LN_TAX	LN_UR
Mean	28.37354	28.84744	0.871749	3.613085	-2.804475	27.05671	2.757503
Median	28.41472	29.18782	2.072231	4.257922	-2.843964	27.69125	2.666479
Maximum	29.13512	31.14666	3.056192	4.955792	-1.150291	29.34967	3.384103
Minimum	27.22988	25.81395	-2.275737	1.344808	-5.69308	23.74267	2.163332
Std. Dev.	0.557268	1.728227	1.932429	1.226198	0.896845	1.831012	0.388379
Skewness	-0.242378	-0.39587	-0.56267	-0.832543	-0.417675	-0.521964	0.270087
Kurtosis	1.917018	1.727592	1.560959	2.068247	4.129848	1.787821	1.620913
Jarque-Bera	2.58104	4.117437	6.118251	6.674566	3.619674	4.694203	4.021727
Probability	0.275128	0.127617	0.046929	0.035533	0.163681	0.095646	0.133873

Source: Ourselves with tests conducted using the EVIEWS 12 software.

According to the results displayed in the table above, there is a variation between the minimum and maximum values for all the variables considered in this study. The largest variations, however, concern the value of taxation. Another observation is that the mean and median values of all the variables are quite close in magnitude. Additionally, it is noted that the studied variables exhibit fluctuations over time. Over the entire study period, the Jarque-Bera test shows a very low value for the inflation variable, which confirms the normality of the data. Similarly, for each of the studied series, the "Skewness" and "Kurtosis" coefficients confirm the hypothesis of normality of the variables.

4.2. Study of the Stationarity of the Series

Before modeling the relationships between the variables, it is important to ensure, through tests, that the long-term variables of the model are stationary. In our study, we will apply the ADF test to determine the stationarity properties of the variable explaining economic growth and its fundamentals. The table below provides the results of the stationarity test:

Table 2. Augmented Dickey-Fuller Test

ADF		Level	First Différence
		T-ADF	T-ADF
Ln PE	Intercept	-0.272023	-5.188494 ***
	Trend and intercept	-1.407399	-5.429056 ***
	None	0.816642	-5.200304 **

Table 2 (cont.). Augmented Dickey-Fuller Test

ADF		Level	First Différence
		T-ADF	T-ADF
Ln GDP	Intercept	-2.058901	-4.198041 ***
	Trend and intercept	-0.288548	-4.665323 ***
	None	3.012023	-2.471004 ***
Ln INF	Intercept	-2.820947 *	-8.918802 ***
	Trend and intercept	-2.963679	-8.859553 ***
	None	-0.450532	-9.027635 ***
Ln TAX	Intercept	-1.076480	-5.558308 ***
	Trend and intercept	-1.531788	-5.210966 ***
	None	2.108296	-5.192089 **
Ln ER	Intercept	-2.026202	-4.176550 ***
	Trend and intercept	-0.649861	-4.422514 ***
	None	0.337442	-3.522706 *
Ln UR	Intercept	-1.395566	-5.704797 ***
	Trend and intercept	-1.797415	-5.716219 ***
	None	-0.254045	-5.781375 **
Ln DS	Intercept	-0.455618	-7.488914 ***
	Trend and intercept	-2.120307	-7.471531 ***
	None	-0.953472	-7.248564 ***

*, ** & *** refers to the rejection at 10%, 5% & 1%.

Source: Ourselves with tests conducted using the EVIEWS 12 software.

The results show that the five variables are not stationary at level. To make them stationary, we applied differencing. The ADF stationarity test results reveal that the variables Ln PE, Ln GDP, Ln Inf, Ln TAX, and Ln ER and Ln UR are stationary at the first difference. This suggests a possible cointegration between the variables.

4.3. Etude Study of Multivariate Cointegration (Johansen Approach)

4.3.1. Cointegration Test

When the variables are integrated at the first difference, it is necessary to check for the existence of a cointegration relationship between the variables. The purpose of this test is to detect if the variables have a unit root and a common stochastic trend. If this is the case, we say that there is a long-term equilibrium relationship. Initially, we determine the number of lags (P) by estimating a VAR in levels between the non-stationary variables: Ln PE, Ln IFL, Ln ER, Ln GDP, DS and Ln UR. The information criteria LR, FPE, and AIC lead to the choice of lag (P = 1).

Table 3. Determination of the Number of Lags p

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-153.4025	NA	5.90e-06	7.824510	8.117071	7.931044
1	124.8817	447.9696	8.49e-11	-3.360082	-1.019594*	-2.507806*
2	164.9437	50.81031*	1.62e-10	-2.924081	1.464335	-1.326062
3	247.3353	76.36301*	5.98e-11*	-4.552943*	1.883401	-2.209182

Source: Ourselves with tests conducted using the EVIEWS 12 software.

We then perform the Johansen test based on P = 1. The results are gathered in the following table, provided by the EViews 12 software:

Table 4. Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.795846	164.0672	125.6154	0.0000
At most 1 *	0.541404	97.33412	95.75366	0.0387
At most 2	0.394920	64.59157	69.81889	0.1217
At most 3	0.335741	43.49100	47.85613	0.1211
At most 4	0.267311	26.30948	29.79707	0.1197
At most 5	0.165383	13.24606	15.49471	0.1061
At most 6 *	0.125935	5.653212	3.841465	0.0174

Source: Ourselves with tests conducted using the EVIEWS 12 software.

The Trace test is used to test the null hypothesis (H_0) that there are r cointegration relationships against the alternative hypothesis (H_1) that there are more than r. The analysis of the table shows that Johansen's test statistic for the first eigenvalue is higher than the 5% critical value (164.0672 > 125.6154). Thus, we reject the null hypothesis (r = 0) at the 1% significance level and conclude that there is at least one cointegration relationship. Furthermore, for r = 2, the statistic (64.59157) is lower than the critical value (69.81889), which indicates that we accept the existence of at most two cointegration relationships among the variables. As a result, the estimation of a VECM (2) model is justified to analyze both the long-term relationships and the short-term adjustments.

4.3.2. Estimation of the Long-Term Relationship

The existence of a cointegration relationship between the variables allows us to determine the long-term and short-term relationship. Based on the cointegration test performed on EViews, two long-term equation has been identified for our analysis. In our study, we will focus on the first equation, which examines the impact of inflation, external debt, unemployement, exchange rate, GDP, and oil taxation on public spending in Algeria.

$$\mathbf{LN\ EP = 19.7384\ LN\ GDP - 10.00692\ LN\ ER - 1.896316\ LN\ INF +}$$
$$\mathbf{- 11.67853\ LN\ TAX + 9.671020\ LN\ UR - 277.7703} \quad (2)$$

- **Interpretation of Results**

The GDP (LN_GDP) has a strong and statistically significant positive coefficient of +19.7384 (t-statistic ≈ 8.18). This result indicates a strong procyclicality of budgetary expenditures in relation to the gross domestic product. This is explained by the fact that the national economy is heavily dependent on the hydrocarbon sector (Amani, 2021). The increase in oil prices leads to a rise in GDP, allowing for the implementation of several development programs aimed at meeting the growing needs of society. This period was also marked by an increase in purchasing power through salary and wage adjustments, as well as the provision of housing and various essential needs of daily life, in order to maintain the country's stability (Ssanwassi, Ouachach, 2022).

The exchange rate (LN_ER) shows a negative and statistically significant coefficient of −10.0069 (t-stat ≈ -2.80). In mono-export economies that rely heavily on imported raw materials, such as Algeria, the economic structure depends primarily on export revenues to meet domestic demand. This creates a strong dependency on imports and exposes these countries to inflationary pressures, especially during periods of declining commodity prices. Indeed, financial inflows from abroad – particularly those linked to inflexible trade structures – are highly affected by price fluctuations. Consequently, a drop in oil prices is generally accompanied by increased inflation expectations, driven by the depreciation of the currency's external value. This leads to growing social and economic pressures on fiscal balances, resulting in rising costs in the general state budget (Salah, Fakhri, 2023). Alesina et al. (2002) highlight the interaction between fiscal policies, including public spending, and exchange rate fluctuations, particularly in economies like Algeria, where economic and monetary policies play a crucial role in budgetary adjustments.

The inflation rate (LN_INF) also negatively affects public expenditure, with a coefficient of −1.8963 (t-stat ≈ -2.44). This is logical in the context of the Algerian economy. Inflation rates contribute to the deterioration of purchasing power, leading to an increase in the prices of goods and the money supply. This results in higher public spending without any real beneficial effect. Consequently, the recorded increases in salaries have been absorbed, and the effect of inflation on public expenditure has turned out to be inverse: wages increased, but in reality, this rise did not improve individuals' standard of living, well-being, or investment in projects (Bekhtaoui, Arzi, 2022). Unlike our findings, Benelbar M'hamed, Senoussi Ali (2019) found a significant positive relationship between government spending and inflation.

The tax burden (LN_TAX) also has a negative and statistically significant coefficient of −11.6785 (t-stat ≈ ...). This result indicates that an increase in tax pressure is associated with a long-term reduction in public spending. This divergence from the expected direct correlation between commodity prices and government expenditures may reflect Algeria's adoption of countercyclical spending measures, in line with Keynesian principles, to mitigate the effects of oil revenue volatility. These findings support the hypothesis that the country has implemented budgetary cushioning strategies in response to fluctuations in oil revenues. This result differs from previous studies, such as those by Mourad and Chouerab Jalloul, who observed a weaker relationship between taxation and public spending over a longer period (1980–2014) (Mourad, Hamma, 2024).

Finally, the unemployment rate (LN_UR) has a positive and significant coefficient of +9.6710 (t-stat ≈ 2.86), showing that rising unemployment is associated with increased public spending. This positive relationship can be explained by the fact that Algeria suffers from high unemployment rates across various social classes and age groups, especially

university graduates. This is due to the Algerian economy being primarily based on the hydrocarbons sector, while other sectors represent only a small share. This situation pushes the government to provide social assistance and support in different sectors, including health and unemployment benefits, which weigh heavily on the state's finances. Thus, as unemployment rises, the budget for social transfers also increases.

4.3.3. Estimation of the VECM Model

In this Vector Error Correction Model (VECM), we have five variables. The results of the VECM estimation are provided in the annexes using the Johansen method. The model is written as follows:

$$\begin{aligned}
&\mathbf{D(LN_EP) = -0.0688323004188*(LN_EP(-1) + 19.7384194192*LN_GDP(-1) +} \\
&\mathbf{- 10.0069210921*LN_ER(-1) - 1.89631570067*LN_INF(-1) +} \\
&\mathbf{- 11.6785307659*LN_TAX(-1) + 9.67101961919*LN_UR(-1) - 277.770300515) +} \\
&\mathbf{- 0.0448946143133*(DETTE(-1) - 29.7552425477*LN_GDP(-1) +} \\
&\mathbf{+ 20.4301092992*LN_ER(-1) + 2.40704918235*LN_INF(-1) +} \\
&\mathbf{+ 14.3766181483*LN_TAX(-1) - 21.5308555853*LN_UR(-1) + 461.030860629) +} \\
&\mathbf{+ 0.061645735203*D(LN_EP(-1)) - 0.00601475016241*D(DETTE(-1)) +} \\
&\mathbf{- 1.1064948586*D(LN_GDP(-1)) - 0.0725981450219*D(LN_ER(-1)) +} \\
&\mathbf{- 0.032688767116*D(LN_INF(-1)) + 0.185191307645*D(LN_TAX(-1)) +} \\
&\mathbf{- 0.250641454184*D(LN_UR(-1)) + 0.138749900333} \qquad (3)
\end{aligned}$$

The error correction term measures the speed at which deviations between public expenditures (Ln PE) and their equilibrium level are corrected. The coefficient of –0.068832 indicates that 6.8832% of deviations are corrected each period.

In the short term, only GDP and oil taxes impact public spending. Income growth initially leads to an increase in both the consumption of goods and services and productivity. However, beyond a certain level, consumption and productivity decline due to rising prices (inflation). Indeed, the slowdown in economic growth requires government intervention in economic activity through increased public spending to meet various needs (Demchri, Zakane, 2018).

An increase in fiscal revenues from oil (oil taxation) leads to an immediate rise in public spending. At the beginning of the 2000s, oil prices experienced a significant increase, which enabled the country to initiate the implementation of economic recovery programs (2001–2014). These programs were primarily aimed at reviving the national economy, developing infrastructure and basic equipment, and stimulating economic growth through public investment (Khlifi, 2021).

However, the model results showed that external debt, inflation, and the unemployment rate do not affect public spending in Algeria in the short term. Despite the monetary expansion experienced by Algeria, public spending was not impacted by these variables. This appears logical for a developing country where inflation does not result solely from monetary factors or supply and demand, but rather from other underlying causes.

Moreover, the State adopted a policy of expenditure rationalization, particularly after the 2014 oil crisis (Houari, Nakal, 2021).

4.4. Stability Test of the Relationship

To implement robustness tests on the residuals, we followed the steps outlined below:

Table 5. Residual Test

Test	Statistique	P-V
Normality (Jarque-Bera)	0.306024	0.8581
Stationarity (ADF)	168.688	0.0000
VEC Residual heteroskedasticity test	505.3924	0.4742
VEC Residual correlation test	48.01241	0.5131

Source: Ourselves with tests conducted using the EVIEWS 12 software.

According to the results in the table above, we observe that the residuals of our empirical model meet the four conditions: normality, stationarity, homoscedasticity, and independence of residuals.

The residuals are indeed normally distributed, as the Jarque-Bera test accepts the null hypothesis of normality (the P-value of the test is significantly higher than the 5% threshold). The ADF test on the residuals confirms their stationarity, with the critical values from Engle and Yoo (1987). The VEC Residual heteroskedasticity test accepts the null hypothesis of homoscedasticity and rejects the alternative hypothesis of heteroscedasticity (the P-value of the test is well above the 5% threshold). Finally, the VEC Residual correlation test reveals that the residuals are not correlated.

4.5. Analysis of Impulse Response Function

The simulation of structural shocks is a powerful method in the dynamic analysis of a group of variables. It reflects the time-based reaction of variables to identified contemporary shocks. We will trace the responses to shocks on the residuals of the studied variables over ten periods, considered as the necessary time for these variables to return to their long-term levels. All shocks are standardized at 1%, and thus the vertical axis indicates the approximate percentage variance in economic growth in response to a 1% shock on the other variables. The results of this test show the reactions shown in the fig. 1 (Abdelmalek, 2018).

A positive shock of 1% on external debt results in a negative and decreasing impact on public spending, reaching -0.105% by the tenth period. The negative response indicates that when a significant portion of government operations is financed through external debt, interest rates may rise in the long term. These interest payments are covered by revenues from the oil sector, leading to a reduction in consumption and savings among taxpayers, and consequently a decrease in capital stock and economic growth (Epaphra, Mesiet, 2021).

A 1% shock to tax revenues results in a positive and increasingly significant effect on public spending, reaching 0.056 by the end of the period. This reflects the important role of tax revenues in the national economy, as they account for more than 60% of public revenues and cover all investment expenditures. It can therefore be said that oil-related taxation constitutes the cornerstone of all government programs (Serarma, 2017).

However, any fluctuation in oil prices calls into question all national strategies, given that public spending in Algeria is closely tied to oil prices. This weakens the national economy and makes it vulnerable to external shocks (Boutayab, Ghezazi, 2019).

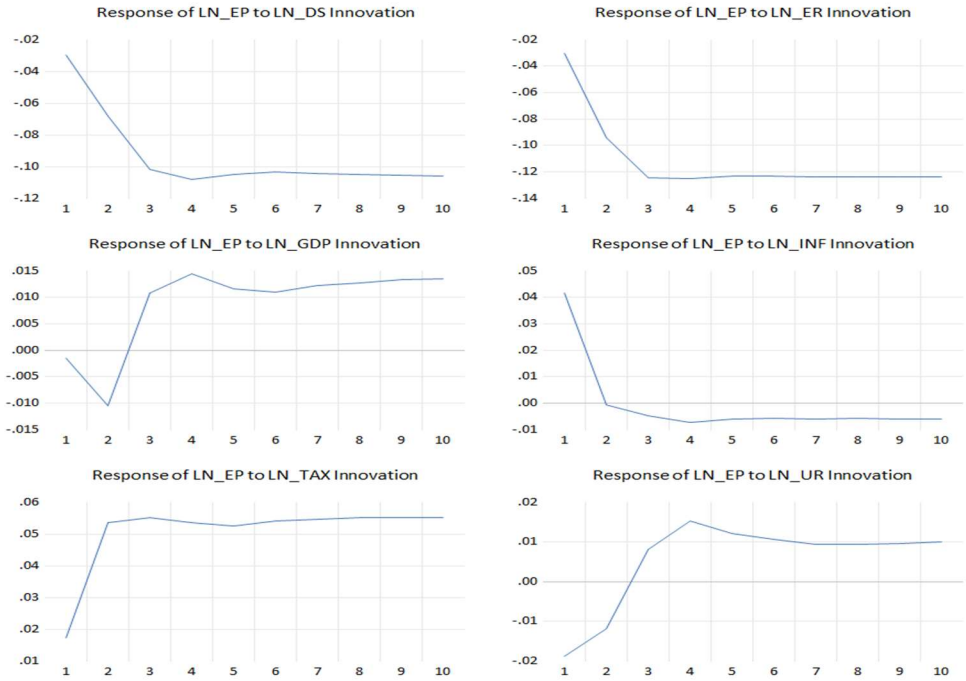

Figure 1. Impulse Response Result

Source: Ourselves with tests conducted using the EVIEWS 12 software.

Inflation exerts a negative influence on public expenditures, with a cumulative impact of -0.005 by the end of the period. According to Ablam Estel Apeti (2023):

> "it appears that inflation targeting may efficiently act upon reducing public expenditure and trigger its reallocation in a direction that is relatively favorable to public investment. In addition, the sharp decline in current expenditure relative to public investment is a strong signal of credibility that IT countries could send to financial markets, given the high political cost of cutting current expenditure".

A 1 % shock to the unemployment rate leads to a marginally negative response in public expenditures, reaching -0.0139 at the end of the observation period. This can be explained by the fact that the Algerian government formulates its fiscal policy for public spnding based on current and expected changes in the unemployment rate. During periods of high oil prices, the adopted fiscal policy is expansionary due to increased revenues from the hydrocarbon sector, which leads to lower unemployment. Conversely, during periods of economic downturn, the policy becomes contractionary, resulting in higher unemployment rates and reduced public spending (Boualkour, 2020).

A shock to real GDP has a positive but modest effect on public expenditures, reaching only 0.0128 by the tenth period. This is due to the absence of a policy for managing and directing public expenditures towards productive sectors, meaning that the state's revenues rely on only one sector responsible for covering the state's expenses (Ghalya, Ben Azza, 2021).

5. CONCLUSION

The objective of this study is to examine the relationship between public spending in Algeria and certain macroeconomic indicators over the period 1980–2023. An econometric error correction model (VECM) was used to analyze the short- and long-term relationships between these variables.

The study's findings reveal that in the long term, gross domestic product (GDP) and the unemployment rate have a positive effect on public spending, whereas inflation, oil-related taxation, and the exchange rate have a negative impact. In Algeria, the national economy is heavily dependent on the hydrocarbon sector; revenues from oil exports enable the country to launch and finance development programs aimed at addressing the growing social needs of the population. This dependency exposes the economy to inflationary pressures, especially during periods of falling commodity prices and depreciation of the national currency. Thus, in order to maintain stability and social peace, the state provides social assistance and support in various areas, notably in health care and unemployment benefits, which weigh heavily on public finances.

In the short term, only GDP and oil taxation have a significant impact on public spending. The results show that, despite the expansionary monetary policies implemented by the government, public spending has not been significantly influenced by inflation, unemployment, external debt, or the exchange rate. This is due to the expenditure rationalization policy adopted by the country, particularly after the 2014 oil crisis.

The structural shock simulation test showed that a positive 1% shock to GDP or oil taxation leads to a positive effect on public spending over a ten-year horizon, whereas a 1% positive shock to the other variables results in a negative effect. It can be said that oil-related taxation is the cornerstone of every government program. Any fluctuation in oil prices calls into question all national strategies, given that public spending in Algeria is closely tied to oil revenues. This dependency weakens the national economy and makes it vulnerable to external shocks.

This alarming situation in the Algerian economy must be reconsidered. The government needs to seek solutions to reduce this heavy dependence on hydrocarbons, such as diversifying exports, promoting productive sectors outside of hydrocarbons – such as agriculture and renewable energy – and implementing policies for effective management and rationalization of public expenditures.

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DESCRIPTIVE ANALYSIS OF IPSAS ADOPTION AND QUALITY OF FINANCIAL REPORTING IN OGUN STATE, NIGERIA

There are a number of concerns about the quality and usefulness of reports prepared and disseminated by Nigerian public sector. This paper examined the influence of IPSAS adoption on the financial reporting quality in Nigerian MDAs. Survey research design and primary data were employed. One hundred and twenty nine accounting professionals in the MDAs were sampled. The responses on IPSAS adoption metrics indicate high grand means with internal control mechanism having 3.73; audit committee 3.83; IPSAS adoption environment 3.90 and IPSAS adoption transparency and accountability 3.73 which are all above the acceptable mean of 3.49. This implies that IPSASs adoption constructs directly influence financial reporting quality of public sector in Ogun state, Nigeria. It is recommended that considerable efforts should be deployed to full adoption and implementation of IPSAS in Nigeria. Engaging stakeholders, is equally crucial to the full adoption of IPSAS and improving the quality of financial reports.

Keywords: accountability and transparency, IPSAS adoption, financial reporting quality, financial performance.

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1. INTRODUCTION

A fundamental factor in realizing the accountability of public financial management is government financial report. The growing demand for government accountability has consequences for management in government parastatals to oblige the general public with financial information relating to their activities. In this regard, government accounting is used to determine the sources and uses of monies generated by various government agencies, parastatals and departments. Profit is not the primary focus, as it is in the private sector, where profit is the primary goal. In Nigeria, government accounting processes have been carried out under the basic framework of fund accounting principles, but applying these principles to financial reporting has been a serious difficulty. This created a number of concerns about the quality and usefulness of reports prepared and disseminated by public organisations, particularly government ministries, departments, and agencies.

Among these concerns are whether MDAs' financial statements provide a realistic and fair picture of its financial performance and position. How can the quality of financial reports by Nigerian MDAs be improved?. In terms of the resources allocated to them, how open and accountable are MDAs?. As financial transparency and disclosure have increased amongst countries around the world, efforts are being made to boost public trust in financial reporting (Beredugo et al., 2021). The need to hold the government accountable for results is growing. As a result, the demand for quality financial reports is critical, as financial reports are the sole way for organisations to convey their financial issues to their stakeholders (Ijeoma, Oghoghomeh, 2014). Both developed and developing countries are concerned about the global quest for better public financial management that ensures greater accountability and transparency. Though government business and accounting operations in Nigeria have been conducted within the general framework of fund accounting principles, the major issue is that financial reporting and public sector accounting are far from the principles in absolute terms and stakeholders' expectations (Olaoye, Talabi, 2018). International Public Sector Accounting Standards (IPSAS) are currently the mainstay of a global accounting revolution in response to calls for increased government financial accountability and transparency.

In summary, IPSASs are international accounting standards that serve as instructions for the compilation of financial statements for the public sector. The primary goal of IPSAS is to improve the quality of general purpose financial reporting in the public sector, which will give a better way of monitoring government resource allocation as well as enhanced transparency and accountability. Recently, despite the introduction of accrual-based IPSAS by several Nigerian state governments, there has been significant debate about the dependability of their financial reports. This could be due to an infrastructural gap in terms of the need for skilled staff who can effectively translate the standards and should report on some specific areas, particularly in the narrative notes accompanying the financial statements to provide users with a detailed explanation of the financial data.

Another gap could be the need for a comprehensive transformation in finance culture and thinking in order to capitalise on the opportunities given to produce value. Audit qualifications on government assets; income and receivables; unusual and wasteful expenditure; and investment property are shown in reports from various Nigerian states (Beredugo, 2021). Valuation, depreciation, impairments, and the fair value of investment property are a few examples of technical accounting concerns and challenges, while existing technology in some states does not support complete IPSAS implementation (Izueke, 2020). In conclusion, despite the importance of government transparency and

accountability as a developing policy issue, there has been little research into the descriptive analysis of the influence of IPSAS adoption on the quality of financial reporting in Nigeria's public sector. Rather, the existing probes have focused on the relationship between IPSAS adoption and various performance measures in the Nigerian public sector. This present study bridged the knowledge gap by studying the characteristic influence of adopting IPSAS on financial reporting quality in Nigerian public sector. Arising from the motivation, this research sought to provide answers to the following questions:

i. How does IPSAS adoption internal control mechanism impact quality of financial reports of ministries in Ogun state, Nigeria?
ii. To what extent does IPSAS adoption audit committee affect quality of financial reports of ministries in Ogun state, Nigeria?
iii. What influence does IPSAS adoption environment have on quality of financial reports of ministries in Ogun state, Nigeria?
iv. How does IPSAS adoption transparency and accountability enhance quality of financial reports of ministries in Ogun state, Nigeria?

2. LITERATURE REVIEW

2.1. Conceptual Review

2.1.1. International Public Sector Accounting Standards (IPSAS)

International Public Sector Accounting Standards (IPSAS) are collections of accounting standards intended to be implemented in the course preparing and reporting all the financial activities of government Ministries, Departments and Agencies (MDAs). IPSASs are designed to be adopted in all government MDAs apart from business oriented government entities. The main objective of IPSAS is the improvement of the quality of financial reporting by public sector entities, which will engender better informed assessment of the resource allocation decisions made by governments, thereby enhancing transparency and accountability (Okowli, 2014). Also, Labode (2014) asserted that IPSASs are designed for the public sector and its use is considered best practice for public sector entities.

They are the public sector equivalent of International Financial Reporting Standards (IFRS) which are applicable only to private sector companies. IPSASs deal specifically with financial reporting matters that were not attended to in IFRS as it relates to the public sector. The IPSASs are issued by the International Public Sector Accounting Standards Board (IPSASB). The IPSASB is vested with the responsibilities of issuing public sector accounting standards, promote their acceptance and the international convergence of the standards, as well as publications of other documents which provide guidance on issues and experiences on financial reporting in the public sector. To date, forty two (42) standards have been issued (Deloitte, 2024). In January 2016, thirty-nine (39) IPSAS were issued by IPASB out of which thirty-eight (38) were strictly based on accrual basis of financial reporting. The IPSASB endorsed accrual basis and regard cash basis as inadequate in meeting the demands of financial report users. IPSASB (2015) explains that the standards apply to public sector entities and are useful for the preparation of financial statements. The objective of IPSAS is to assist government officials in making choice decisions for public governance to be conducted transparently and creditably (Ademola, et al., 2020).

2.1.2. Financial Report Quality

The process of dissemination of financial information and other data to external consumers by a business enterprise is known as financial reporting. Providing high-quality information about reporting organizations that may be utilized to make wise financial decisions is the primary goal of financial reporting (Opanyi, 2016). Egolum et al. (2021) also defined financial reporting as the process of formally reporting a business's financial activity. It has been regarded as a necessary tool for every player in the market. Additionally, it lessens ambiguity and disagreement amongst all parties involved, including management, investors, government regulators, the general public, and other stakeholders. Opanyi (2016) described the quality of financial information as the ability to influence the decisions made by users of that information. Financial information has the potential to influence decisions if it has predictive and confirmatory values (IASB, 2010). As a result, reported information is only valuable if it relates to issues of primary relevance to the consumers. Annual reports must be thorough, unbiased, and devoid of substantial errors in order to accurately portray economic events (IASB, 2010).

According to Hadiyanto, Syafar and Mahri, (2018), the veracity of the information provided to users in financial reports is what determines their quality. Qualitative traits can be used to gauge the quality of financial reports. Relevance and faithful representation, two essential qualitative traits that are intended to satisfy the needs of various users in providing useful information for decision-making, are what define the quality of financial reporting (Abed et al., 2022). However, a few more qualities are added to the essential ones required to create high-quality financial statements, including comparability and understandability (Rashid, 2020). Information must be categorized, described, and presented in a clear and succinct manner in such a way to be more easily understood (IASB, 2010). If the user does not understand what is being said, the information, no matter how important, is rendered useless.

The quality of information that allows users to discern similarities and differences between two sets of economic occurrences is referred to as comparability. It comprises consistency, which refers to using the same accounting standards and processes from period to period within a business or across entities in a single period (IASB, 2010). The importance of timeliness cannot be overstated information should be available to decision-makers before it loses its ability to affect those decisions. The length of time it takes for information to be given is referred to as timeliness, and it is critical in terms of assisting a decision-maker (IASB, 2010). The quality of financial reports is very important in an effort to maintain public trust by protecting accountability and transparency of public money and facilitating effective and efficient decision making. The high-quality financial reports enable stakeholders to use such information in evaluating the economic performance and expect that such information will assist them in measuring the soundness of the reporting entity and in making valid financial decisions (Kantudu, Alhassan, 2022).

2.1.3. Determinants of Quality of Financial Reporting

The elements influencing financial reporting quality are numerous and diverse. Accounting policies, the extent of disclosure, and management competence are some examples. All of these factors contribute to the overall financial reporting quality. Industry affiliation and company size are two important potential firm variables influencing quality (Bowrin, 2008). When it comes to industry association, the banking industry appears to have greater financial statement quality (Bowrin, 2008). Furthermore, it has been well documented that a company's size is directly related to the promptness and hence quality

of financial reporting (Owusu-Ansah, 2000). This is mostly due to the fact that larger organisations often retain the services of large audit firms, who have more resources and expertise (Bukenya, 2014).

Furthermore, it has been suggested that the quantity of information, which in this context refers to the number of financial analysts, has a major impact on the quality of financial statements. If the company is monitored by a large number of analysts, the quantity of information has a significant impact on the quality of the financial statements. Shkurti and Naqellari (2010) also state that one reason for low quality financial statements is a lack of third-party demand for financial information, and that a lack of professional experts and poor best practice incentives supported by authorities can lead to a lack of high-quality data. When evaluating financial statement quality, it is critical to examine the consequences of both international and national accounting standards. This is because, according to Latridis (2010), adopting IFRS standards leads to higher quality financial information, such as more timely loss recognition and less earnings management.

2.1.4. Relationships between IPSAS Adoption and Financial Report Quality

Accounting standards are important because they establish the standard for how essential company transactions are carried out. According to Clarke (2009), if accounting reports are not created in accordance with the standards, it is nearly hard to make meaningful comparisons between performance over different time periods and between businesses. According to Ochung (2017), increasing accounting quality could entail eliminating accounting practices that are not accurately representative of a company's performance and are used by executives to influence earnings. By minimising disparities in international accounting standards and unifying reporting formats, IPSAS can eliminate many of the changes that analysts have historically required to make in order to compare financial data worldwide.

This means that investors will incur less cost when comparing government financial data across markets and countries, resulting in an improvement in the public sector's agency problem, fewer information asymmetries among investors, and a reduction in estimation risk (Bradshaw et al. 2014). The elimination of these disparities in accounting rules facilitates cross-border acquisitions and divestitures, ultimately rewarding investors with higher takeover premiums. IPSAS was principally developed to guide government owned entities in preparing qualitative financial reports and proper implementation of IPSAS helps to boost the quality and reliability of reporting systems within government institutions (Brown, 2013). Opaniyi (2016) found out that IPSAS standard are essential in developing qualitative financial reports. Moreover, IFAC also recommended accrual basis of financial reporting to ensure consistency, comparability and enhance credibility of financial reports (Udeh, Sopekan, 2015).

2.2. Theoretical review

2.2.1. Legitimacy Theory

Legitimacy theory was propounded by John Dowling and Jeffrey Pfeffer in 1975. Legitimacy theory which is closely related to stakeholder theory focuses on the company’s interaction with the society. The theory states that organisations continuously try to ensure that they carry out activities in accordance with societal boundaries and norms (Deegan, Unerman, 2011). This means that the organisation is also part of the society where an organisation should pay attention to the norms that apply in the social community. Given

the position of administration in the public sphere, which is frequently perceived to be insecure due to administrators' unelected status, much time and attention has been devoted to defending the role and function of public administration. Such efforts have shifted over time, from a focus on neutrality, expertise, and experience as a reservoir of authenticity and value in the performance of official functions to an increasing need for administrators to be accountable on multiple levels for their attention to specific needs, potential to play a valuable interactive role with the public, and yet to remain true to old standards of administration as public opinion may still require (Pierre, 1993). Legitimacy is a condition showing cultural congruence, normative support, or compliance with relevant rules or laws, not a commodity to be held or transferred (Scott 1995).

For the public sector, legitimacy may be defined as the gap between administration's ability to implement policy and the public's expectations of administration (Pierre 1993). Government activities by elected authorities or administrators should serve a public purpose in public administration. Furthermore, the competence of an administrative agency to regulate in the public interest must always be based on a valid grant of authority. This could include constitutional and statutory grants and limitations that are subject to judicial interpretation, or if there is no clear view for or against whether an activity is permissible, an assessment can be made about whether the activity or policy is reasonably related to activities specifically authorised by law (Suchman, 1995). According to the notion of legitimacy, organisations endeavour to guarantee that they are viewed as working within the constraints and norms of their particular societies, that is, they attempt to ensure that their activities are perceived as “legitimate” by outside parties. These boundaries and standards are not set, but rather fluctuate through time, requiring organisations to be responsive to the ethical or (moral) context in which they operate (Deegan, Unerman, 2011). Legitimacy is a relative concept that varies depending on the social context in which the organisation functions, as well as time and place. For an organisation aiming to be viewed as legitimate, it is not the organization's actual behaviour that is significant; rather, it is what society collectively knows or perceives about the organization's behaviour that shapes the legitimacy.

Legitimacy theory evolved from organisational and social system theory, which sees organisations as complex components that must interact with their surroundings in order to exist (Guthrie, Petty, Ricceri, 2010). According to legitimacy theory, an organisation must maintain integration of its value system with that of the social system within which it operates in order to attain legitimate status, which is the approval and support of society and the elimination of threats to survival. In terms of government institutions, legitimacy theory focuses on how public officials operate in order to legitimise their acts (Mourao, Carmo, 2020). In this context, public officials are under pressure to divulge information in order to dispel any suspicions about their management, particularly if they face sanctions, such as if they are deemed inefficient or corrupt. As a result, when individuals take an active role in demanding accurate and complete information from them, they are more inclined to offer budgetary and financial information, as well as the reasons for their actions. In other words, when citizens are interested and able to participate in public affairs (monitoring Budget execution), the dissemination of public financial information by the government under specific norms can be considered as a step towards transparency and accountability. Accounting disclosure policies are viewed as a technique by legitimacy theory to impact the government entity's relationships with the other parties with which it interacts (Ismail, Adel, 2014).

2.3. Empirical Review

The research of Ababneh, Porretta and Hija (2019) analysed the impact of IPSASs implementation on the financial reporting and internal control system in UN agencies. The study of the participants comments revealed that IPSAS adoption enhanced the financial reporting of UN agencies, brought them in line with globally recognised standards, and made their financial statements clear and comparable among themselves. Furthermore, the deployment of IPSAS resulted in a better internal control mechanism for UN organisations. Similarly, Ambarchian and Ambarchian (2021) investigated the quality of IPSAS-based financial reports of intergovernmental organisations in Ukraine that have fully implemented the accrual method of accounting. The study database includes 20 financial reports that are estimated by 190 disclosure standards and grouped into 31 indicators. The qualitative characteristics of predictive value, completeness, neutrality, absence of material errors, timeliness, and verifiability, in particular, have been substantiated as significant, whereas the qualitative characteristics of confirmatory value, understandability, and comparability have been identified as insignificant and thus excluded from the model. Atuilik (2016) used a quasi-experimental design and Transparency International's (TI) Corruption Perception Index (CPI) of adopting governments for periods after the announcement of the adoption of IPSAS to investigate the relationship between the adoption of IPSAS and the country's perceived levels of corruption. The study discovered clear evidence that governments in developing countries that announce the adoption of IPSAS had higher scores on perceptions of corruption than non-adopting administrations. In developed countries, however, it was discovered that corruption perception does not differ much between governments that have embraced IPSAS and those that have not.

In the same vein, Akinleye and Alaran-Ajewole (2018) investigated the impact of IPSAS on information delivery in Nigeria. Data were sourced from 266 respondents from the Federal Ministry of Finance, FCT-Abuja, and the Ekiti State Ministry of Economic Planning and Budget, Ado-Ekiti, using a questionnaire. Ordinary Least Square Regressions were used to test the hypotheses, and the result shows that the introduction of International Public Sector Accounting Standards increased the quality of information transmission, hence improving accountability and transparency in the Nigerian public sector. Ofoegbu (2016) also investigated the new public management and accrual accounting basis for transparency and accountability in the Nigerian public sector. Questionnaires were administered to 112 public-sector auditors and accountants. Standard deviations, means, and Friedman's test statistics were used to analyse the data collected. The findings suggested that the adoption and implementation of IPSASs in the Nigerian public sector greatly improve transparency, albeit with certain challenges.

In conclusion, Shehu and Adamu (2019) investigated the difficulties encountered by first-time users of International Public Sector Accounting Standards (IPSAS) in Nigeria. Their research concentrated on a qualitative examination of Pre-IPSAS implementation. According to their findings, while converting to IPSAS, first-time users should expect to have to comply with the standard's requirements. The time commitment and resource needs required to conduct seminars and workshops for those concerned in an organization's financial concerns are significant challenges.

3. METHODOLOGY

This study examined IPSAS adoption in Ministries, Departments and Agencies (MDAs) in Ogun State western part of Nigeria. The descriptive survey research design

proposed by Cox and Hassard (2010) was used. The survey research design was utilised because it allowed for objectivity and accurate sampling of respondents' opinions. One hundred and ninety (190) accountants, internal auditors and cash officers made up the population while one hundred and twenty nine (129) respondents were purposively selected for sampling and one hundred and twenty one (121) questionnaires were successfully retrieved. Data generated through a well-structured questionnaire on the 5-point Likert scale of strongly disagreed (SD), disagreed (D), neutral (N), agreed (A) and strongly agreed (SA) were analysed using descriptive statistics.

4. RESULTS AND DISCUSSION OF FINDINGS

Table 1 depicts the descriptive statistics of respondents' opinion on financial reporting quality (FRQ). Results are presented using the major response levels and the respective mean response scores. Results of item 1 showed that majority of the respondents representing 39.7% and 45.5% strongly agreed and agreed that the financial reports in the organization prepared are complete, neutral, lack of material error, and can be verified. The mean response score of 4.17 with standard deviation 0.873 implies that the respondents agreed on the analysed item. From item 2, about 65% of the respondents agreed that their

Table 1. Descriptive Statistics of Financial Reporting Quality

s/n	Statements		SD	D	N	A	SA	Total	Mean [SD]
1	The financial reports your organization prepared are complete, neutral, lack of material error, and can be verified.	**f**	1	7	10	55	48	121	4.17
		%	.8	5.8	8.3	45.5	39.7	100.0	[.873]
2	Your organization prepares financial reports on time to meet the stipulated time frame as the National Treasury required	**f**	2	30	24	36	29	121	3.50
		%	1.7	24.8	19.8	29.8	24.0	100.0	[1.156]
3	The financial reports prepared by your organization shows high level of transparency and accountability to the users.	**f**	3	11	13	30	64	121	4.17
		%	2.5	9.1	10.7	24.8	52.9	100.0	[1.098]
4	Financial reports disclose financial and non-financial matters which help in decision making process	**f**	6	14	17	36	48	121	3.88
		%	5.0	11.6	14.0	29.8	39.7	100.0	[1.201]
5	Financial reports prepared by your organization contain relevant information that the users require	**f**	5	6	7	62	41	121	4.07
		%	4.1	5.0	5.8	51.2	33.9	100.0	[.985]
6	Financial reports prepared by the company is verifiable by the users	**f**	4	6	6	44	61	121	3.15
		%	3.3	5.0	5.0	36.4	50.4	100.0	[1.595]
7	Financial reports prepared by your organization is understandable by the users of such reports	**f**	5	12	8	46	50	121	3.94
		%	4.1	9.9	6.6	38.0	41.3	100.0	[1.171]
	Grand mean								**3.84**

Figures in [ ] represents standard deviation

Source: Researcher's Self Computation from Field Survey, 2024.

organization prepares financial reports on time to meet the stipulated time frame as required by the National Treasury as the mean response score of 3.50 with associated standard deviations 1.156 implies that the respondents agreed to the items analysed. Item 3 of the table also showed that majority of the respondents representing 52.9% strongly agreed that financial reports prepared by their organization show high level of transparency and accountability to the users as mean response score of 4.17 corroborate the frequency and percentage analysis.

On the analysis of item 4, the result shows that 39.7% of the respondents strongly agreed, 29.8% agreed, 14% were neutral, 11.6% disagreed while 5% strongly disagreed that financial reports disclose financial and non-financial matters which help in decision making process. The mean response score of 3.88 with associated standard deviation of 1.201 implies that the respondents agreed to the analysed items. Taking item 5 into consideration, result showed that majority of the respondents representing 51.2% agreed that financial reports prepared by their organization contain relevant information that the users require, 33.9% strongly agreed, 5.8% were neutral, 5% and 4.1% disagreed and strongly disagreed respectively. The mean response score of 4.07 implies that the respondents agreed on the analyzed item.

It cannot be overemphasized from item 6 that 50.4% strongly agreed, 36.4% agreed, 5% neutral, 5% disagreed while 3.3% strongly disagreed that financial reports prepared by the company is verifiable by the users. Mean response score of 3.15 with associated standard deviation 1.595 that the respondents were neutral on the opinion that financial reports prepared by the company is verifiable by the users. It is also evident in item 7 of the table that 41.3% and 38% of the respondents strongly agreed and agreed that financial reports financial reports prepared by the organizations is understandable by the users of such reports. 6.6% of them were neutral, 9.9% and 4.1% disagreed and strongly disagreed respectively. From the responses above, it can be deduced that responses emanating from financial reporting quality is high as a grand mean of 3.84 was recorded which is above the acceptable mean of 3.49. The respondents opined that financial reporting quality of Ministries, Agencies and Departments in Ogun State is within the specifications.

4.1. Answering Research Questions

RQ1. How does IPSAS adoption internal control mechanism impact quality of financial reporting of public sector in Nigeria?

Table 2 depicts the descriptive statistics of respondents' opinion on internal control mechanism. Result of item 1 indicated that 38.8% of the respondents strongly agreed that there are sufficient IPSAS adoption internal control mechanisms in their MDAs; 48.8% agreed, 1.7% were neutral, while 10.7% strongly disagreed. Mean response score of 4.02 indicated that the respondents agreed on the sufficiency in the adoption of internal control mechanisms. From item 2, finding also showed that the implementation of internal control mechanisms has helped to ensure compliance with IPSAS in their MDAs as 52.9% of the respondents agreed to the analysed item, 19% of them strongly agreed, 7.4% neutral, 10.7% disagreed and 9.9% strongly disagreed. The mean response score of 3.54 indicated that the respondents agreed on the analysed item.

On the analysis of item 3, 17.4% and 60.3% of the respondents strongly agreed and agreed that there are well established policies and procedures to address acceptable business practices, conflicts of interest and operational ethics which help in the implementation of IPSAS in your MDAs; 5.8% of them were neutral, 12.4% disagreed

while 4.1% strongly disagreed. The mean response score of 3.52 implies that the respondents agreed that provision of policies and procedures to address acceptable best practices, conflicts of interest and operational ethics were well established. Taking item 4 into consideration, 48.8% and 28.8% of the respondents strongly agreed and respectively agreed that internal control systems and processes in place provide for effective and efficient help in meeting the IPSAS adoption objective in their Ministry/Department/Agency; 28.9% of them agreed, 11.6% were neutral, 1.7% and 9.1% of the strongly disagree and disagreed respectively. The mean response score of 3.93 implies that the respondents agreed on the analyzed items.

Table 2. Descriptive Statistics of Respondents opinion on Internal Control Mechanism

s/n			SD	D	N	A	SA	Total	Mean [SD]
1	There are sufficient IPSAS adoption internal control mechanisms in your Ministry/Department/Agency	**f**	13	0	2	59	47	121	4.02
		%	10.7	.0	1.7	48.8	38.8	100.0	[1.088]
2	Implementation of internal control mechanisms has helped to ensure compliance with IPSAS in your Ministry/Department/Agency	**f**	12	13	9	64	23	121	3.54
		%	9.9	10.7	7.4	52.9	19.0	100.0	[1.310]
3	There are well established policies and procedures to address acceptable business practices, conflicts of interest and operational ethics which help in the\ implementation of IPSAS in your Ministry/Department/Agency	**f**	5	15	7	73	21	121	3.52
		%	4.1	12.4	5.8	60.3	17.4	100.0	[1.065]
4	Internal control systems and processes in place provide for effective and efficient help in meeting the IPSAS adoption objective in your Ministry/Department/ Agency	**f**	11	2	14	35	59	121	3.93
		%	9.1	1.7	11.6	28.9	48.8	100.0	[1.119]
5	Your Ministry/Department/Agency periodically reviews internal controls to determine weak areas and non-compliance.	**f**	4	16	6	58	37	121	3.79
		%	3.3	13.2	5.0	47.9	30.6	100.0	[.999]
6	There are challenges with implementation of IPSAS and internal control mechanisms in your Ministry/Department/Agency	**f**	8	3	10	72	28	121	3.60
		%	6.6	2.5	8.3	59.5	23.1	100.0	[1.288]
7	There are compliance benefits with the implementation of IPSAS and internal control mechanisms in your Ministry/ Department/Agency	**f**	8	2	15	47	49	121	3.74
		%	6.6	1.7	12.4	38.8	40.5	100.0	[1.201]
	Grand mean								**3.73**

Figures in [ ] represents standard deviation

Source: Researcher's Self Computation from Field Survey, 2024.

Taking item 5 into cognizance, it can be seen that majority of the respondents, representing 47.9% agreed that their MDAs periodically reviewed internal controls to determine weak areas and non-compliance; with 30.6% strongly agreed, 5% were neutral,

13.2% and 3.3% of them disagreed and strongly disagreed respectively. The mean response score of 3.6 implies that respondents agreed on the analyzed item. Item 6 of the table indicated that respondents agreed on the mean response score of 3.60 that there are challenges with implementation of IPSAS and internal control mechanisms in their MDAs. This is evident from 59.5% and 23.1% of the respondents agreeing to the statements. On the analysis of item 7, respectively, 38.8% and 40.5% of them agreed and strongly agreed that there are compliance benefits with the implementation of IPSAS and internal control mechanisms in their Ministry/Department/Agency; 12.4% of them were neutral, 1.7% and 6.6% disagreed and strongly disagreed. The mean response score of 3.74 with associated standard deviation 1.201 implies that ministry/department/agency have compliance benefits with the implementation of IPSAS and internal control mechanisms. From the responses above, it can be deduced that responses emanating from internal control mechanism is high as a grand mean of 3.73 was recorded which is above the acceptable mean of 3.49. The respondents opined that IPSAS adoption internal control mechanism impact positively quality of financial reporting of public sector in Nigeria.

RQ2. To what extent does IPSAS adoption audit committee affect financial reporting quality of public sector in Nigeria?

On the analysis of respondents' opinions on audit committee as a measure of IPSAS adoption, item 1 of Table 3 showed that 17.4% and 63.6% of the respondents strongly agreed and agreed respectively that the quality of oversight provided by audit committee determines the level of IPSAS adoption in their MDAs; 7.4% were neutral, 5.8% disagreed while 5.8% also strongly disagreed. This implies that majority of the respondent agreed on the analyzed item as the mean response score of 3.81 confirms the high level of agreement. From item 2, result indicated that majority of the respondents' representing 58.7% agreed that Audit Committee meets regularly to review financial statements and compliance with IPSAS adoption as 14% of them disagreed on the opinion analyzed. The mean response score of 3.76 also showed that the respondents were in agreement with the item.

Taking item 3 into consideration, majority of the respondents representing 92.5% were of the opinion that audit committee members have accounting and finance management skills plus necessary experience for effective oversight role. The mean response score of 4.13 with associated standard deviation 0.816 corroborate the results analyzed. Existence of audit committee has improved the quality of reporting as a result of ensuring there is strong internal control system and compliance with IPSAS adoption in the MDAs as opined by 78.2% of the respondents in item 4. The mean response score of 3.91 showed that the respondents agreed on the item analyzed. From item 5 of Table 2, it is indicated that 68.6% of the respondents opined that the audit committee reports were presented to the board of management for adoption and implementation by the management of their MDAs, 14.9% of them strongly disagreed while 8.3% disagreed. The mean response score of 3.37 indicated that the respondents neither agreed nor disagreed on the item analyzed.

On the result of item 6, majority of the respondents representing 57.9% agreed that audit committee ensures that all the implementations are effected by the management according to the board recommendations, 22.3% strongly agreed, 5% of them were neutral and 9.9% strongly disagreed. The mean response score of 3.78 indicated that the respondents agreed on the analyzed item. It cannot be overemphasized from item 7 that 35.5% strongly agreed, 42.1% agreed, 9.9% neutral, 5% disagreed while 7.4% strongly

Table 3. Descriptive Statistics of Respondents opinion on Audit Committee

s/n	Statements		SD	D	N	A	SA	Total	Mean [SD]
1	The quality of oversight provided by audit committee determines the level of IPSAS adoption in your Ministry/Department/Agency.	f	7	7	9	77	21	121	3.81
		%	5.8	5.8	7.4	63.6	17.4	100.0	[.986]
2	The Audit Committee meets regularly to review financial statements and compliance with IPSAS adoption	f	0	17	14	71	19	121	3.76
		%	.0	14.0	11.6	58.7	15.7	100.0	[.885]
3	Audit committee members have accounting and finance management skills plus necessary experience for effective oversight role	f	4	2	3	77	35	121	4.13
		%	3.3	1.7	2.5	63.6	28.9	100.0	[.816]
4	Existence of audit committee has improved the quality of reporting as a result of ensuring there is strong internal control system and compliance with IPSAS adoption in your Ministry/Department/Agency	f	0	16	8	68	29	121	3.91
		%	.0	13.2	6.6	56.2	24.0	100.0	[.913]
5	The audit committee reports are presented to the board of management for adoption and implementation by the management of your Ministry/Department/Agency.	f	18	10	10	75	8	121	3.37
		%	14.9	8.3	8.3	62.0	6.6	100.0	[1.198]
6	The audit committee ensures that all the implementations are effected by the management according to the board recommendations	f	12	6	6	70	27	121	3.78
		%	9.9	5.0	5.0	57.9	22.3	100.0	[1.151]
7	The Audit Committee has contributed to the improvement of financial reporting in your Ministry/Department/Agency since the adoption of IPSAS	f	9	6	12	51	43	121	3.93
		%	7.4	5.0	9.9	42.1	35.5	100.0	[1.153]
	Grand mean								**3.83**

Figures in [ ] represents standard deviation

Source: Researcher's Self Computation from Field Survey, 2024.

disagreed that the audit committee has contributed to the improvement of financial reporting in their MDAs since the adoption of IPSAS. Therefore, from the responses above, it can be concluded that IPSAS adoption taking audit committee into consideration is high as a grand mean of 3.83 was recorded which is above the acceptable mean of 3.49. The respondents opined that IPSAS adoption audit committee has directly impacted the quality of financial reports of ministries in Nigeria.

RQ3. What influence does IPSAS adoption environment have on financial reporting quality of public sector in Nigeria?

Table 4 depicts the opinion of respondents on IPSAS adoption environment in relation to financial reporting quality. Result of item 1 of the table indicated that 38.8% of the respondents strongly agreed, and 48.8% agreed that there is sufficient awareness among finance and internal audit staff regarding the International Public Sector Accounting

Standards adoption, as 10.7% of them strongly disagreed and 1.7% neither agree nor disagree this also implies from the mean response score of 4.05 that respondents agreed on the analysed item. On item 2, it can be seen that 19% of the respondents strongly agreed, 52.9% of them agreed, 7.4% neutral, 10.7% disagreed while 9.9% strongly disagreed that their Ministry/ Department/ Agency has adopted IPSASs according to the National Treasury circulars, policies and guidelines. The result is in line with the mean response of 3.6 recorded, which implies that majority of the respondents opined to the statement analysed. Item 3 of the table showed that majority of the respondents also opined on mean response score of 3.74 that the management of their MDAs has provided full support for the adoption of IPSASs in terms of resources and staff training. This is in line with 77.7% of the respondents who agreed and strongly agreed to the analysed item.

Table 4. Descriptive Statistics of Respondents Opinion on Adoption environment in relation to Financial Reporting Quality

s/n			SD	D	N	A	SA	Total	Mean [SD]
1	There is sufficient awareness among finance and internal audit staff regarding the International Public Sector Accounting Standards adoption	f	13	0	2	59	47	121	4.05
		%	10.7	.0	1.7	48.8	38.8	100.0	[1.175]
2	Your Ministry/Department/Agency has adopted IPSASs according to the National Treasury circulars, policies and guidelines.	f	12	13	9	64	23	121	3.60
		%	9.9	10.7	7.4	52.9	19.0	100.0	[1.201]
3	The management of your Ministry/ Department/Agency has provided full support for the adoption of IPSASs in terms of resources and staff training.	f	5	15	7	73	21	121	3.74
		%	4.1	12.4	5.8	60.3	17.4	100.0	[1.021]
4	Your Ministry/Department/Agency has qualified staff that are involved in the adoption of IPSASs	f	11	2	14	35	59	121	4.07
		%	9.1	1.7	11.6	28.9	48.8	100.0	[1.223]
5	IPSAS adoption has brought about reduction in fraud, mismanagement, and corruption in public sector entities since the adoption of IPSAS	f	4	16	6	58	37	121	3.89
		%	3.3	13.2	5.0	47.9	30.6	100.0	[1.086]
6	IPSAS standards have made it easier for you to understand financial reports of public sector entities in Nigeria	f	8	3	10	72	28	121	3.90
		%	6.6	2.5	8.3	59.5	23.1	100.0	[1.003]
7	There have been improvements in the budgetary control and financial management processes of public sector entities in Nigeria since IPSAS adoption	f	8	2	15	47	49	121	4.05
		%	6.6	1.7	12.4	38.8	40.5	100.0	[1.094]
	Grand Mean								**3.90**

Figures in [ ] represents standard deviation

Source: Researcher's Self Computation from Field Survey, 2024.

From item 4, it can be evidenced that their MDAs have qualified staff that are involved in the adoption of IPSASs. This is as opined by 77.7% of the respondents who agreed and strongly agreed to the analyzed item. The mean response score of 4.07 which is above the threshold of 3.49 indicated that the respondents agreed to the analyzed item. Item 5 of the

table also showed that majority of the respondents representing 78.5% were of the opinion that IPSAS adoption has brought about reduction in fraud, mismanagement, and corruption in public sector entities while 5% of them were neutral, 13.2% disagreed and 3.3% of the respondents strongly disagreed. The mean response score of 3.89 indicated that the respondents agreed that their ministry/department/agency periodically reviews internal controls to determine weak areas and non-compliance. On the result of item 6, it is indicated that 23.1% and 59.5% strongly agreed and agreed respectively that IPSASs have made it easier for them to understand financial reports of public sector entities in Nigeria. While 8.3% of them was neutral, 2.5% and 6.6% disagreed and strongly disagreed respectively.

The mean response score of 3.90 is above the threshold of 3.49 which implies that respondents opined to the analysed items as there are challenges in the implementation of IPSAS and internal control mechanisms in the state ministries and parastatals. Lastly, item 7 of the table also indicated that respondents agreed based on the mean response score of 4.05 that there have been improvements in the budgetary control and financial management processes of public sector entities in Nigeria since IPSAS adoption as the percentage of respondents in agreement is high. From the responses in Table 4, it can be concluded that IPSAS adoption environment is high as a grand mean of 3.90 was recorded which is above the acceptable mean of 3.49. This implies that IPSAS adoption environment may have a positive influence on the financial reporting quality of public sector in Nigeria. This is as a result of the quality put in place in the preparation of the public sector reports.

RQ4. How does IPSAS adoption transparency and accountability enhance financial reporting quality of public sector in Nigeria?

Table 5 depicts the descriptive statistics of respondents' opinion on transparency and accountability in relation to financial reporting quality. Results indicated from items 1–7 that majority of the respondents were of the opinion that every staff in their MDAs is familiar with the adoption of IPSAS in the Nigerian public sector (mean response score = 4.02); that IPSAS adoption has increased transparency and accountability in the Nigerian public sector (mean response score 3.54); that IPSAS adoption improved the accuracy and reliability of financial reporting in the Nigerian public sector (mean response score 3.52); that there is an increase in stakeholders' trust regarding the financial information disclosed in public sector entities' financial reports due to IPSAS adoption (mean response score 3.93); that IPSAS adoption has positively affected the governance of public sector entities in Nigeria (mean response score 3.79); that the adoption of IPSAS has led to more effective decision making by stakeholders in the Nigerian public sector (mean response score 3.60) and that implementation of IPSAS has enhanced the efficiency of accounting practices in the public sector entities (mean response score 3.74).

Similarly, the frequency and percentage analysis of the scaled items were also presented as it justifies the mean response scores. From the responses above, it is evident that responses emanating from IPSAS adoption transparency and accountability are high as a grand mean of 3.73 was recorded which is above the acceptable mean of 3.49. This implies that IPSAS adoption transparency and accountability influence financial reporting quality of public sector in Nigeria. The findings of this study align with the results of the studies conducted by Ababneh, et al. (2019); Ambarchian and Ambarchian (2021); Akinleye and Alaran-Ajewole (2018), Izueke et al. (2020) and Shehu and Adamu (2019) who found that the adoption of International Public Sector Accounting Standards increased the quality of

information transmission, hence improving accountability and transparency in the Nigerian public sector.

Table 5. Descriptive Statistics of Respondents Opinion on IPSAS Adoption Transparency and Accountability in relation to Financial Reporting Quality

s/n			SD	D	N	A	SA	Total	Mean [SD]
1	Every staff in your Ministry/ Department/ Agency is familiar with the adoption of International Public Sector Accounting Standards (IPSAS)	f	7	7	7	56	44	121	4.02
		%	5.8	5.8	5.8	46.3	36.4	100.0	[1.088]
2	IPSAS adoption has increased transparency and accountability in the Nigerian public sector	f	18	8	12	57	26	121	3.54
		%	14.9	6.6	9.9	47.1	21.5	100.0	[1.310]
3	IPSAS adoption improved the accuracy and reliability of financial reporting in your entity	f	15	1	18	80	7	121	3.52
		%	12.4	.8	14.9	66.1	5.8	100.0	[1.065]
4	Because of IPSAS adoption, there is an increase in stakeholders' trust regarding the financial information disclosed in your entity's financial reports	f	8	6	14	52	41	121	3.93
		%	6.6	5.0	11.6	43.0	33.9	100.0	[1.119]
5	IPSAS adoption has positively affected the governance of your entity.	f	5	8	21	60	27	121	3.79
		%	4.1	6.6	17.4	49.6	22.3	100.0	[.999]
6	The adoption of IPSAS has led to more effective decision making by stakeholders in your organisation.	f	16	8	14	54	29	121	3.6
		%	13.2	6.6	11.6	44.6	24.0	100.0	[1.288]
7	The implementation of IPSAS has enhanced the efficiency of accounting practices in your organisation.	f	14	3	13	61	30	121	3.74
		%	11.6	2.5	10.7	50.4	24.8	100.0	[1.201]
	Grand Mean								**3.73**

Figures in [ ] represents standard deviation

Source: Researcher's Self Computation from Field Survey, 2024.

5. CONCLUSION AND RECOMMENDATIONS

The impact of IPSAS adoption on financial reporting quality of public sector in Ogun state Nigeria was examined. Precisely, it analysed the impact of IPSAS adoption internal control mechanisms, audit committee, environment, transparency and accountability on credibility and comparability of financial reporting. One hundred and twenty one (121) questionnaires were successfully retrieved from a sample of one hundred and twenty nine (129) respondents. The descriptive results indicated that IPSAS adoption exerted positive influence on financial reporting quality. It is therefore recommended that engaging stakeholders, including citizens, policymakers, and auditors, is crucial in promoting the adoption of IPSAS and ensuring the quality of financial reports. Similarly, regular communication and consultation with stakeholders will facilitate the alignment of financial reporting practices with IPSAS. The strengthening of the institutional framework for compliance monitoring, as well as the legal and regulatory framework, to improve financial reporting quality.

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FINANCIAL FLOWS AND SOCIAL SUSTAINABILITY DEVELOPMENT IN NIGERIA

The three inter-related pillars of sustainable development have been neglected by the United Nation which informed examining the impact of financial flows on the attainment of quality education (Goal 4). The study employed time-series data sourced from Central Bank Statistical Bulletin and World Development Indicator from 1991 to 2022. The auto-regressive distributed lag was employed to determine the short and long-run relationship between the outcome and explanatory variables. The findings revealed that remittances and external debt had a positive significant effect on primary school enrolment rate, while government expenditure on education had a negative significant effect on primary school enrolment rate. It is therefore recommended that government should ensure transaction cost does reduce remittances and ensure external debt and government expenditure on education are expended to educational sector to improve primary school enrolment rate.

Keywords: financial flows, social sustainability development, external flows, internal flows.

1. INTRODUCTION

The attainment of development is a function that ensures, the absorptive capacity of all the micro-agents in the economy sustains such development now and in the future because that is when development and growth can be attained holistically. Development is strategic, inclusive, and multi-dimensional in its attainment, because it warrants the buoyancy of all the agents in the economy's circular flow of income, to be desirous of sustaining growth. It is against this backdrop that locates the African continent, to be a crawling and stifling continent, being weighed in the achievement of its sustainable development goals (Akanle, 2014). The neglect of the country pushing towards resolving its visible developmental

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challenges has a spill-over effect on other developed countries who intend to take advantage of the labor availability and density in the knowledge bank that can be an asset to developed economies and multi-national organisation, due to the increase in the level of world globalization (Akanle, 2014; Sachs, Schmidt, Kroll, Lafortune, Fuller, Woelm, 2020).

The development mantra of "Sustainable development" was launched in United Nations in 1987, after World War II. A report was published titled "Our Common Future" by the World Conference on Environmental and Development. The published article defined sustainable development as the proponent that ensures that future generation can meet their own economic, social, and environmental needs when the need of the present generation is also met now (Voica, Panuait, Haralambie, 2015; WCED, 1987). The United Nations leader at that conference determined that development should be captured from the standpoint or pillars of economic sustainability, environmental sustainability, and social sustainability, not only that but development that would be sustainable must have international and national specifics.

However, the household/people remain a germane component towards the attainment of social sustainable development goals in Nigeria. Sustainable Development report forecasted that sixty million Africans could suffer from poverty and food security, while about one hundred and ten million African children may not have lucid primary education and a good healthcare system at their disposal, to improve their social status. (Bamidele, Elumah, Adelowokan, 2022; Olanrewaju, 2022; World Bank in Nigeria, 2022). According to the World Bank report of 2022 which reported that four people out of twenty individuals in the country live below the national poverty line. These are worrisome facts and figures that show the importance of the country chunking out financial options that would help the country reduce the menace of poverty, improve the health infrastructure and propel the educational quality of the people toward the attainment of goal one to four of the sustainable development goals. (Bamidele, et al, 2022; Olanrewaju, 2022; World Bank in Nigeria, 2022; SOS, 2022).

This makes the attainment of quality education which is goal four of the interrelated goals, from the sustainable development goals that was rolled out in 2015, due to the un-attainment and lack of funding options of the goals in 2020 and still present in the 2015 agenda that is expected to be achieved by developed, developing and emerging countries on or before 2030. To remedy, this social sustainable plague, the government in various stages and political level had either subsidized or directly funded the educational sector in Nigeria. Available data on public expenditure in education revealed that between 2005-2007 and 2011- 2020, the percentage of it was around 6.3%, 7.8%, 8.7%, 9.3%, 9.86%,10.1%, 10.5%, 10.7%, 7.9% and 7.4% respectively (Nenbee, Danielle, 2021). It still shows a poor level of funding, towards the improvement of attainment of primary school education in Nigeria.

Based on this above premises, this study examines into the effect of financial flows (external and internal) towards the attainment of social sustainability measured with the primary school enrolment rate in Nigeria.

2. LITERATURE REVIEW

Theoretical review

Human Capital Theory

The theory emphasizes the importance of investment in education and technical skills for individual productivity (Becker, 1962; Schultz, 1961). It posits that investing in the education of the population leads to increased productivity, efficiency, and comprehensive socio-economic development. Schultz (1961) describes the human capital theory as focusing on educational investment to achieve socio-economic development goals. Education is considered a productive force within the economy, influencing factors such as social progress, productivity, growth, and technological innovation (Becker, 1994; Benhabib, Spiegel, 1994). From this perspective, education is seen as a deliberate investment that enhances the labor force, boosts individual and organizational productivity, and drives national development and growth. Human capital theory suggests that individuals make various investment decisions based on their educational capital. Financial inflows into a country can support higher educational attainment and health improvements, which are crucial channels for development. Increasing foreign inflows, especially remittances, can alleviate financial and credit constraints, thus promoting productive investment. Remittances, in particular, have a positive effect on educational investment in children by easing credit constraints and reducing household risk, enabling families to invest more in education (Ali Baret et al., 2022).

Empirical review

Onyekwelu (2022) examined international capital inflows and human capital development in Nigeria. Other specific objectives is to investigate the effect of foreign portfolio investment on human capital development in Nigeria, examine the effect of external debt stock on human capital development in Nigeria, determine the effect of foreign direct investment on human capital development in Nigeria, access the effect of official development assistance on human capital development in Nigeria. The study adopted an *ex-post facto* research design because the data for the study are secondary data which were sourced from the Central Bank of Nigeria (CBN), Statistical Bulletin and Annual reports and Statement of Accounts, The data were analyzed with econometric techniques involving descriptive statistics, Augmented Dickey Fuller Tests for Unit Roots and the Ordinary Least Square (OLS). The result of the study indicates that foreign portfolio investment, external debt stock, foreign direct investment and official development assistance has positive and significant effect on human capital development index (HDI). The study concludes that international capital inflow has positive effect on human capital development in Nigeria within the period under review. In line with the objective of the study, the study recommends that, there is the need for greater foreign participation in the stock market which could enhance foreign portfolio investment in the country and maintain sustainable human capital development. External debts should be contracted solely for economic reasons and not for social or political reasons. An effective policy should be made based on the fiscal and monetary policies which should be aimed at achieving a realistic foreign direct investment in human capital development in Nigerian. Since theories have supported that these capital channels should boost human capital development in Nigerian, it is pertinent that Nigeria government should investigate the spending pattern of the funds obtained through official development assistance.

Oloke, Olabisi, Johnson, Awofala and Aderemi (2022) examines into the nexus between foreign capital inflows and human capital development in Nigeria spanning from 1990 to 2020. This study relied on secondary data which was sourced from the World Development Indicators. Consequently, the FMOLS method was utilized to analyze the data. The findings revealed that trade openness has a negative and significant relationship with human capital development. In the same vein, FDI and portfolio investment have a significant inverse relationship with human capital development in Nigeria. However, official development assistance has a direct relationship with human capital development, the relationship is significant at 10 percent level of significance. And exchange rate has a positive and significant relationship with human capital development. Both external debt and remittances have insignificant positive relationship with human capital development in Nigeria. In a nutshell, the majority of the inflows of foreign capital in Nigeria have a significant and negative relationship with human capital development in this study. Steaming from the above findings, this study recommends that the policymakers in Nigeria should deploy the inflows of foreign capital in the direction of the human development oriented programmes in the country.

Olowookere, Olowo, Mabinuori and Aderemi (2021) investigated into the examining the contributions of the different components of foreign capital inflows in driving one of the key goals of sustainable development-poverty reduction in Nigeria. In achieving the objective of this study, annual data between 1990 and 2019 were utilized with the application of FMOLS and Granger causality technique of estimation. The findings of this research work are as follows; firstly, foreign capital inflows and poverty reduction have a long run equilibrium relationship in Nigeria. Furthermore, there is a unidirectional causality flowing from poverty reduction to foreign direct investment. Poverty reduction Granger causes foreign portfolio investment. Also, feedback relationship exists between poverty reduction and remittances. This implies that poverty reduction is a strong factor causing the inflows of foreign capital such as FDI, FPI and remittances in Nigeria. Moreover, the majority of the components of foreign capital inflows such as FDI, FPI and remittances contributed immensely to the reduction of poverty in Nigeria. This implies that foreign capital inflows have the capacity to propel the achievement of Sustainable Development Goal one poverty reduction in Nigeria. Therefore, this study makes the following recommendations for the policymakers in Nigeria and by extension Africa that, any time these policymakers set to achieve Sustainable Development Goal one i.e poverty reduction, foreign capital inflows such as remittances, foreign portfolio investment, FDI and external debt should be given priority in their country. And such, the policy that facilitates the sporadic inflows of these variables should be embarked upon by the Nigerian policymakers in particular and African policymakers in general.

Amaefule (2020) examines into the impact of the dynamical nature of foreign direct investment inflow and official development assistance inflow on growth and trade indicators in Ghana and Nigeria. Secondary data sourced from Word development indicators for the period covering 1970 to 2017 were utilized. The Nonlinear ARDL Bound F-test showed a long-run relationship between global capital inflow and growth and trade. Particularly, positive rise in foreign direct inflow would generate capital inflows and growth and trade. A positive rise on foreign direct investment positive impact on real gross domestic product in Ghana and a negative impact on real gross domestic product in Nigeria. It also shows that foreign direct investment in Nigeria would generate positive foreign aid causes a positive impact on real gross domestic product.

Mohamed (2020) investigated into the dynamic relationship between foreign capital inflows on economic growth of Mediterranean countries2 over the period 1980–2018 Foreign direct investment (FDI) and official development aid (ODA) were used as a main source of capital inflow in this study. A standard growth model are estimated using panel co-integration approach. In addition, both fixed-effects and random effects models were used to check for the significant of the parameters. Panel unit root are employed to check for the efficiency of the data. The long run relationship is estimated using fully modified OLS and: Panel Dynamic Least Squares (DOLS) methods. The empirical results reveal that there exist a long run co-integrating relationship between foreign aid, FDI and economic growth in Mediterranean countries. The results of FMLOS and DOLS show that FDI ODA variables are positive and have significant impact on the long run growth of the Mediterranean economy. Further, fixed – effects method is selected as random effect model is rejected based on Hausman test result. The results of fixed effect show that FDI and Foreign aid variables ate positive and statistically significant. As a policy recommendation the study, suggest that proper absorptive capacity should be met in order to attract FDI and ODA such as sound macroeconomic policies, good institutions, deep financial institution, low inflation rate and supplementing public expenditures.

Ehigiamusoe and Lean (2019) examines the impact of foreign capital inflows on economic growth in Nigeria for 1980–2015 period. It employs Autoregressive Distributed Lagged (ARDL)-bounds test, and finds a co-integration relationship between foreign capital inflows and growth. Specifically, foreign portfolio investment has positive impact on growth, while the impact of foreign loans is negative. Nevertheless, foreign direct investment and foreign aid have insignificant impact on growth, suggesting that Nigeria cannot rely on foreign direct investment and foreign aid as vehicles to stimulate growth. Rather, an increase in foreign portfolio investment or reduction in foreign loans has beneficial effects on the economy.

Lozi and Shakatreh (2019) investigated into the impact of international capital flows on the economic growth in Jordan during the period from 2005 to 2017, the study also examines trends and composition of capital inflows. The study used descriptive analytical research method which was appropriate for the purpose of research. By using time series data, the study found that Foreign Direct Investment (FDI), foreign portfolio investment (FPI), grants (Gr) and Worker remittances (WR) are positively affecting the economic growth direct contribution. Based on the research results, the study came with a several recommendations, the most important recommendation is; the government of Jordan should create and relax the rules and regulations to attract more investors, and also the government should work hand in hand with the developed countries to create economic and employment opportunities, improve the country's competitiveness, and expand growth within the private sector so that everyone in Jordan has the opportunity to contribute to a brighter future.

Adams and Klobodu (2018) examines into the differential effects of capital flows on economic growth in five Sub-Saharan African (SSA) countries over the period 1970–2014. Using the autoregressive distributed lag methodology, the findings show that in the long-run capital flows (i.e. foreign direct investment (FDI), aid, external debt, and remittances) have different effects on economic growth. FDI has a significant positive effect in Burkina Faso and negative effects in Gabon and Niger whereas the impact of debt is negative in all countries. Aid, however, promotes growth in Niger and Gabon whiles it deters growth in Ghana. Remittances, on the other hand, have a significant positive effect in Senegal. Finally, gross capital formation is significant in most of the countries and the impact of

trade is mixed. These results suggest that the benefits of capital flows in SSA have been overemphasized.

Klobodu and Adams (2016) examines into the differential effects of capital flows on economic growth in Ghana over the period 1970–2014 using autoregressive distributed lag (ARDL). Breakpoint unit root tests are employed to cater for structural change and breaks in time series. Afterwards, these break dates are fed into the ADRL model as dummy variables to allow for the computation of a more robust cointegrating vector. The findings indicate that in both the short and long run capital flows (i.e. FDI, aid, and external debt) have negative effects on economic growth. However, remittances exhibit positive insignificant elasticity in all the regressions. Further, the empirical results show that while the impact of trade, gross capital formation and population growth on growth are mixed, that of inflation is negative. The results of the study are consistent with the idea that the impact of capital flows in Africa has been exaggerated.

Rehman and Ahmad (2016) investigated into the effect of foreign capital inflow variables to analyze their impact on economic growth of 21 developing countries for the period of 1990 to 2013. Modern econometric techniques are applied for data analysis including panel unit root test and pooled mean group (PMG) estimation for short-run and long-run analysis. The results indicate that inflows including net external debt and net official development assistance have significantly negative impact on economic growth of developing countries, while net foreign direct investment and net remittances have positive and significant impact on economic growth in the long-run. The negative sign of error correction term shows the convergence of the variables towards equilibrium in the long-run. The study highlights the need of allocation of foreign resources effectively and efficiently.

Nwosa and Akinbobola (2016) investigated into the role of macroeconomic policies (monetary, fiscal and trade policies) in the relationship between capital inflows (proxy by foreign direct investment, foreign aid and international workers' remittances) and economic growth in Nigeria for the period 1970 to 2013. The study employed Autoregressive Distributed Lag (ARDL) Bound co-integration technique. The study found that macroeconomic policy plays a fundamental role in the relationship between capital inflows and economic growth in Nigeria.

Adamu, Kabuga and Suleiman (2015) investigated into relationship between remittances, aid, foreign direct investment, financial development and economic growth. The study employed the ARDL bounds test for co-integration using the annual time series over the period of 1977 to 2014. The findings revealed that in the short run remittance and aid have negative and statistical significant effects on growth in the country. On the other hand, Foreign Direct Investment has a positive and statistically significant effect on growth. These relationships are also true in the long run albeit not statistically significant. The study concludes that Foreign Direct Investment and financial development are important determinants of economic growth in Nigeria. These findings highlight the importance of improving financial deepening in the toolkit of Nigeria's economic policy and underpin the reasoning behind giving capital inflows a prominent role in the development strategy of the country.

3. METHODOLOGY

The secondary was sourced from the world development index and Central Bank statistical bulletin of 2022. The social sustainability was measured with primary school

enrolment. The external financial flows was capture from external flows of foreign direct investment, remittances, foreign aids, external debt and Net export and the internal flows were captured from the government expenditure on health, government expenditure on education. The Auto-regressive distributed lag (ARDL) model was used to draw inference after the stationary test gave the validity in other not to violate Engel Granger (1949).

Linear Representation:

$$PS_t = (\beta_0 + \beta_1 FDI_t + \beta_2 FA + \beta_3 Rem_t + \beta_4 NetE + \beta_5 ExtD_t + \beta_6 GEE + \beta_7 GEH_t + \varepsilon_t)$$

The Auto-regressive Distributed Lag (ARDL) approach by Pesaran, Shin, and Smith (2001) is used for testing the existence of co-integration relationship and error-correction estimation. The ARDL approach is been applied to the exogenous and endogenous variables of a different order of co-integration (Pesaran and Pesaran, 1997). This approach allows the estimation of short and long-run parameters concurrently. The short-run (error-correction model) model and the long-run model (co-integration model) of the ARDL model equation can be specified below is written as:

$$\begin{aligned}\Delta LPS_t = \rho\varrho_{t-1} + \sum_{i=1}^{q} \alpha_{1i}\, \Delta LPS_{t-i} + \sum_{i=0}^{q} \alpha_{2i}\, \Delta LFDI_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\, \Delta LFA_{t-i} + \\ + \sum_{i=0}^{q} \alpha_{4i}\, \Delta LRem_{t-i} + \sum_{i=0}^{q} \alpha_{5i}\, \Delta LNetE_{t-i} + \sum_{i=0}^{q} \alpha_{6i}\, \Delta LExtD_{t-i} + \\ + \sum_{i=0}^{q} \alpha_{7i}\, \Delta LGEE_{t-i} + \sum_{i=0}^{q} \alpha_{8i}\, \Delta LGEH_{t-i} + \beta_1 LFDI_{t-1} + \beta_2 LFA_{t-1} + \\ + \beta_3 LRem_{t-1} + \beta_4 LNetE_{t-1} + \beta_5 LExtD_{t-1} + \beta_6 LGEE_{t-1} + \beta_7 LGEH_{t-1} + \varepsilon_t\end{aligned} \tag{3.1}$$

The short-run model (Error-correction model):

$$\begin{aligned}\Delta LPS_t = \rho\varrho_{t-1} + \sum_{i=1}^{q} \alpha_{1i}\, \Delta LPS_{t-i} + \sum_{i=0}^{q} \alpha_{2i}\, \Delta LFDI_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\, \Delta LFA_{t-i} + \\ + \sum_{i=0}^{q} \alpha_{4i}\, \Delta LRem_{t-i} + \sum_{i=0}^{q} \alpha_{5i}\, \Delta LNetE_{t-i} + \sum_{i=0}^{q} \alpha_{6i}\, \Delta LExtD_{t-i} + \\ + \sum_{i=0}^{q} \alpha_{7i}\, \Delta LGEE_{t-i} + \sum_{i=0}^{q} \alpha_{8i}\, \Delta LGEH_{t-i} + \varepsilon_t\end{aligned} \tag{3.2}$$

The Long-run model (co-integration model):

$$\begin{aligned}\Delta LPS_t = \gamma_o + \beta_1 LFDI_{t-1} + \beta_2 LFA_{t-1} + \beta_3 LRem_{t-1} + \beta_4 LNetE_{t-1} + \\ + \beta_5 LExtD_{t-1} + \beta_6 LGEE_{t-1} + \beta_7 LGEH_{t-1} + \varepsilon_t\end{aligned} \tag{3.3}$$

PS= primary school enrolment rate, FDI= foreign direct Investment, FA= Foreign Aid, Rem= Remittances, NetE= Net export, ExtD= External Debt, GEE= Government expenditure on Education, GEH: Government expenditure on health, $\rho\varrho_{t-1}$ is the lagged error correction term for equation 3.1–3.3 and $\alpha_1 - \alpha_7$ are the short-run coefficient and $\beta_1 - \beta_8$ are the long-run parameter for that explanatory variables, t is the time period in the inquiry, ε_t are the error term.

Table 1. Description of Variables

S/N	Description	Unit	Source
1	Foreign Direct Investment (FDI)	₦' Billion	CBN Statistical Bulletin (2022)
2	Foreign Aid (FA)	US Dollars	World Development Indicators (2022)
3	Remittances (Rem)	US Dollars	World Development Indicators (2022)
4	External Debt (ExtD)	US Dollars	World Development Indicators (2022)
5	Net Export (NetE)	US Dollars	World Development Indicators (2022)
6	Government Expenditure on Health	₦' Billion	CBN Statistical Bulletin (2022)
7	Government Expenditure on Education	₦' Billion	CBN Statistical Bulletin
8	Primary School enrolment rate	Percent (rate)	World Development Indicators (2022)

Source: Author's Compilation, 2023.

4. RESULTS

The above table depicts the descriptive statistics used in the study. PS (Primary School enrolment rate), has a mean value of 1.95%, a median value of 1.95%, and a Standard deviation has a variation of 0.03. FDI (Foreign Direct Investment) has a mean value of 3.48%, a median value of 3.54%, and a Standard deviation has a variation of 0.65. FA (Foreign aid) has a mean value of 8.99%, a median value of 9.25%, and a Standard deviation has a variation of 0.57. REM (Remittances) has a mean value of 3.66%, a median value of 2.99%, and Standard deviation a variation of 2.25. Ext D (External Debt) has a mean value of 3.28%, a median value of 3.21%, and Standard deviation a variation of 0.53. NetE (Net export) has a mean value of 6.62%, a median value of 6.91%, and a Standard deviation of a variation of 0.61. GEH (Government expenditure on health) has a mean value of 1.95%, a median value of 2.01%, and a Standard deviation of a variation of 0.42. GEE (Government expenditure on education) has a mean value of 2.05%, a median value of 0.38%, and a Standard deviation has a variation of 0.34. TAXR (Tax revenue) has a mean value of 2.91%, a median value of 3.10%, and a Standard deviation has a variation of 0.64.

The skewness in the variable includes; PS (Primary School enrolment rate) indicates a short-tailed (negative skewness) at -0.15. FDI (Foreign Direct Investment) indicates a short-tailed (negative skewness) at -0.40. FA (Foreign aid) indicates a short-tailed (negative skewness) at -0.12. REM (Remittances) indicates a long-tailed (positive skewness) at 0.06. ExtD (External debt) indicates a long-tailed (positive skewness) at 0.63. NetE (Net export) indicates a short-tailed (positive skewness) at -0.85. GEH (Government expenditure on health) indicates a short-tailed (negative skewness) at -0.21. GEE (Government expenditure on education) indicates a positive-tailed (positive skewness) at 0.07.

Table 2. Descriptive Analysis

	PS	EXT_DEBT	FDI	FOR_AID	GEE	GEH	NET_EXPT	REMIT
Mean	1.955200	3.281089	3.483937	8.994511	2.160876	1.957320	6.628978	3.661185
Median	1.952970	3.212587	3.546409	9.257645	2.137101	2.010938	6.919588	3.998536
Maximum	2.009060	4.534918	4.593828	10.05812	2.596487	2.507382	7.299083	8.333830
Minimum	1.890217	2.642356	2.155943	8.181815	1.600755	1.350319	5.313048	0.118105
Std. Dev.	0.032912	0.530335	0.657173	0.577609	0.342817	0.387844	0.616041	2.252081
Skewness	-0.152258	0.630027	-0.405812	-0.126114	0.072610	-0.211088	-0.853167	0.063689
Kurtosis	2.191063	2.447183	2.371540	1.540015	1.342765	1.519025	2.563353	1.885666
Jarque-Bera	1.151793	2.445565	1.361025	2.835434	3.574708	3.063212	4.007054	1.624871
Probability	0.562201	0.294410	0.506357	0.242266	0.167403	0.216188	0.134859	0.443776
Sum	72.34241	101.7138	108.0021	278.8298	66.98715	60.67692	205.4983	113.4967
Sum Sq. Dev.	0.038996	8.437666	12.95629	10.00897	3.525710	4.512684	11.38519	152.1560

Note; PS (Primary School enrolment rate), FDI (Foreign direct investment), FA (Foreign aid), EXTD (External debt), REM (Remittances), NetE (Net export), GEE (Government expenditure on education) and GEH (Government expenditure on health).
Author's Compilation, 2023.

Source: E-view 10.

Table 3. Correlation Matrix

	PS	NET_EXP	GEH	GEE	FOR_AID	FDI	EX_DEBT	REMI
PS	1.000000							
NET_EXPORT	-0.367239	1.000000						
GEH	-0.456215	0.668813	1.000000					
GEE	-0.772439	0.670670	0.616078	1.000000				
FOREIGN_AID	0.289270	0.638019	0.688810	0.652149	1.000000			
FDI	-0.998311	0.683226	0.670475	0.685242	0.618368	1.000000		
EXTERNAL_DEBT	-0.489366	0.724541	0.603118	0.646547	0.541298	0.642482	1.000000	
REMITTANCES	-0.299923	0.601788	0.601117	0.715019	0.602570	0.769184	0.440442	1.000000
TAXR	0.33752	0.652798	0.689127	0.799851	0.633372	0.981283	0.889142	0.783942

Author's Compilation, 2023.

Source: E-view 10.

The Kurtosis in the variable include: PS (Primary School enrolment rate) is leptokurtic at 2.19, since (2.19>3), FDI (Foreign Direct Investment) is leptokurtic at 2.37, since (2.37<3), FA (Foreign aid) is leptokurtic at 1.54, since (1.54<3), REM (Remittances) is leptokurtic at 1.88, since (1.88<3), ExtD (External Debt) is leptokurtic at 2.44, since (2.44<3), NetE (Net export) is leptokurtic at 2.56, since (2.56<3), GEE (Government expenditure on health) is leptokurtic at 1.51, since (1.51<3), GEE (Government expenditure on education) is leptpkurtic at 1.34, since (1.34<3), TAXR (Tax revenue) is leptokurtic at 2.12, since (2.12<3).

The table 3 above show is the correlation matrix table that helps to test for multicollinearity among the outcome and explanatory variables. The multicollinearity of 0.90 shows to be very high and would generate spurious results if used for any ordinary least square estimation. The above shows that the relationship between the variables in is below the threshold of 0.90. The explanatory variables of net export, foreign direct Investment, external debt and remittances has a negative relationship with PS (Primary School enrolment rate) while foreign aid and tax revenue has positive relationship with PS (Primary School enrolment rate) in Nigeria.

Table 4. Unit Root Analysis

Variable	Level T-Stat	Critical Value @ 5%	First Difference T-stat	Critical Value @ 5%	Prob	Order of Integration
PS	-3.540	-3.7777	-1.9506	-3.57434	0.0007	I(I)
FDI	-1.8819	-3.56837	----------	----------	0.0013	I(0)
FA	-2.34611	-3.5875	-5.3015	-3.5806	0.0010	I(1)
REM	-2.6000	-3.5683	----------	----------	0.0000	I(0)
EXTD	-1.50601	-3.5742	-3.7468	-3.5742	0.0349	I(I)
NEtE	-1.7390	-3.5683	-5.5735	-3.5742	0.0005	I(I)
GEE	-2.6623	-3.5683	-5.8412	-3.5742	0.0002	I(I)
GEH	-1.9051	-3.5683	-6.4024	-3.5742	0.0001	I(I)

Author's Compilation, 2023.

Source: E-view 10.

The Augumented Dickey-Fuller unit root results which are a pre-estimation test, help to give direction on the actual econometrics analysis that would be suitable for drawing inferences for the outcome and explanatory variables in the model specification. The FDI (Foreign Direct Investment) and the REM (Remittances) are both stationary at level I(0). PS (Primary School enrolment rate), FA (Foreign aid), ExtD (External debt), NetE (Net export), GEE (Government expenditure on education) and GEH (Government expenditure on health) are stationary at the level I(I). Based on the order of integration of the variables, the ARDL (Auto-regressive distributed lag) technique was used to investigate both short and long-run relationships. This has to be followed, so as not to validate the position of Granger 1957, in drawing inference from faulty unit root expressions.

Table 5. Lag Length Selection Criteria

Lag	LogL	LR	FPE	AIC	SIC	HQ
0	7.443178	NA	1.43e-10	0.031818	0.387327	0.154540
1	208.4053	298.5723	6.25e-14	-7.794587	-4.595014*	-6.690095
2	305.3240	99.68782*	1.77e-14*	-9.675657*	-3.632018	-7.589393*

Author's Compilation 2023.

Source: E-view 10.

The table 5 showed different lag length criterion (LR, FPE, AIC, SIC and HQ). The Akaike information criterion depicting lag order length of (II) for the model is selected. After establishing the lag order length, the ARDL, short and long-run equation results were estimated and explained in the below.

Table 6. Autoregressive Distributed Lag (ARDL)

Dependent Variable: Primary School Enrolment rate (PS)

Variable	Coefficient	Std. Error	t-statistic	Prob
PS(-1)	0.626748	0.156806	3.996963	0.0004
FDI	0.002879	0.025199	0.114252	0.9099
FA	0.006035	0.020972	0.287772	0.7757
REM	0.002193	0.004407	0.497702	0.6227
NETE	-0.009983	0.027647	-0.361090	0.7208
EXTD	0.027077	0.009406	2.878768	0.0077
GEE	-0.021012	0.034814	-0.603538	0.5512
GEH	-0.004661	0.030911	-0.150797	0.8813
C	0.691228	0.297349	2.324635	0.0279
R-squared	0.6407		Mean dependent	1.9547
Adj R-squared	0.5343		S.D dependent	0.0332
F-statistic	6.0208		Durbin-Watson	1.5204
Prob(F-statistic)	0.0001			

Author's Compilation 2023

Source: E-view 10.

The previous PS (-1) has positive significant effect on PS. FDI has positive insignificant effect on PS. FA has positive insignificant effect on PS. REM has positive insignificant effect on PS. NETE has negative insignificant effect on PS. ExtD has positive significant effect on PS. GEE has negative insignificant effect on PS. GEH has negative insignificant effect on PS. The Durbin Watson value of 1.5 shows low presence of serial auto-correlation among the explanatory variables in the model. The measure of the goodness of fit, R^2, shows that 64% variation in the dependent variable can be explained by the independent variable leaving 36% unexplained. The Adjusted R-square depicted that if additional variable is added to the independent variable, the independent variable will still be able to explain at 53% variation in the dependent variable. The F-statistics (6.0208) which is greater than its prob (F-statistics) 0.0001 at 5% level of significance indicated that the linear relationship between the independent and dependent variables were statistically significant.

The ARDL bound test is an improvement on the ARDL modelling which makes use of both F and t-statistics to test the significance of the lagged level of the variable in a univariate equilibrium correction system when it is difficult to ascertain whether the time series data is trend or first difference stationary. ARDL Bound test helps to ascertain whether there is long-run co-integration relationship between the dependent variable PS and the independent variables FDI, FA, REM, EXTD, NETE, GEE and GEH.

Table 7. Bound Test Result

t-statistics	Value	K	I(0)	I(1)
F-statistics	11.74759	7	2.32	3.5

Bound test at 5% level of significance

Source: E-view 10.

The table 7 above revealed the bound test result. The result of the F-statistics value which is 11.74759 is higher than the lower bound and the upper bound values of 2.32 and 3.5 respectively at 5% level of significance. This implies that there is a long-run relationship among the variables was accepted and the alternative hypothesis was rejected. Therefore, there is a long-run co-integration among the variables.

Table 8. Co-integration Form

Variable	**Coefficient**	**Std-Error**	**t-Statistic**	**Prob**
D(FDI)	0.002879	0.025199	0.114252	0.9099
D(FA)	0.006035	0.020972	0.287772	0.7757
D(REM)	0.002193	0.004407	0.497702	0.6227
D(NETE)	-0.009983	0.027647	-0.361090	0.7208
D(EXTD)	0.027077	0.009406	2.878768	0.0077
D(GEE)	-0.021012	0.034814	-0.603538	0.5512
D(GEH)	-0.004661	0.030911	-0.150797	0.8813
ECM(-1)	-0.373252	0.156806	-2.380341	0.0246

Author's Compilation 2023

Source: E-view 10.

The table 8 explained the short-run relationship between financial flows, expansionary fiscal measures and primary school enrolment rate in Nigeria. The results shows that the speed of adjustment from an earlier disturbance away from the long run identified by the CointEq(-1) is negative and significant with a coefficient estimate of -0.3732. The value of the error correction term is -0.3732 depicts the deviation from the long-run equilibrium in one year is corrected by 37%. These outcomes further validates the presence of long-run relationship among the variables in the model. At the speed of adjustment of 37%, there is a short-run relationship among external financial flows, fiscal policy and primary school enrolment rate.

Table 9. Long run Coefficients

Variable	Coefficient	Std-Error	t-Statistic	Prob
FDI	0.007713	0.068651	0.112355	0.9114
FA	0.016169	0.054899	0.294532	0.7706
REM	0.005877	0.012473	0.471163	0.0413
NETE	-0.026746	0.078805	-0.339390	0.7369
EXTD	0.072544	0.035373	2.050811	0.0201
GEE	-0.056293	0.082971	-0.678474	0.0032
GEH	-0.012488	0.084720	-0.147408	0.8839
C	1.851907	0.490849	3.772865	0.0008

Author's Compilation 2023.

Source: E-view 10.

The table 9 above reveals the long-run relationship between financial flows, expansionary fiscal measures and primary school enrolment rate in Nigeria. Foreign direct investment has a positive insignificant effect on primary school enrolment rate in Nigeria. Foreign aid has a positive insignificant effect on primary school enrolment rate in Nigeria. Remittances has a positive significant effect on primary school enrolment rate in Nigeria. Net export has a negative insignificant effect on primary school enrolment rate in Nigeria. ExtD has a positive significant effect on primary school enrolment rate in Nigeria. Government expenditure on education has a negative significant effect on primary school enrolment rate in Nigeria. Government expenditure on health has a negative insignificant effect on primary school enrolment rate in Nigeria.

In terms of magnitude, the interpretation is important due to the fact that the model is a log-log model, in such cases the functional form should be considered (Asteriou, Hall, 2011). A percentage increase in foreign direct investment will lead to 0.00 unit increase in primary school enrolment rate. A percentage increase in foreign aid will lead to 0.01 unit increase in primary school enrolment rate. A percentage increase in remittances will lead to 0.00 unit increase in primary school enrolment rate. A percentage increase in net export will lead to -0.02 unit decrease in primary school enrolment rate. A percentage increase in external debt will lead to 0.07 unit increase in primary school enrolment rate. A percentage increase in government expenditure on education will lead to -0.05 unit decrease in primary school enrolment rate. A percentage increase in government expenditure on health will lead to -0.01 unit decrease in primary school enrolment rate.

Table 10. Diagnostic Test for Financial flows and Social Sustainability in Nigeria

Test	Value	Prob
Jarque-Bera Normality Test	2.0648	0.3561
Serial Correlation LM Test	8.1780	0.8117
Breausch-Pagan-Godfrey Heteroskedasticity Test	0.3604	0.9177

Author's Compilation 2023.

Source: E-view 10.

The diagnostic test conducted includes the Jarque-Bera Normality test, Serial correlation LM Test and Breausch-Pagan-Godfrey Heteroskedasticity Test to ensure the

model is in tandem with respective econometric properties. The Table 10 above depicts the Jarque-Bera Normality Test shows an insignificant results, indicating that the residual of the regression estimate was distributed normally. The F-statistics value obtained from the serial correlation LM Test and heteroskedasticity test were insignificant, depicting that no presence of serial autocorrelation and heteroskedasticity in the regression estimate residual. The conclusion of this findings is that the model were estimated correctly.

Stability Test

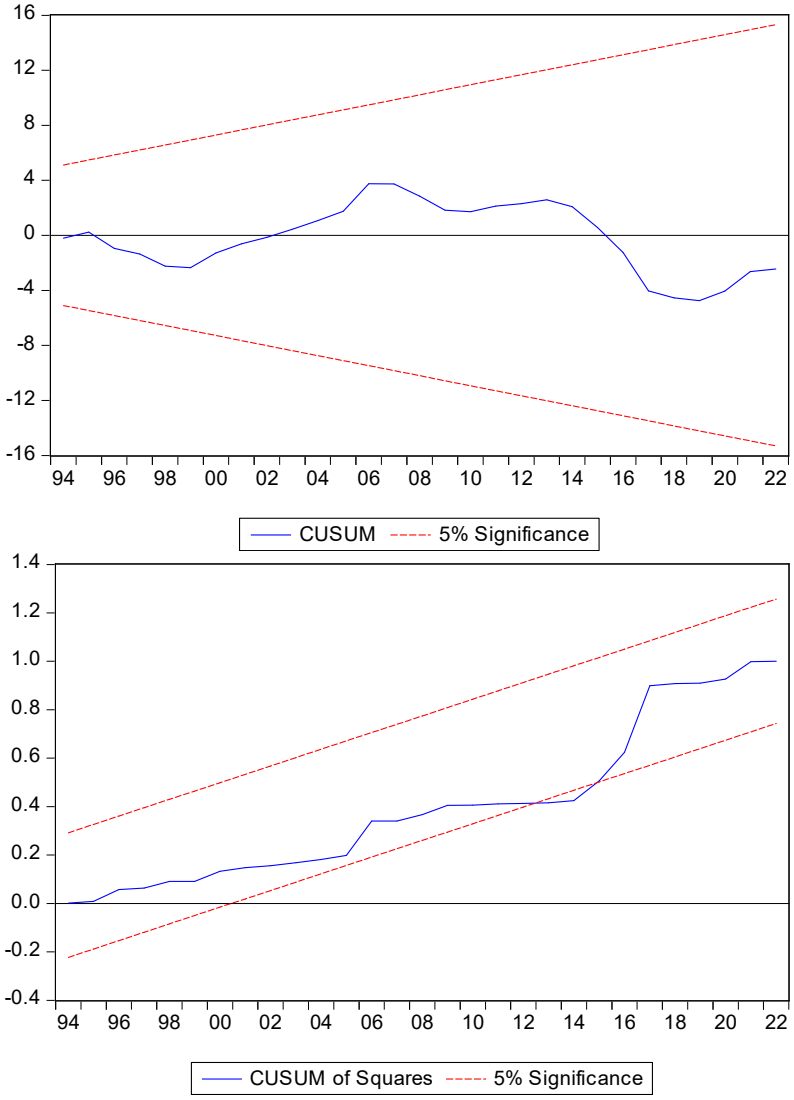

Figure 1. Stability Test (CUSUM) Test and (CUSUM) of Squares test
Source: E-view 10.

The stability test results showed that the model estimates were within the critical boundaries of a 5% level of significance. The results employs that the model is dynamically stable and the inference drawn from it are reliable for policy formulation.

5. DISCUSSION

The findings revealed that remittances and external debt has a positive significant effect on primary school enrolment rate while government expenditure on education has a negative significant effect on primary school enrolment rate in Nigeria. This suggests that financial inflows from remittances and external borrowing provide critical resources that facilitate access to primary education, potentially by alleviating household financial constraints and enabling investments in educational infrastructure. Conversely, government expenditure on education is found to have a negative and significant effect on primary school enrollment rates. This counterintuitive result may indicate inefficiencies in the allocation or utilization of educational funds, such as mismanagement, corruption, or a misalignment between government spending priorities and the actual needs of the educational sector. These findings highlight the complex dynamics of education financing in Nigeria and underscore the need for more effective policy interventions that not only increase access to funding but also ensure that these funds are used efficiently to improve educational outcomes. Addressing the inefficiencies in government spending could be crucial in reversing the negative impact on enrollment rates and achieving the desired educational goals in Nigeria. the findings above agree with the work of olowookere et al (2021), that remittances and external debt are inflows that can help in the reduction of poverty level in nigeria, niching on the ideology that increase in primary school enrolment would aid the reduction of poverty level, because it would aid the literacy level of populace and them been employable in the economy. The study also agree with the works of ur rehman, ahmed (2016), Klobodu, Adam (2016), adam, klobodu (2018) and lozi, shakatreh (2019). Particularly, the works of nwosa, akinbobola (2016) indicates the importance of government expenditure on education has a tool in improving the educational sector in the economy which is a holistic view of the educational sector.

6. CONCLUSIONS

Based on the above findings the government should consider leveraging the positive impact of remittances and external debt by creating policies that facilitate the flow of remittances and ensure that external borrowing is directed towards improving educational infrastructure and access. For example, remittance programs could be incentivized by reducing transaction costs, making it easier for families to receive funds that could support their children's education. Notably, the negative impact of government expenditure on education suggests a need for a thorough review of how educational funds are allocated and spent. The government should prioritize transparency and accountability in the education sector, ensuring that funds are efficiently used for their intended purpose, such as improving school facilities, providing learning materials, and training teachers. Additionally, the government could engage in public-private partnerships to enhance the efficiency and effectiveness of educational spending. By collaborating with private organizations, the government can draw on additional resources and expertise to address gaps in the education system. Finally, regular monitoring and evaluation should be implemented to assess the impact of educational spending and adjust policies as needed to ensure that they contribute positively to primary school enrollment rates.

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ENTREPRENEURIAL EDUCATION AND INTENTIONS A MODERATED MEDIATION MODEL EXPLORING GENDER DYNAMICS AND GOVERNMENTAL INFLUENCE IN ALGERIA

This study investigates the complex interplay between entrepreneurial education (EE), entrepreneurial intention (EINT), gender dynamics, and governmental support within the specific context of Algerian higher education. Employing a moderated mediation model and a quantitative approach with a sample of 273 university students, the research reveals nuanced insights into the factors shaping students' aspirations for entrepreneurship. While EE positively influences EINT, the impact is significantly modulated by governmental financial assistance, indicating its crucial role in translating entrepreneurial education into practical intent. However, counter to conventional expectations, the study demonstrates that gender does not significantly moderate the EE-EINT relationship within this context. These findings contribute to the ongoing debate on the effectiveness of entrepreneurship education and highlight the necessity of tailored support systems that take into account specific regional, economic, and cultural contexts. Our study advances the current literature by uniquely combining gender and governmental support as crucial moderators, addressing an important research gap, especially in emerging economies.

Keywords: entrepreneurial education, entrepreneurial intention, gender, government assistance, Algeria.

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1. INTRODUCTION

Today, *EE* plays a vital role in fostering economic development, promoting *EINT*, and enhancing human competitiveness in uncertain conditions (Haijun, Wang, 2023). The importance of entrepreneurship education in fostering creative minds and advancing societal and economic progress has been brought to light in this setting, which has led to the introduction of legislation and resources to assist college students in being entrepreneurs (Guo, Wu, 2022). Liang-Mei and Yang (2023) show that governments have to focus on the main component of higher education standard, which are the innovation and the *EE*, in order to develop the country's educational, social, and economic conditions.

EE has a beneficial effect on students' inclinations to become entrepreneurs, according to research studies done by Shofwan et al. (2023) and Nafid et al. (2023). Furthermore, students' perspectives on entrepreneurship and their family background have positive effects on their intentions to become entrepreneurs (Nabi, G and all, 2017). A key function of *EE* is to encourage students to pursue entrepreneurial endeavors while enrolled in university (Nanang, et al., 2023)

EINT is a crucial factor in motivating and influencing entrepreneurial actions. Personal attitude, subjective norms, perceived behavioural control, and education are some of the characteristics that impact *EINT* (Muhammad, et al.2023; Laila, et al. 2023). These elements help business students think like entrepreneurs and foster their ambitions to start their own companies (Daryal, et al., 2023). Another paradigm that can be used to explore the interaction between *EINT*, attitudes, norms, perceived control, and theory of planned behaviour is the entrepreneurial event model (Bagus, et al., 2022). Hence, college students' entrepreneurial aspirations are bolstered by entrepreneurship instruction.

Existing research indicates that *EE* increases the capacity of individuals to assimilate knowledge and stimulates their interest in entrepreneurship (Nor, et al.2023). *EE* can also cultivate and enhance potential entrepreneurs by providing them with the necessary knowledge, skills, and mindset (Li. Li, 2023). Having an indirect impact on the intention to start a business (Hoang et al., 2020). Nevertheless, the reason behind certain students' persistent lack of entrepreneurial aspirations following *EE* is still a mystery. Research on what causes entrepreneurship education's impacts to be so variable is urgently needed.

Christina et al. (2022) identify gender factor as one that affect *EE*, and they confirm that there are significant differences in the performance outcomes of entrepreneurship courses based on the gender composition of student teams. In addition, mixed-gender teams tend to perform better than one gender teams, both in terms of grades for their business plans and in attracting interest in their ideas (Wei, 2023). Furthermore, research indicates that *EE* and *EINT* are positively correlated, with male students outperforming female students in some aspects of *EINT* (Maheshkuma et al., 2023). These results emphasise the significance of incorporating gender dynamics into *EE* and encouraging mixed-gender teams in order to improve performance outcomes (Jose et al., 2022). It is still unknown, though, how this relationship affects *EINT* in combination with external factors like education. We hypothesise a positive moderating effect because, despite the fact that female entrepreneurs are less successful than male entrepreneurs, gender diversity in the workplace can benefit entrepreneurship. In other words, a diversity of genders in the workplace can result in a diversity of perspectives and experiences, which can inspire new ideas. Additionally, gender diversity can result in a more welcoming and encouraging workplace, which can foster the growth of entrepreneurs.

Additionally, research has indicated that *EE* does indeed increase the likelihood that students will engage in entrepreneurial activities; nevertheless, male students tend to score higher on some measures of *EINT* than their female counterparts (Maheshkuma et, al., 2023). How this link interacts with other variables, such as education, to impact the intention to start a business, meanwhile, is still not well understood. We postulate a positive moderating effect since gender diversity in the workplace can positively affect entrepreneurship, even if men have frequently been demonstrated to play a more significant role in the entrepreneurial process. What this means is that gender diversity in the workplace can spark new ideas by bringing in a wider range of perspectives and experiences. Another way that gender diversity can help entrepreneurs succeed is by creating a more welcoming and supportive workplace.

Government support is essential to promoting *EINT* (Trang, 2023; Acha et, al. 2023; Kristi et al., 2022; Jinzi et al., 2022). Studies have shown that government interventions, such as financial support, have a significant impact on generating entrepreneurial interest (Hazliza et al., 2022).

A major barrier to student entrepreneurship is the absence of start-up funding and other resources (Wright et al., 2006). From here, it can be argued that government support for entrepreneurship education programs and university support can influence students' intention to become entrepreneurs. Policymakers and educators have a greater responsibility to create a supportive environment for entrepreneurship, providing incentives, and developing entrepreneurial skills to foster a more entrepreneurial community.

The significance of *EE* in inspiring college students to launch their own companies is well-documented, there is limited quantitative analysis of how government support affects this relationship. The fact is that not all countries can provide the necessary support for entrepreneurship (Abdulaziz et al., 2020).

Students who study entrepreneurship are more conscious of the financial strains and hazards involved in launching a business. Students from poor countries may fear that these risks will place an additional burden on their countries, which may reduce their intention to start businesses. (Milenko et al., 2013; Linas et al., 2023). That is why we argue those university students' *EINT* and *EE* are positively correlated, with a moderate beneficial effect of government funding support. Put simply, the level of government backing directly correlates to the effectiveness of *EE* in inspiring students to pursue entrepreneurial endeavors.

This study is based on the basic hypothesis that *EE* enhances individuals' desire to start their businesses. The study also explores the factors that affect the effectiveness of *EE* in achieving this goal. The researcher tested the hypothesis on a sample of 273 university students at the University Centre of Maghnia who received *EE*. It was found that government funding strengthens the association between *EE* and entrepreneurial ambition, but that depending on just one gender, men in particular, weakens this effect.

Multiple contributions are made by this study. Firstly, this study contributes to our understanding of how *EE* affects students' intentions to start their businesses. Specifically, by looking at how gender and government support play a moderating role, we see that these two variables can greatly affect how effective entrepreneurship programs are. Additionally, research has indicated that men are more likely to be the ones to launch new businesses than women are. This is likely attributable to the fact those men are naturally more entrepreneurial, more naturally gifted as leaders, and more naturally inclined to take the initiative (Regina et al., 2023).

However, this study reveals the importance of gender mixing in the exchange of ideas, opinions, creativity, and innovation, which contributes to creating an entrepreneurial environment that developing countries aspire to. Third, we highlight the significance of government support in entrepreneurship. Most university students look forward to government support, especially government funding, to start their businesses due to the lack of sufficient income (Egidius et al., 2023). Findings from this study imply that students in low-income nations may be less likely to take risks, even if they have a greater understanding of and practice entrepreneurship. Economic risks that the government can be exposed to can be an obstacle to taking the step of starting a business.

By looking at how gender, government financing support, and *EINT* are related, this study fills a need in the literature. According to Sun et al. (2020), it also addresses the need to evaluate how *EE* affects students' individual characteristics.

2. LITERATURE REVIEW

2.1. Entrepreneurial education

EE is a system that pursuits to broaden people's awareness, understanding, self-esteem, and capability to apprehend, check, and execute business opportunities (Yang, Q and all, 2022). It goes past conventional commercial enterprise schooling and focuses on building entrepreneurial competencies that decorate adaptability and competitiveness (Heliona et al., 2023). Entrepreneurship schooling is a discipline that has increased to encompass the development of students' entrepreneurial attitudes and abilities, supporting them in becoming independent and flexible individuals with an entrepreneurial spirit (Haijun, Wang, 2023).

It includes training teachers in unique competencies, techniques, and equipment to inspire self-belief, flexibility, leadership, and initiative in freshmen (Lila et, al.2022). Entrepreneurship training also plays a role in the transformation and upgrading of industrial structures and assuaging the employment problem of college students (Birdthistle et al., 2023).

2.2. Intention entrepreneurship

Entrepreneurial purpose refers back to the willingness and hobby of individuals, mainly college students, to pursue entrepreneurship and launch new businesses. It is taken into consideration as a critical aspect within the development of an entrepreneurial way of life and is a sturdy predictor of entrepreneurial conduct (Ramazan et al, 2023; Laila, et al., 2023). Factors influencing entrepreneurial aim encompass perceived desirability, perceived feasibility, propensity to behave, exposure to hit entrepreneurs, palms-on revel in, entrepreneurship-centered education, entry to investment and mentorship, supportive and inclusive surroundings, crucial questioning and problem-solving skills, and non-stop gaining knowledge (Suadi et al., 2022; Fahmi et al., 2022). The Theory of Planned Behaviour (TPB) is often used to determine *EINT*, focusing on attitudes closer to conduct, subjective norms, and perceived behavioural control (Mahir et al., 2020).

EE has a wonderful affiliation with college students' *EINT* (Rindi et al., 2023). Students who've taken extra entrepreneurial guides document better degrees of *EINT* (Nafid et al., 2023). Entrepreneurial mastering has a vast fine predictive effect on the *EINT* of college students (Xuchen et al., 2023). The consequences propose that entrepreneurial training performs an essential position in promoting *EINT* among students (Thi et al., 2023). The findings additionally imply that *EE* can enhance college students' talents and

entrepreneurial competence, main to better *EINT*. Overall, those studies highlight the significance of entrepreneurial training in shaping college students' *EINT* and endorse the need for designing guides and programs that promote entrepreneurial passion and offer sensible skills. Based on this premise, this study presents the initial research hypothesis:

H_1: There is a strong and favorable correlation between EE and EINT.

2.3. Gender, entrepreneurial intentions, and entrepreneurial education

In light of the sociocultural context, gender may significantly stimulate EI. Despite the global surge in female entrepreneurship, empirical evidence suggests that women have significantly fewer opportunities to initiate their projects than males (Mwobobia, 2012). Several factors deter women from pursuing entrepreneurial careers, one of which is the limited availability of opportunities for women in regions where entrepreneurship is dominated by gender-based norms that consider it to be a male-dominated domain (Verheul et al., 2012).

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Equally, some students have claimed that women have much lower EI than men (Langowitz and Minniti, 2007). Alternatively, research by other scholars has shown that gender is no longer a factor in EI (Indarti, Rokhima, 2008; Yao et al., 2016). The myriad ways in which people own views, values, and aspirations in the workplace manifest themselves likely contribute to this (Koellinger et al., 2013). As a result, these different impacts demonstrated that gender is not yet a conventional predictor of EI.

H_2. Gender significantly moderates the EE – EINT relationship where males have a Stronger Relationship than Females.

2.4. The role of government support as a moderator between courses on entrepreneurship and the desire to start one's own business

The relationship between *EE* and entrepreneurial inclination is moderated by government finance support (Tamer et al., 2022). While the Vietnamese study found no direct effect of *EE* on *EINT*, it did find an indirect effect through entrepreneurial self-efficacy and components of the idea of deliberate conduct (private mindset, subjective norm, perceived behavioural control) (Maheshwari, Linh Khan, 2022).

Similarly, some other look at performed in Saudi Arabia showed that college incubators, which offer economic aid as a dimension of aid, have a fully mediated relationship with entrepreneurship goals through a non-public attitude (Kulikova, 2023). These findings advocate that government financing assistance, as part of entrepreneurial schooling, plays a critical position in shaping *EINT* by influencing non-public attitudes and self-efficacy (Jinzi et al., 2023; Hazliza et al., 2022). Based on these grounds, the subsequent hypothesis is put forward.

H_3. Government Financing Support moderates EE – EINT relationship

The three hypotheses mentioned before make up the research model of the study.

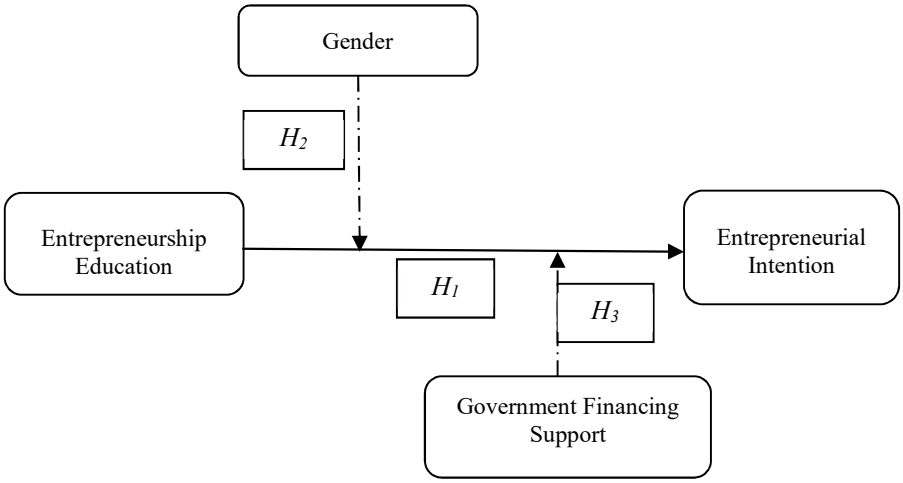

Figure 1. Research Model

Source: Prepared by researchers based on Study Hypotheses.

3. METHODOLOGY

3.1. Data collection and sample

This study employed a descriptive research design to rigorously investigate the complex relationships between entrepreneurial education (EE), entrepreneurial intention (EINT), and the moderating influence of university support within the specific context of the University Centre of Maghnia in Algeria. A stratified random sampling strategy, informed by the LR Gay formula, was meticulously applied to select a representative sample from a population of over 1,500 students. This process ensured proportionate representation across different academic levels and disciplines. Following rigorous data cleaning protocols, a final dataset of 273 valid responses was secured from a self-designed Likert-scale questionnaire, which had been diligently pre-tested to ensure both validity and reliability. The careful in-person administration of these questionnaires by the researcher directly to the participants resulted in a remarkably high response rate of 96.46%, minimizing the potential for non-response bias. Data analysis was subsequently performed using SPSS (version 26), employing appropriate parametric statistical procedures to assess the relationships between the variables. The demographic composition of the sample was as follows: 54.6% of respondents were male, while a substantial majority were enrolled in master's programs (69.4%), and were majoring in economic and administrative sciences (65.3%), with the vast majority falling within the 20-30 age bracket (90.3%). This comprehensive and methodologically robust approach, which includes careful sampling, rigorous data cleaning, and analysis of relevant demographic factors, ensures the credibility, reliability, and generalizability of the subsequent findings and their potential contribution to the academic discourse on entrepreneurship in higher education (Refer to Table N°01).

According to L. R. Gay's guidelines for selecting sample sizes for research studies:

1. For small populations (N < 100), survey the entire population.
2. For populations around 500, sample about 50% (250 participants).
3. For populations around 1,500, sample about 20% (300 participants).
4. For populations over 5,000, a sample size of 400 should be adequate.

For your specific case with 3,500 students, following Gay's guidelines, you would need approximately 350–360 participants (around 10% of the population) to ensure a representative sample.

Table 1. shows the Demographic Attributes of Respondents

Variable	Category	Frequency	(%)
Gender	Male	145	53,4
	Female	128	46,6
Education Level	Master's Student	189	69,4
	Licens's Student	84	30,6
Age	20-30	245	90,3
	30-40	22	08,1
	40 or more	06	01,6
Major	Economic and Management Major	152	55,8
	Engineering Major	56	20,6
	Humanities and Social Sciences Major	65	23,6

Source: Prepared by researchers based on the results of statistical processing using SPSS.

3.2. Data analysis

Anjum et al. (2022) employed PLS-SEM via SmartPLS4 to test the direct and indirect relationships of the different latent variables. We started by drawing out the test version, which is where we checked the validity and reliability of the constructs. We checked for dependability using Cronbach's alpha and composite reliability (CR). We have tested it for validity by looking at its convergent and discriminant validity. According to Henseler et al. (2014), the appropriate constraint is 0.70, and Table 2 shows Cronbach's alpha and CR values that are more than that. According to Table 2 (Hair et al., 2017), convergent validity was determined by checking that the common variance extracted (AVE) price was more than 0.50. The Hetrotrait - Monotrait (HTMT) ratio, the Fornell and Larcker (1981) criterion, and the cross-loadings were computed to guarantee discriminant validity. According to Table 03, all of the devices had pass loadings more than 0.7, which is the ideal threshold limit. The construct's correlation coefficient must be lower than the square root of AVE, as suggested by Fornell and Larcker (1981).

According to Table 2, the correlation cost for each assembly is higher than the square root of AVE in this investigation. Following the recommendation of (Henseler et al., 2015), the HTMT ratio (Table 3) should be less than 0.9. This solves the issue of discriminatory validity.

Table 2. Construct reliability and convergent validity

Construct	Items	Loading	Alpha	CR	AVE
EE	EE1	0,886	0,668	0,750	0,603
	EE2	0,736			
	EE3	0,639			
	EE4	0,753			
	EE5	0,748			
	EE6	0,877			
INT	INT1	0,880	0,719	0,789	0,570
	INT2	0,710			
	INT3	0,700			
	INT4	0,729			
	INT5	0,708			
	INT6	0,818			
SUP	SUP1	0,893	0,815	0,868	0,562
	SUP2	0,811			
	SUP3	0,788			
	SUP4	0,747			
	SUP5	0,718			
	SUP6	0,733			

Source: Prepared by researchers based on PLS-Smart outputs.

Table 3. Discriminant validity (Fornell–Larcker criterion)

	EE	INT	Gender	SUP
EE	0,775			
INT	0,292	0,755		
Gender	0,137	0,143	1,000	
SUP	0,361	0,436	0,331	0,779

Source: Prepared by researchers based on PLS-Smart outputs.

There was no issue with multicollinearity in this study because the variance inflation factor (VIF) values for each construct were lower than the threshold of 5 (Hair et al., 2017), which is used to analyze potential issues of collinearity. Afterward, the model was evaluated using several metrics. The standardized root mean square residual (SRMR) value is 0.053, which is below the good fit criterion of 0.08 (Hu and Bentler, 1999). Another metric to examine for model fit is the normed fit index (NFI), which should have a value near 1. A good model fit is attained because both SRMR and NFI are satisfied, with an NFI value of 0.90. Using structural equation modeling, we tested hypotheses after making sure the model was valid and reliable.

Table 4. Variance Inflation Factor (VIF) Analysis

Construct	VIF Value
EE	1.873
INT	2.134
SUP	1.926
Gender	1.247

Note: VIF values <5 indicate absence of multicollinearity (Hair et al., 2017).

Table 5. Model Fit Indices

Fit Index	Obtained Value	Threshold	Assessment
SRMR	0.053	<0.08	Good fit
NFI	0.90	>= 0,9	Good fit

Note: SRMR < 0.08 indicates good model fit (Hu and Bentler, 1999)

Note: NFI ≥ 0.90 indicates good model fit

Table 6. Discriminant Validity (HTMT ratio)

	EE	INT	Gender	SUP	Gender*EE
EE					
INT	0,571				
Gender	0,249	0,173			
SUP	0,672	0,536	0,384		
Gender*EE	0,401	0,392	0,054	0,317	
SUP*EE	0,335	0,416	0,032	0,253	0,055

Source: Prepared by researchers based on PLS-Smart outputs.

3.3. Results

This study embarked on a quest to understand the complex interplay of entrepreneurial education (EE), entrepreneurial intention (EINT), gender dynamics, and governmental support within the specific context of Algerian higher education. Our rigorous analysis, employing a moderated mediation model, reveals a series of compelling findings that contribute significantly to the existing body of knowledge.

Table 7. Path Analysis

Hypothesis	Relationship	Beta	SD	t-value	P-value	Decision
H1	EE—INT	0,377	0,130	2,904	0,004	Supported
H2	Gender*EE-INT	0,617	0,441	1,399	0,162	Not Supported
H3	SUP*EE-INT	0,340	0,148	2,298	0,022	Supported

Source: Prepared by researchers based on PLS-Smart outputs

Firstly, our findings robustly support H_1, confirming a significant and positive association between Entrepreneurial Education (EE) and Entrepreneurial Intention (EINT) (β=0.377; t=2.904; p=0.004). This finding resonates with established literature, suggesting that well-structured EE programs play a crucial role in nurturing students' aspirations for entrepreneurship. The coefficient (β=0.377) underscores the tangible impact of formal education on shaping entrepreneurial mindsets, moving beyond mere theoretical knowledge to instill a genuine desire for venture creation. This positive impact also speaks to the potential of well-designed curricula in higher education for promoting entrepreneurship as a viable career path among students.

However, our investigation delves further, unearthing important nuances beyond direct associations. Contrary to conventional assumptions about universal gender disparities, we found that H_2, postulating that gender significantly moderates the EE-EINT relationship,

must be rejected (β=0.616; t=1.399; p=0.162). Specifically, our study does not support the notion that the effect of EE on EINT differs significantly based on gender in the Algerian context. This unexpected finding challenges the common narrative that male students consistently exhibit stronger entrepreneurial intentions following EE. Instead, it may signal an emerging shift in gender dynamics within the Algerian academic environment, where both male and female students are equally impacted by effective entrepreneurship education. This opens a new line of inquiry that challenges existing paradigms in similar cultural contexts and the need to investigate context-specific dynamics.

Most critically, we found compelling evidence supporting H_3, revealing that governmental financial assistance plays a critical moderating role in shaping the relationship between EE and EINT (β=0.340; t=2.298; p=0.022). This statistically significant result highlights the indispensable role of financial incentives provided by the government in catalyzing the translation of EE into real-world entrepreneurial intentions. Specifically, the study strongly suggests that the positive influence of EE on EINT is amplified when coupled with tangible financial assistance. This resonates with the existing literature, which highlights a major barrier to entrepreneurship for students as the absence of start-up funding and other resources, making governmental financial assistance a pivotal mechanism for driving entrepreneurial pursuits among university students, especially in an emerging economy like Algeria. This makes the role of government, not just as a support mechanism, but as a potential catalyst, and is a key contribution of this research

In summary, this study demonstrates that while EE is a vital cornerstone for building entrepreneurial aspirations, the translation of educational input to intent is greatly influenced by specific support mechanisms like government financing but, surprisingly, not by gender dynamics.

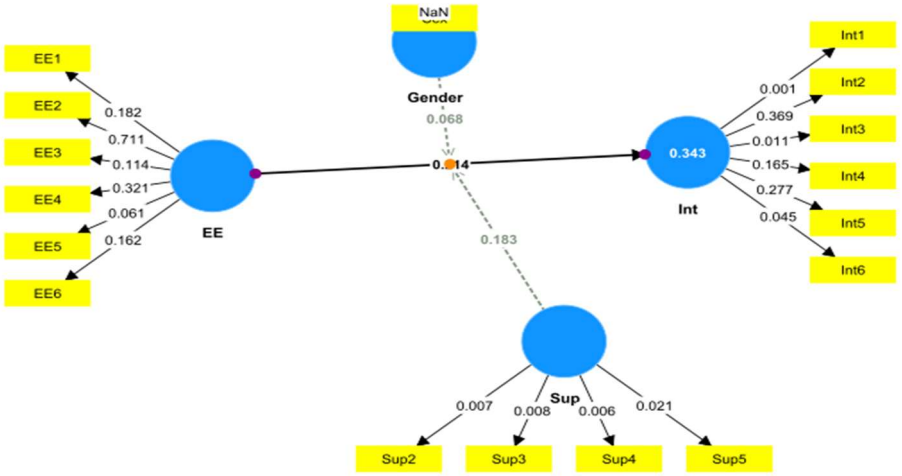

Figure 2. Structural modeling analysis

Source: Prepared by researchers based on PLS-Smart outputs.

3.4. Discussion of the results

This study embarked on a rigorous investigation into the interplay of entrepreneurial education (EE), entrepreneurial intention (EINT), gender dynamics, and governmental support within the specific context of Algerian higher education. Employing a robust moderated mediation model and a meticulously collected dataset from 273 university students, our findings offer nuanced insights that significantly contribute to the extant literature on entrepreneurship, particularly within the context of developing economies.

Our analysis initially validates the established positive association between EE and EINT, aligning with the findings of numerous studies (e.g., Shofwan et al., 2023; Nafid et al., 2023; Rindi et al., 2023). This confirms that structured entrepreneurial programs play a critical role in nurturing students' aspirations for venture creation. The statistically significant positive path coefficient ($\beta = 0.377$, $p < 0.01$) underscores that exposure to EE fosters a tangible desire for venture creation, extending beyond mere theoretical knowledge. This is consistent with the arguments put forth by Nanang et al. (2023), who emphasize EE's function in encouraging entrepreneurial endeavors, and highlights the importance of well-designed curricula in higher education that promotes entrepreneurship as a viable career path among students, especially in an emerging economy. The magnitude of our effect further contributes to the growing body of evidence that validates EE as a crucial intervention.

However, where our study offers a significant departure from the established literature is in the exploration of moderating factors, particularly regarding gender dynamics. Contrary to the commonly held notion that gender disparities in entrepreneurial inclination are universal (as suggested by studies like Langowitz and Minniti, 2007; Mwobobia, 2012; Maheshkumar et al., 2023), we found that gender did not significantly moderate the EE-EINT relationship ($\beta=0.616$, $p=0.162$). This null finding is not a weakness of the study; rather, it serves as a critical contribution, challenging the notion that male students universally exhibit stronger entrepreneurial intentions following EE. Our result aligns with other studies that report gender is no longer a significant factor in EI (Indarti, Rokhima, 2008; Yao et al., 2016), suggesting that this relationship may be context-specific, and varies based on the educational culture and the societal context. This finding may also reflect the changing gender dynamics in the Algerian academic environment, and the increasingly proactive approach women have been taking in pursuit of entrepreneurial opportunities (Veckalne et al., 2023). This outcome suggests the importance of not applying generalized findings about gender differences from other contexts to settings such as Algeria without specific empirical evidence. It also signifies an emerging area that challenges existing paradigms in similar cultural contexts that may warrant further research.

Crucially, we identified a significant positive moderating role of governmental financial assistance in the EE-EINT relationship ($\beta = 0.340$, $p < 0.05$). This finding supports the arguments of Trang (2023), Acha et al. (2023) and Hazliza (2022) showing the importance of government support to promote EINT. Our analysis confirms that the effectiveness of EE in fostering entrepreneurial intentions is substantially amplified when coupled with tangible governmental financial support. This result aligns with prior research that has highlighted the major financial barrier that students, particularly in developing countries, face in pursuing entrepreneurship (Wright et al., 2006). Our findings demonstrate that while EE imparts necessary skills and knowledge, its impact on students' intentions is significantly enhanced when governments provide necessary financial backing to translate education into tangible action. This further underscore the importance of

integrating government financial assistance within the national framework of EE to effectively drive entrepreneurial pursuits, and the practical implications this has for policy makers who are trying to create an entrepreneurial environment that supports business creation. Moreover, our study also builds upon the work of Kulikova (2023) and Tamer et al. (2022), which indicates the mediating role of government financing in the relationship between entrepreneurial education and intentions, adding a critical contextual variable.

In summary, our study shows that while EE is a fundamental pillar for fostering entrepreneurial aspiration, the translation of this aspiration into concrete intentions is significantly modulated by the availability of governmental financial support and less by gender in the Algerian context. By integrating governmental support into EE programs, policymakers and educators can create an environment where entrepreneurial intentions are more likely to lead to entrepreneurial behavior. This study demonstrates the need to approach entrepreneurship education and policy with a more nuanced understanding of the different variables at play.

By carefully considering previous research, our analysis builds on current understanding of EE and EINT by highlighting the crucial moderating effect of government financial assistance and the lack of moderating effect of gender, within the Algerian context. The study encourages re-evaluation of the universality of findings in entrepreneurial studies, and shows the need for context-specific research and policy development.

3.5. Limitations

Despite the rigorous methodology employed, this study is not without limitations, which offer avenues for future research. Firstly, the sample was drawn exclusively from one university in Algeria (University Centre of Maghnia). This limits the generalizability of our findings to other educational institutions or regions within Algeria. While we took care to ensure the diversity of the sample within the selected university, future research could expand data collection to include a wider range of higher education institutions across the country, as well as different regions to account for regional variations in cultural context and economic development. Further cross-national comparative studies would be beneficial to see if the same effects hold across other countries and geographical locations.

Secondly, while our study employed quantitative methods to capture the relationships between our variables, we did not explore the qualitative nuances that might underlie these relationships. Future studies may benefit from incorporating qualitative interviews with students to understand their perspectives on entrepreneurship, the role of government support, and how gender dynamics intersect with their entrepreneurial aspirations. A mixed methods approach would allow us to obtain richer and deeper insights.

Furthermore, our assessment of governmental support was limited to financial assistance. Other forms of government support, such as mentorship programs, access to business incubators, and policy advocacy, were not considered. Future studies could explore these other dimensions of governmental support to gain a more complete picture of their impact on entrepreneurial intentions. This would allow for a more holistic understanding of the complexities involved in creating a supportive entrepreneurial ecosystem.

Finally, this study's cross-sectional design does not allow for an assessment of causality, or the evolution of entrepreneurial intent over time. Longitudinal studies that track students' progress over time, before and after EE, could provide valuable insights into the long-term effects of EE and the dynamics between intention and action.

Furthermore, there may be other unobserved factors at play that could impact EINT, including personality traits, family background, and networking opportunities.

These limitations notwithstanding, this study contributes to a richer understanding of the complex factors impacting entrepreneurial intentions, particularly in the context of Algerian higher education. By explicitly highlighting these limitations, we aim to encourage future researchers to build on our work, exploring these gaps in our knowledge base. This study is a step in understanding these dynamics, and further investigation using varied approaches is crucial to fully understand the process.

4. CONCLUSIONS

This study provides a compelling analysis of the interconnected dynamics between entrepreneurial education, entrepreneurial intentions, gender, and governmental financial support within the specific context of Algerian higher education. Through a robust application of a moderated mediation model and a meticulous analysis of data from 273 university students, our research delivers insightful contributions to the growing body of literature on entrepreneurship, particularly within emerging economies. The findings confirm the positive influence of well-designed entrepreneurship education programs on fostering students' ambitions to launch new ventures, reinforcing the important role educational institutions play in nurturing the entrepreneurial spirit. Moreover, our study moved beyond the established correlation and found that, in the Algerian context, gender does not significantly moderate the relationship between entrepreneurial education and intentions, challenging commonly held assumptions about gender disparities in entrepreneurial aspirations and suggesting a new perspective for understanding these dynamics within specific cultural contexts. Critically, this research has unequivocally shown that governmental financial assistance plays a significant moderating role in amplifying the impact of entrepreneurial education on students' intentions to launch their own businesses. This highlights the critical need for governments in similar economies to recognize the importance of combining robust education programs with tangible financial support mechanisms. The significance of this finding lies in its ability to translate educational input into real-world entrepreneurial ambitions, by providing critical funding, which is often a significant barrier, and highlighting the need to address this gap with strategic policies.

In conclusion, this research underscores that the cultivation of entrepreneurial intentions is not simply a function of education alone, but rather a result of the synergistic interaction between quality education and targeted financial support, while also demonstrating that, within the given context, gender may be a less significant factor than previously assumed. These insights have major implications for policymakers, educators, and institutions striving to create supportive ecosystems for entrepreneurship, particularly within the context of emerging economies. By demonstrating the significance of this dynamic, and highlighting the relative unimportance of gender (in the studied context) this study offers a new perspective, and demonstrates that to effectively cultivate entrepreneurship, initiatives must integrate robust educational programs with clear and direct financial support, while also focusing on specific contextual influences. These findings offer critical guidance for developing more effective strategies to foster a thriving environment for entrepreneurial activity.

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IMPLEMENTING R5 AND KIVA IN WAREHOUSE MANAGEMENT A CASE EXAMPLE FOR SPAR IKEJA, NIGERIA

The logistics of any superstore chain is its ability to get the products at the shelves which their customers really want. The SPAR Nig ltd is a limited liability company operating in Nigeria under license from its South Africa conglomerate whose franchise was given to do the business in Nigeria. Considering that it has been able to meet the high customer flow, thus, need for reliable and unadulterated goods and products, SPAR has developed a warehouse within its superstore chain's location. The goods are kept and restocked on shelf as the replenishment is required on no advance Warehouse Management System. The aim of this paper is to analyze the replenishment technique for goods efficiently and effectively while using less hazardous methods and reduce the traffic of high end machinery like forklift moving product inside the control space. The method analysis using CAM methodology will employ a small AGV simulated system requested by shelve pickers and run the simulation of product to the pickers with minimal walk around following the nodes path outline on the floor bowl. This will implicitly create a refined work for staff and introduce technology to solve related issues/ergonometric enhancement for employees while promoting the speed of shelf replenishment.

Keywords: SPAR, AGV, KIVA, R5, WMS, POR.

1. INTRODUCTION

1.1. Brief History on SPAR Nig.

In crafting recognition for building on a strong identity, that brand gains scope into a community yearning for want. By promoting initiatives and driving the expansion of its network across Nigeria, SPAR Nig ltd, had evolved in the nigeria market with increased retail footprint and launch of about two stores in a short span in its expansion plan.

In the Nigerian context; It had relieved its first stores on 19 October 2008 in the SPAR Supermarket at Opebi, with accompanying stores at Surulere in October 2010 on a grand facade of ceremonial shopping feet. From SPAR Hypermarkets documentary on their retail sales area of about 1,000 m^2 and 2,500 m^2 in both locations of the state of Lagos (SPAR

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Intl: *"2019 Review"*). SPAR reportedly states the Surulere region caters for a momentous populace of up to 640,000 persons and 160,000 households across localities of different thriving business firms (SPAR Intl: *"2019 Review"*). Also, the SPAR Opebi, located off Allen way, Ikeja area pulls a population of the greater to about 1.2 million and 300,000 households across vicinity; having shoppers troops into the mall to benefit from a formal Supermarkets with good offering in retail experience (SPAR Intl: *"2019 Review"*).

The new innovation in stores provides a complete sensational experience for shoppers with a full hypermarket super offerings of beverage, food (un-perishable), grocery stuff, farm fresh fruit & vegetable, inhouse butchery, bakery stuff, wine, beer & spirits, Take-to-Go, household electronics, indifferent large range of items.

The Customers in Nigeria truly has associated the SPAR Brand with their quality and decor of their hypermarkets has helped SPAR Nigeria to attain its place as a fortier grocery hub for retail excellence. Their offering serves a good mix of different locally and globally produced products. The SPAR Nigeria now has quite a number of its hypermarkets with 14 locations and counting in Nigeria with some over 45,000 m^2 of retail bowl area (SPAR Intl: *"2019 Review"*). Notably, there are eight stores in Lagos, two in Abuja and Port Harcourt with one in Enugu and Calabar as seen across the country.

Generally, the stores have been performing on a large scale with many people trusting the brand and enjoying its services. The stores reflect the global brand insight and pursuit for excellence, and this is seen by the various well-known brands it offers for sales in the shelve making most of its product a high roller. The history of SPAR can be traced far back to the Dutch owners who started at the early 18th century (SPAR Intl: *"History 2018"*).

The name was originally DESPAR, an acronym of the Dutch phrase *Door Eendrachtig Samenwerken Profiteren Allen Regelmatig* (English: "through united co-operation everyone regularly profits") (SPAR Intl: *"History 2018"*). The acronym was chosen to resonate with the verb *sparen*, which (related to English *spare*) means “save [money]” in Dutch and some other languages, among them German (*Englisch-Deutsch Wörterbuch,* 2015) and Scandinavian languages (with variants such as *spara* or *spare*). “Spar" is Dutch for "spruce tree”, after which the logo was chosen. As the organization expanded across Europe, the name was abbreviated by dropping the *DE* prefix (SPAR Intl: *"About Us 2018"*).

A lookup from spar-international online document tells that it was founded in the Netherlands in 1932, by Adriaan van Well, and now consists of more than 13,500 stores in 48 countries (SPAR Intl: *"About Us 2018"*). The company's name is derived from an acronym slogan “Door Eendrachtig Samenwerken Profiteren Allen Regelmatig”, which Van Well in the description of their brand translates as “Everyone works better together” (SPAR Intl: *"About Us 2018*).

In 1988 SPAR South Africa became a wholly owned subsidiary of Tiger Brands, a holding company with a large diversified portfolio, however it was unbundled and listed as a separate company in 2004. In July 2014 Spar Group South Africa opened its first supermarket in Angola but no expansion of the brand is planned for this market (SPAR Intl: *"2019 Review"*). A SPAR shop may be owned independently, by a franchisee, or be part of a chain, depending on the model applied in any given country. The owners of the parent company vary from country to country and may include the shop owners themselves. The name and the current logo were most recently revised in 1968 by Raymond Loewy and have since remained unchanged (SPAR Intl: *"History 2018"*).

1.2. The Statement for Problem

Given that substantially, has proven the capability of SPAR Nig growth in the retail business and evolved it stores into the digital age using advanced technology techniques employed as it introduces into the market. *Thus, it portrays the need to close and constantly replenish and fill up the shelves with fast moving and high demand products as needed on the main bowl*. Hence, the need to employ BOTS. The Bots are chosen because AGV are bulk and fitting into the aisle will require slickness and sophistication which can only be delivered using bots' technology.

This will be primarily the first in the country as the SPAR Nig brand will introduce a technique never used before in retail superchain stores in Nigeria and probably in Africa. It will be observed that bots will work alongside customers and shelves pickers as the product required, demand and want will be captured constantly across the customer needs in the main bowl and promote more interaction with the staff and the employee of SPAR brand while increasing with customer satisfaction index rating.

1.3. The Objective

Since the paper will be purely an technical experimental alternative, and these bots will not actually be brought but using the current parameter will be designed layout to simulate the successful implementation of employability in the case as its scenario will reflect real live occurrence. Hence, the objective will aim to meet critical points in promoting and reaching the goal of the Bots use in retail super stores.

The Bots will run on a mapped floor on two scenarios, across the plan. This will show how both KIVA and R5 autostore can be introduced into the SPAR Nig outlet and how the entire structure will optimally reduce pickers walk around and achieve harmonic in the relation of Man-Machine, here bot. The defined route will be tagged across the floor plan as its aid the bots move more freely in a defined set of rules and obstruction can be detected to aid it from crashing onto incoming customers.

Hence, the scope of the paper will be a work around following the criteria which will aid the implementation technique to be used in the upcoming section of the design layout plan for bot integration:

1) Identification of KIVA and R5 autostore bots to be employed on the existing plan.
2) Remodeling of the plan section to assign each bot a specialty area and hence promote its efficacy.
3) Introduce the Bots as close as possible to the main bowl for easy running time and reduce drag.
4) Promote a redefined node for path across the entire superstore inclusive of its warehouse content.
5) Lastly, bring in synergy with the Bots and human interaction to reveal the innovation of the concept for application.
6) Relate this in a FLEXSIM model to simulate and picture adaptation which will show the concept and promote the idea in play as desired concept.

Using the scope in the guide, the entire layout will be analyzed by the FLEXSIM model and read time will reveal how efficient and effective the model becomes and aid future models for scalability and improvement.

Thus, before commencement a brief view of the literature of bots and its difference with AGV will be discussed in the adaptation of the AGV & BOT technology from inception to modern types and its uses.

2. LITERATURE REVIEW

2.1. Concept of AGV and Auto-Bots

The subject of this project starts with the phenomenal Automated guided vehicle. So, what is AGV? An automated guided vehicle or automatic guided vehicle (AGV), also called autonomous mobile robot (AMR), is a portable robot that follows along marked long lines or wires on the floor, or uses radio waves, vision cameras, magnets, or lasers for navigation (Autostores: Dec 2024). Their occurrences are used in technological, industrial and warehouse applications in lifting and transporting larger heavy materials in/through large industrial factories, buildings or warehouses.

The AGV can tow-drag objects behind them in trailers to which they can autonomously attach. The trailers can be used to move raw materials or finished products. The AGV can also store objects on a bed. The objects can be placed on a set of motorized rollers (conveyor) and then pushed off by reversing them. AGVs are employed in nearly every industry, including pulp, paper, metals, newspaper, and general manufacturing. Transporting materials such as food, linen or medicine in hospitals is also done (Wikipedia: Automated guided vehicle: Dec 2024).

An AGV can also be called a laser guided vehicle (LGV) [Intel: Autonomous Mobile Robots Dec 2024]. In Germany the technology is also called *Fahrerloses Transportsystem* (FTS) and in Sweden *förarlösa trucker* (Wikipedia: Automated guided vehicle: Dec 2024). Lower cost versions of AGVs are often called Automated Guided Carts (AGCs) and are usually guided by magnetic tape (Wikipedia: Automated guided vehicle: Dec 2024). The term AMR is sometimes used to differentiate the mobile robots that do not rely on their navigation on extra infrastructure in the environment (like magnetic strips or visual markers) from those that do; the latter are then called AGVs (Wikipedia: Automated guided vehicle: Dec 2024). The AGCs are available in a variety of models and can be used to move products on an assembly line, transport goods throughout a plant or warehouse, and deliver loads (Wikipedia: Automated guided vehicle: Dec 2024).

Figure 1. Example of a Packmobile with trailer, typical existing AGV
Source: (Wikipedia).

The first AGV was brought to market in the 1950s, by Barrett Electronics of Northbrook, Illinois, and at the time it was simply a tow truck that followed a wire in the floor instead of a rail (Intel: Autonomous Mobile Robots Dec 2024). Out of this technology came a new type of AGV, which follows invisible UV markers on the floor instead of being towed by a chain. The first such system was deployed at the Willis Tower (formerly Sears Tower) in Chicago, Illinois to deliver mail throughout its offices (Intel: Autonomous Mobile Robots Dec 2024).

Over the years the technology has become more sophisticated and today automated vehicles are mainly Laser navigated e.g. LGV (Laser Guided Vehicle) (Intel: Autonomous Mobile Robots Dec 2024)]. In an automated process, LGVs are programmed to communicate with other robots to ensure product is moved smoothly through the warehouse, whether it is being stored for future use or sent directly to shipping areas (Wikipedia: Automated guided vehicle: Dec 2024). Today, the AGV plays an important role in the design of new factories and warehouses, safely moving goods to their rightful destination (Savant et al., March 2006). The AG's are generally classified into various types, which can be sorted for different specific work processes. Their shapes and various sizes in capabilities for workload and range of operation in heights/complexity. The different various AGV's which are commonly available in the industry seen today and where they could be employed in services of goods and manufacture (JBT Co., 2009).

1. *Towing Vehicles* (also called "tugger" vehicles) were the first type introduced and are still a very popular type today. Towing vehicles can pull a multitude of trailer types and have capacities ranging from 2,000 pounds to 160,000 pounds (JBT Co.: 2009).

Figure 2. Tugger AGVs can move trailers or trains of trailers more safely than a manually operated tugger

Source: (Wikipedia).

2. *AGVS Unit Load Vehicles* are equipped with decks, which permit unit load transportation and often automatic load transfer. The decks can either be lift and lower type, powered or unpowered roller, chain or belt decks or custom decks with multiple compartments (JBT Co.: 2009).

Figure 3. Tugger AGV towing multiple trailers in a warehouse environment
Source: (Wikipedia).

3. *AGVS Pallet Trucks* are designed to transport palletized loads to and from floor level, eliminating the need for fixed load stands (JBT Co.: 2009).

Figure 4. Unit load AGV (dual)
Source: (Wikipedia).

4. *AGVS Fork Truck* can service loads both at floor level and on stands. In some cases, these vehicles can also stack loads in a rack. They can sometimes lift to 30' to store or retrieve on high-bay racking (JBT Co.: 2009).
5. *AGVS Hybrid Vehicles* are adapted from a standard man-aboard truck so that they can run fully automated or be driven by a fork truck driver. These can be used for trailer loading as well as moving materials around warehouses. Most often, they are equipped with forks, but can be customized to accommodate most load types (JBT Co.: 2009).
6. *Light Load AGVS* are vehicles which have capacities about 500 pounds or less and are used to transport small parts, baskets, or other light loads through a light manufacturing environment. They are designed to operate in areas with limited space. Also, they are *AGVS Assembly Line Vehicles:* are an adaptation of the light load AGVS for applications involving serial assembly processes (JBT Co.: 2009).

Figure 5. Forklift AGV with StabilizerPad. Source: (Wikipedia)

Figure 6. Hybrid AGV picking load

Before the explanation of the design philosophy, look at some few concepts of superstore. The warehouse is a critical part of the management and control of flow of products in and out of the store. What is a Warehouse Management System? A Warehouse Management System is used to control the overall flow of materials through the warehouse or a distribution center [F. Nynke; De René, Steef L. 2002]. A WMS at its core is flow-designed to track as inventory is processed into shelves, stored, taken around, or and transferred from facilities, while ensuring a systematic productive way to the distribution processes (Law, McComas, 1990).

While distinctive WMS systems offer various capabilities, the predominate modules active in the following process areas (JBT Co.: 2009):

1) Picking.
2) Replenishment.
3) Receiving.
4) Slotting / Packing.
5) Labor Management.
6) Quality Control/Quality Assurance.
7) Shipping/Location Management.

Generally, Automated Guided Vehicles (AGV) are used in various processes in the complexities of transporting different goods and material including carts, rolls, racks, pallets and containers. AGVs exceed in the applications of the following characteristics:

1) Repetitive materials movement of over a long distance.
2) Frequent delivery of loads.
3) Medium flow throughput/size.
4) Right on-time/ last miles deliveries at critical and night shift deliveries in grave inefficiency.
5) Operations with complex shifts.
6) System tracking of material and secure process of important.

The KIVA and R5 bot Systems provides an intricate approach to automation fulfillment in order management using a varied fleet of mobile robot driving units, dynamic shelves, workstations port and sophistication in control software system.

To pick, pack, and ship operations; operators stand across station ports perimeter of the warehouse building within the inventory mobile shelving racks, which are called pods (Robotics Tomorrow: 2011). These pods are arranged in a grid pattern in the interior of the building; when an operator requires an item for an order, a mobile robot brings the pod containing that item to the worker's station (Autostores: 2024).

The worker picks the items they need out of the pods and places them into the orders they are working on. Once the items have been picked, the mobile robots return each of the pods they are carrying to a storage location on the grid floor. These are usually a different location than the one it picked the pod up from. Each worker is usually supported by 5-10 mobile robots, so they are kept continuously busy filling orders (Autostores: 2024).

The Kiva system found usefulness in both full and split-case packaging, and slow pace moving stock, as customary in manufacturing and storage in a range of product categories and different industries (Robotics Tomorrow: 2011). In inventory, KIVA and R5 System become mobile so every worker can quickly access refillment of the products to order in a timely manner.

The KIVA and R5 solutions are a complete revolution of stock and order fulfillment which incorporates hardware integration and software drivers installed to improve replenishment, picking, and supply/shipping process. During implementation, client's systems are integrated into the enterprise software which serves as the primary interface point BUS connection with the warehouse management system (Robotics Tomorrow: 2011) (WMS). This form of mate between the WMS and an AGV software system so the AGV becomes the picker and order sorter across the zone within the facility and across the main ops area under the WMS control (Robotics Tomorrow: 2011) as in figure 7.

In a success-point, the Kiva solution brings a lot of value for shipping and delivering fulfilled orders onto the specific docks at an efficient sequence and shortest timing to optimize loading of trucks, safety, route plans and the efficacy in delivery out of the warehouse (Robotics Tomorrow: 2011).

Quality in highest regards becomes the core benefit of the Kiva/R5 system within its standard system-guided scope of work. They come with indicators equipped with laser pick-light for picking and replenishment aided by the lights for directing item placement into orders, barcode and scanner (Laser Pallet: August 2017). Operators use easy-to-follow handheld device touch screens to accurately correct items and quantities integrated in the system. As such, eliminating rigorous quality control (QC) checks. Bot recognizes how critical quality assurance is needed and this is measured across operations and other levels of quality spot control process (Robotics Tomorrow: 2011).

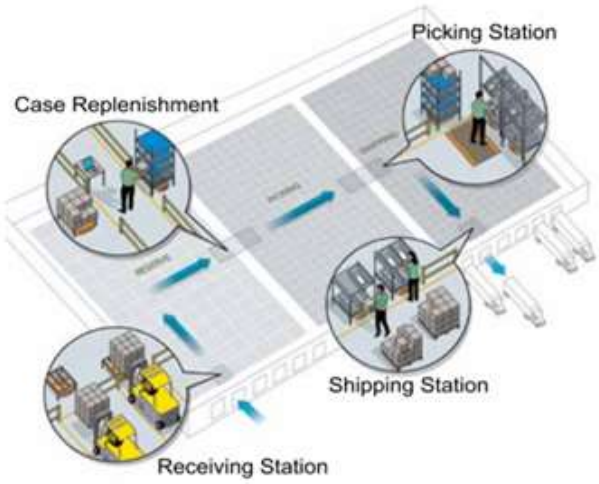

Figure 7. The KIVA strategy for the Warehouse management system for logistics firms
Source: (KIVA system).

The KIVA and R5 Mobile (figure 8) AGV Fulfillment solution automation technology for distribution environments becomes an innovative process. The AGV systems typically can be integrated into most WMS packages. During the replenishment, the system chooses the best pods based on a sophisticated strategy coded in that encompasses pod type, its merchandise characteristics, open available pod space, the proximity to fulfillment and picking item consolidation. Details like expiration dates, lot, integrity case, items, product with SKU inflow associated with other factors. The deciding code in the software sets product characteristics including weight, pick acceleration and ergonomics packs.

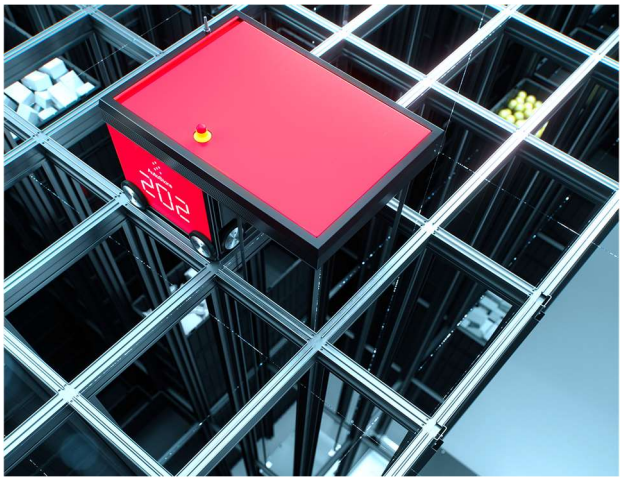

Figure 8. R5 concept of store racks and product storage shelves in logistics firms
Source: (autostore).

There can be some overlap in functionality between AGV and WMS applications being operated, but in any case the main duty of a KIVA bot is for forward picking and packaging within the distribution center zone and processes operations overseen by the WMS (Robotics Tomorrow: 2011).

2.2. Experimental Setup and Methodology

An experimental flow will be analyzed using the layout of the Ikeja SPAR superstore. This will allow a map of the areas where the KIVA and R5 will operate since their systems are of different characteristics. This will allow the pickers and movers to work at different places and at different speeds for the AGV to be more efficient since there will not be many AGV's which will be employed into the solution. Thus, experimentally a setup will review these challenges and encompass the solution using the method of employing the KIVA in the heavier section and the R5 inside the superstore for their shelf replenishment. This will synchronize the warehouse in a more orderly manner, control traffic in a logical sense and achieve the efficiency thought of a good Warehouse management system i.e., WMS.

Since this will be purely a theoretical CAM base objective approach, the need for examining the entire floor plan in totality of the store will not be required. The data retrieved from online journals and catalog, especially google images of SPAR stores with its content will be used to conduct the model. The R5 and KIVA will also not be required in Real Time as only technical facts existing will be considered in the model of the entire system employing best fit to the right location.

Generally, the working principle of an AGV can be simulated using CAM software, and this will not be a hindrance. The operational model will allow analysis on various aspects of the AGV such as Bots R5 and KIVA to be introduced and interpreted for the sake of the implementation. Further research may still need to be addressed but this will not be in the constraint of SPAR Ikeja, and the warehouse concept as adopted here. All instrumentation will be theoretical with computer graphic and model being the ideal finished result of the method applied. Considering the outcome of the model the scenario used will determine the analysis and results of the experimental setup for each model if the models will be more than one. The CAM FLEXSIM will be employed here, as it will enable a time-fast method in bringing the model to reality from test and analysis.

FlexSim has been used to automate simulation model development for more than a decade; a 2008 study described a FlexSim-based solution that communicates with Product Lifecycle Management (PLM) software to generate simulation models (FlexSim: 2021) (cc *FlexSim* doc). With the quest of Industry 4.0 revolution in speed to push manufacturers into automation and sync improved communication bandwidth, FlexSim as a simul-desk has high use to develop computer simulation models for these applications as light speed (FlexSim: 2021). Generally, the purpose of simulation software, such as FlexSim can be used in a number of process/ fields (FlexSim: 2021):

1) Material/handling: Lift-Conveyor process, Autos robots in manufacturing (AGV), packaging stacking, bulk warehousing.
2) Logistics and Process distribution: Container Port terminal, Rail operations, manufacturing and supply chain, design distribution, retail center workflow, service, and storage facilities, etc.
3) Transportation Process: Road Highway traffic system, Train transit station tunnel/ pedestrian walk flow, maritime ship vessel and waterway coordination, custom containers traffic and decongestion, etc.

4) Others apps: Oil mining fields, solid mining fields, Pipe/conveyor networking data flowing process, etc.

Let not forget that KIVA and R5 have been used in the past and presently being used by advanced logistics firms and companies of logistics solutions in the industries. The approach here will introduce the need for technological and perhaps industry 4.0 approach to warehouse management in the African concept and in Nigeria market which will be the game changer for SPAR brand and reflect a new experience for her esteemed customers. The figure 9, completely outlines the principle and specification of the bots on their sophistication in bringing the whole of logistics warehouse good fulfillment in an automated manner reducing human interaction and accident related cause and incidents to the barest minimum.

Figure 9. The KIVA and R5 in action in the logistics center

Source: (KIVA system and autostore).

The KIVA and R5 has the following technical specification as below enumerated (Table 1):

Table 1. Technical Specification for R5 and KIVA AGV system bot.

Technical Built Specification for R5	Technical Built Specification for KIVA
Dimension Measurement. R5; Width: 700 mm (2.3 feet) / Length: 963 mm (3.2 feet)	Kiva Frame Chassis Dimensions: Circular 3D Height-Width-Depth = 25.6 in (65.1 cm); Slide Rack Mount Kit Inclusive
Robot Weight-R5: 145 kg (319 lbs) inclusive batteries.	Kiva Frame Chassis; Max Weight: 75 lbs. (34 kg)
Power pack/Wphr. 100 Watts (Under Operation)	Kiva Max Power Consume: 500 Watts
Operational temperature. 2°–35° C (35°–95°F)	Standard Voltage: 100-240 VAC, Frequency: 50-60Hz
Speed Attainable. 3.1 m/s (11 km/h) / 10.2 fts (7 mi/h)/	Automatic-Sensor for AC Power Input charge
Pickup Acceleration. 0.8 m/s² (2.6 ft/s²)	Pickup Acceleration. ~1.0 m/s² (2.9 ft/s²)
(cited: AutoStore-AS)	(cited: KIVAsystem)

The specification guides the localization and the quantity of bots to be deployed into the mall. Given that the speed and the weight per payload will be a very good deciding factor, the bots will be limited to the frequency of request and the maximum payload to be carried by a physical human. As the bot for example KIVA would get to lift a weight 2 times that of a human capacity, it guarantees the lifts and the movement of this weight at an extraordinary pace and the delivery become seamless as it fulfills the requester call. Thus, a total number of 15-20 KIVA and 5-8 R5 autostore bots will be implemented into these proposal setups, meeting the frequency rate and payload specification needed.

3. METHODOLOGY

3.1. Model Design and Simulation Approach

A Warehouse Management System is a complex task as it involves the planning, control and decisions that connects to goods or item inbound, storage and outbound flows (Faber et. al., 2013) as cited by Monica et al., 2017. Different criteria are considered in assessing warehouse process evaluation including the cost of warehousing, the level of rotation, the quantity of damaged goods, space utilization, utilization of technical resources, rate and speed of order fulfillment and accuracy of order.

As the storage service market continues to evolve, it is important that innovative technologies such as KIVA and R5 systems are implemented for cost optimization and positioning for competitive advantage in terms of market share among other metrics.

Most research shows that not less than 50% of storage and warehousing cost is engulfed by the picking and packing phase which implies implementing an automated assisted technology such as KIVA and R5 would go a long way in saving the company used as case study in this research paper time, money and employee energy which leads to overall improved warehouse management systems by optimization of the picking, sorting, and packaging activities by the AVG's.

Accordingly (Law et al., 1991), the implementation of simulation modeling for designing new systems to improve the existing system is fast gaining more ground more importantly with the surge in the complexity of modern-day systems, computational cost reduction, various software improvements and the availability of animation (Law et al., 1991). In highlighting nine important elements that guarantees the success of a design simulation and modeling process as follows (Law et al., 1991):

1) Having the knowledge of the methodology of simulation, stochastic models of operations research (for instance Queueing theory, probability theory and statistics).
2) Accuracy of problem formulation (i.e., having the knowledge of the performance issues of the existing system can help to know the appropriate level of model details).
3) Access to the right information about the system's operating procedure and logic control.
4) Randomly modeling the system in a reasonable way.
5) Adopting or selecting the correct simulation software and using it correctly (For this study, the simulation software package adopted is Flexsim eliminating the need for programing which saves time and cost).
6) Validating and giving credence to the established model.
7) Employing the proper statistical procedures for interpreting the output (classical statistics techniques for independent data not applicable directly)
8) Employing excellent project management techniques (cc: Law et al., 1991).

In creating a model, two approaches can be utilized being the structural and object-based approaches (Olczyk, Sawicka, 2010) as cited by Monica et al., 2017. The structural approach makes use of structural programming languages while the object-based approach is the core modeling that represents the system imitation. For this study, the second approach is adopted where the activities of the KIVA and R5 with the Spar Nigeria Ltd storage space is modeled using an object-based simulation tool known as FlexSim to suggest solutions to the existing problems with picking and packing in the store.

For simulation and modeling to be achieved, there is a need to first analyze the key activities and mapping of the processes in the SPAR Nigeria Ltd warehouse system. Thereafter, simulation and modeling are carried out with the output serving as a pointer for identifying the bottlenecks in the warehouse system of the store. Hence, the need for redesigning the processes for improvement possibilities.

The simulation inputs are the store or warehouse activities commonly performed manually that the new design aims at replacing using the KIVA and R5 systems or technology.

The validation technique adopted in the simulation and modeling is structural walk-through to detect errors and ensure the consistency of the model performance. Probability distribution and analysis of the design output data were all selected. Here, animation was adopted as the debugging tool, and all implemented via the FlexSim.

According to Law and Kelton (1991); sensitivity analysis is most preferred to check the aspect of the model (an input parameters, a probability distribution or level of detail in a subsystem) has the greatest impact on the desired performance measure to prioritize that aspect in terms of carefulness of designing that aspect of the model (Law, Kelton, 1991). He also established in his "Simulation Modelling and Analysis" that the validity of a simulation model is to know that the performance measure is closely approximate to the expected or proposed performance configuration of the system which means the degree of aligning or resemblance between the existing system and the proposed system increases the confidence level of the proposed system]. (Law, Kelton, 1991).

A model will be designed using CAM software, a preparation of the model environment will simulate the activities that the AGV will assist in carrying out in the warehouse. The SPAR Nig. ltd has a medium size warehouse with about 8,000 sqm as described in the layout (SPAR Intl.). This will allow just a few numbers of KVIA to implement the lifting procedures and achieve the lifts from the trucks to the inventory area and from there to the pickers who will install this item into the WMS system.

The R5 duties will include storing these items on the shelf in the automated warehouse, a second location close to the entry point into the store from the service channel. This will allow the entire process of retrieval to be done from the automate Com point of the cube by a few service team members as they fulfill the request from the shelve pickers as they are served by a few KIVA inside the superstores.

To commence, the existing layout of the store and the warehouse are as described in the figure 10, below. The shape of the layout makes it easier to install both process drive outlook on the store and introduction of technological improvement for the efficacy and staff optimum workload.

The analysis will look at entry and exit points for the SPAR driveway and consider any improvement to accommodate the truck flow into the store. Furthermore, on the analysis as seen from the front view of SPAR Nig ltd Ikeja, will consider how the visitor parking to

ensure no obstruction on the new improvement will affect the parking space for the store as allocated.

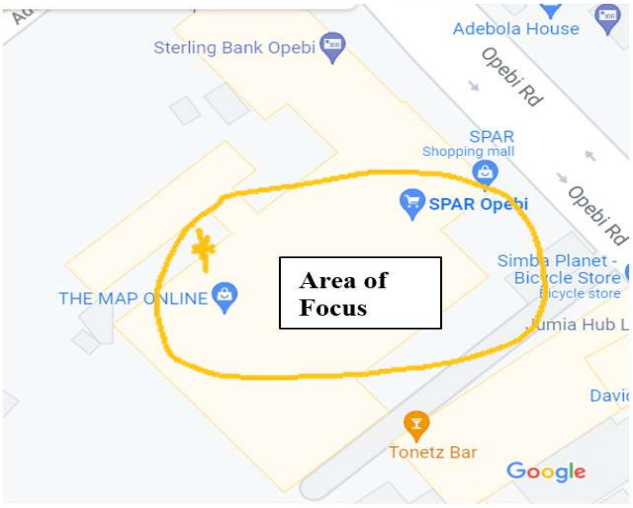

Figure 10. Layout configuration of Spar Nig ltd Ikeja, Nigeria
Source: google map.

Figure 11. View of the entrance and exit for SPAR superstore Ikeja
Source: (google map).

In all due consideration, a typical model can be mapped and created with existing nodes for the KIVA and R5 as assigned across the route. A pictorial representation of the entire structure will give further review on key critical indicators which will prove the functionality in the actual operations. A model on FLEXSIM will eventually have a view as below:

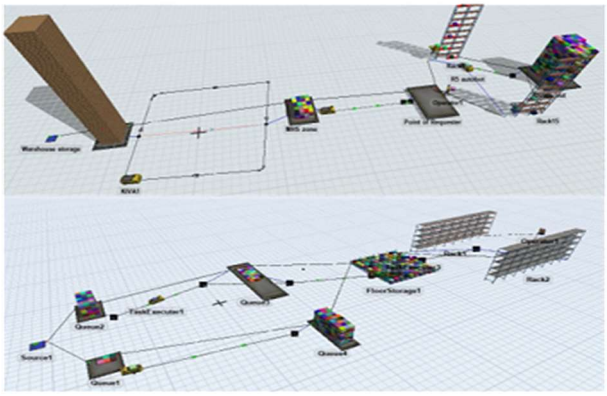

Figure 12. View on FLEXSIM using nodes for AGV operation in a logistics center

Source: (Flexsim simu run).

Generally, taking in account simulation methods as meant to be employed. The model as constrained across SPAR Nig Ltd, will be drawn in accordance with the principle adopted in the industry. The R5 zone will be situated at the extreme point close to the cashiers due to the need to feed from the front access which contains some drive thru, for this purpose. Glass open doors can replenish the R5 autostore system. The main warehouse which is located at the back of the plaza building carries the most space as it is used for the keeping of long, heavy, and larger items which can not be piled up in the store showroom. The fig below shows the model and simulation for the zoning of the entire store using the describe system previously pointed out.

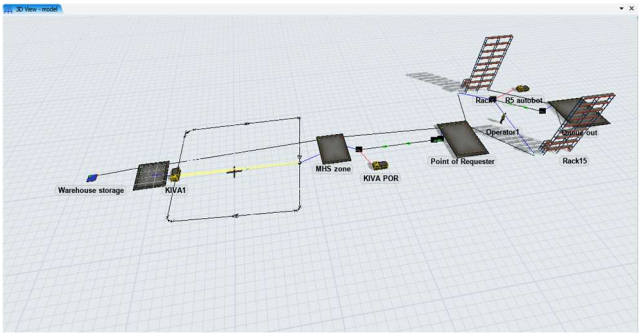

Figure 13. Theme 1 for the zoning option applicable to the warehouse-storage-main bowl for SPAR Nig ltd.

Source: (Flexsim simu run).

Consistently two themes have been modeled to provide a comparison to the likely option to select during the ERP system integration into the retail superstore. This inclusion will simulate the easier scenario to work with both the KIVA and the R5 bots. Here, speed of replenishment will be the focal issue of the meeting. The bots will be expected to navigate traffic of different order, which won't be an issue.

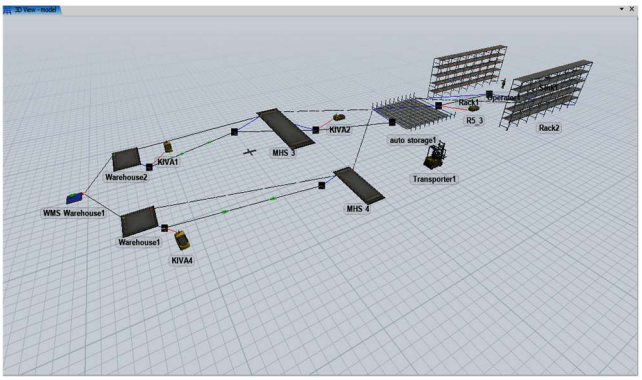

Figure 14. Theme 2 for the zoning option applicable to the warehouse-storage-main bowl for SPAR Nig ltd.

Source: (Flexsim simu run).

The KIVA will solely handle the back storage and the inner's special cold chambers while delivering to the requestor way front at the shelves. The network path will be the access track for the route, and these serve as the safety control for the bots and keeping them in orderly manner across the main bowl. Consequently, when run on the FLEXSIM program, a unified and fast-paced delivery is obtained with timing as low as 3 min topping at 5 min between the Warehouse and the retail floor achieving the set time requested on any WMS application. This gives the pickers comfort and control in a relaxed order.

4. RESULTS AND DISCUSSION FOR IMPLEMENTATION

In the analysis of the described CAM model as implemented to SPAR Nig ltd, Ikeja, Nigeria. The whole of the super store has been remodeled to look and bring the facility into the modern warehouse of the 21st century using AGV has optimized the process as will be further described. A close look show, the existing description from the layout plan and how the improvement has optimized the arrangement across the layout area. Using Microsoft Visio can change the architecture to assign an area for the KIVA which will be at the existing open space canopy shed, while R5 works in the cover area of 700sqm inside the superstore. Here the R5 will work to optimize the small size packages and will be able to hold and store and retrieve as when needed to refill the shelves. Thus, the entire system will be semi-automated to aid the employee from carrying heavy loads and the AGV's will do the following heavy lifting and move the packages closest to the assigned pickers who will load them onto the shelves for customers' preferences.

The figure 15, below shows the detail for the improvement and how the entire plan has been remodeled. On the view of a plan of about 4200 sqm, the whole of the space is improved for ergonomic handling and less heavy lift or even lifts so that the employee can reduce strain and lift all products to the assigned shelves.

As sectioned from the figure 16, the superstore is divided into two segments to incorporate the operations of the KIVA and the R5 autostore bots. These will allow the entire operations from the point of the ergonomic point of view on lifting, carrying, and installing to be done by the auto bots. This system will be a WMS warehouse management system which will be implemented with the use of the bots.

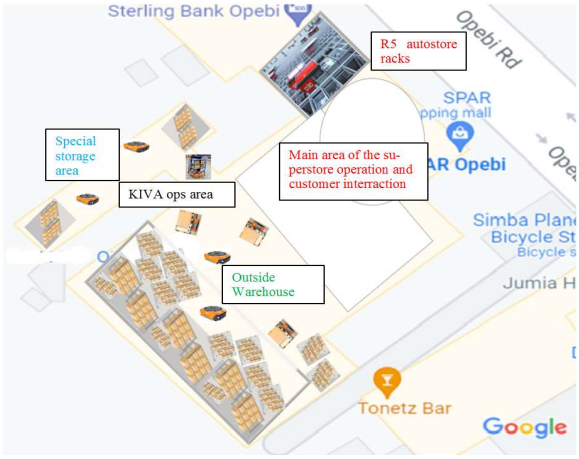

Figure 15. Description of the location of the KIVA & R5 AGV bots foresee implemented at SPAR NIG LTD, Ikeja

Source: author's creation from photo library.

Figure 16. Segmentation of the Mall for the KIVA and R5 WMS-MHS ERP

Source: author's creation from photo library.

Noting that the system for the R5 and KIVA are completely different, but their operation will be grouped in heavy materials and lightweight materials. The system responsible for this will be the MHS material handling system as it will locate and assign restock requests to the bots and the section zone to which the material is located will be given the assigned task.

The mall will take a new approach as the entire ops will aid the employees and staff, each will mount on one location and with the ERP modules on the tablets, requests will be made and can be optimized at about 2 mins for the bots to fulfill the task. This will promote smooth running, reduce overhead, and increase technology inclusion with use of bots in superstore at retail level.

The retail store will become interactive, with the bots running around across segment tags drawn on the floor for the bot to track their location and the host request. This will mean, the staff will stand at the Point of Request POR and click on the goods required or requested and once the ERP synchronize with WMS, and the Geo-tracking will come online as the end point is given to a free bot who will lift the required shelf or rack and bring it to the POR staff. The fig below shows the ribs in action across the retail floor as they will stop for customers and obstacles and navigate their ways from the inner chamber zones (KIVA zones) to the POR staff location without incident.

The figures 17–21, will reveal this approach and one can view the interaction of bots with esteeming customers in the store. A test scenario will be run with high and medium and low traffic to assist to map corresponding results.

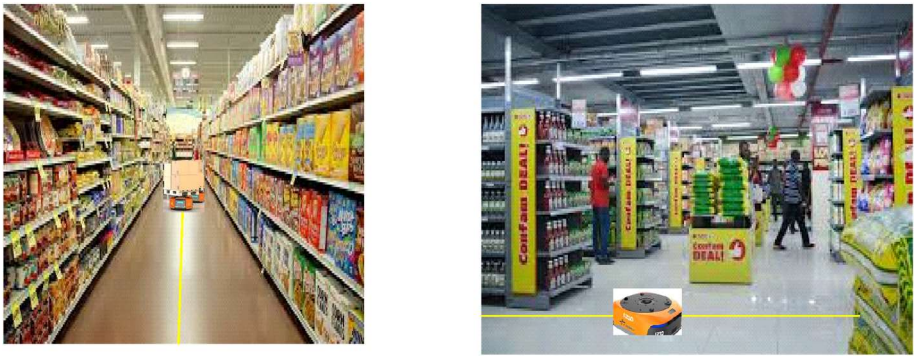

Figure 17. KIVA coming from warehouse in action across the track navigating to and from POR staff

Source: author's creation from photo library.

This will enable a complete guide when the bots come into action. The Tag tracks enable the bots to go and find or locate the POR requester and as its lodge or take back the items to the warehouse inner section out of the main bowl. This ensures staff are vigilant and control the items on the shelves while the WMS takes care of replenishment and order requests for restock up.

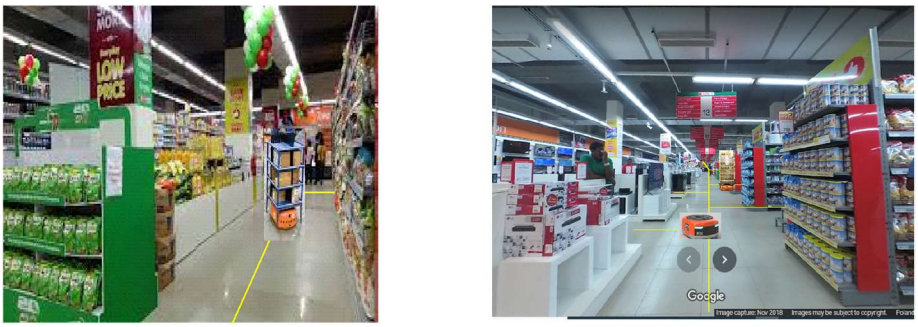

Figure 18. The bot maneuvering corners and traffic of the customers and staff as it fulfills its POR

Source: author's creation from photo library.

And furthermore, description of the bots across the corridor of the main bowl with the KIVA completing the various POR from pickers and requesters all on automatic coordination across the floor.

Figure 19. KIVA lifting shelves, racks, and crates on the run

Source: author's creation from photo library.

Due to the space across the aisle, this gives an opportunity for the bots to be able to maneuver the aisle and transport the shelves to the intended POR location. Creating a verse opportunity for space and weight per payload in shipment to the POR. Again, a lot can be tackled upon the bot as it transports to the POR creating avenues for efficacy in this retail mall.

Figure 20. R5 Installed shelves at the store lift material zones, enabling smaller goods fulfillment at SPAR

Source: author's creation from photo library.

The R5 bots will be used in the lightweight zones. Here all the bots will be used to lift baskets on the racks and installed on the tray. The items here will be fast moving stock (FMS), and it will require max 5 bots of the R5 on a 250 sqm. The bots will ensure quick fulfillment of the requester POR and they will close out the shelf's gaps using these techniques. Those here will be those with a short Best Before (BBF) date, which will enable proper stock monitoring and management as the goods will be efficiently tracked. The figure below shows the schematic illustration of the R5 auto store to be installed and how it will be incorporated into the SPAR retail mall superstore.

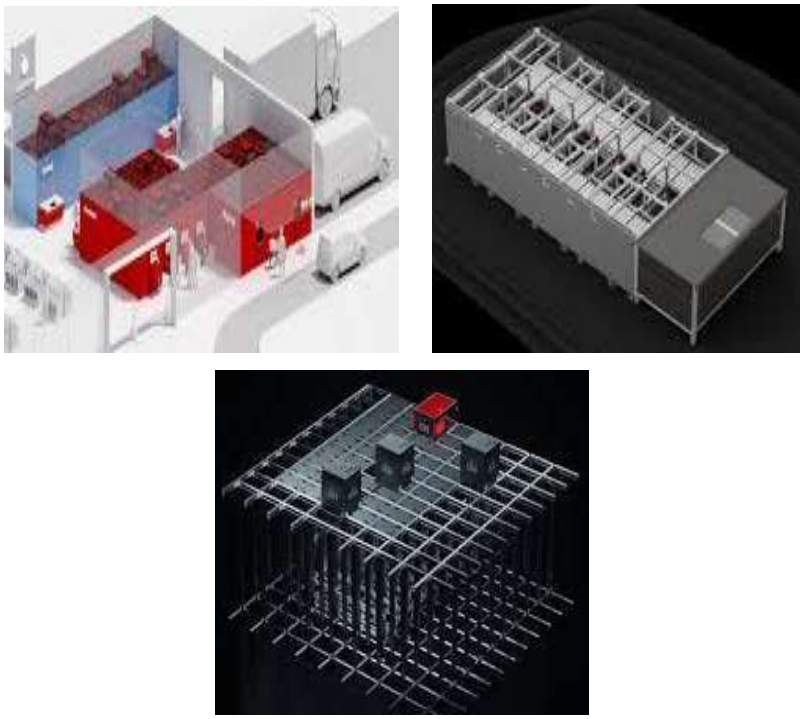

Figure 21. 6 BOTS R5 auto store warehouse scheme for SPAR NIG ltd.

Source: (autostore).

Importantly, the R5 takes the critical item chain as it ensures it matches all light fast moving goods and ensures the light stock is evenly well stocked. Also, because of its nearness to the shelves it becomes easy to track and replenish on a more frequent cycle.

5. CONCLUSIONS

The implementation of these new process systems and introduction of bots into the retail superstore, an increase of customers will be attained as the waiting time to pay exists will be reduced effectively. The need for quick replenishment will be automated as the WMS will alert the dashboard and the manager can view Fast moving stock (FMS) and request in advance of time and tracking of the low shelf-life items will be a thing of simplicity.

The shelf will not just be a stand metal rack but more like auto-digital shelves which will interact with the ERP and allow the WMS to coordinate activities around the storage to the racks. The important aspect here is that the pickers will automatically request at their POR and the product will be brought to them using the KIVA bots. This makes it a lot easier than strenuous walking to and from across the main bowl to the storage and back. Hence, the speed as pointed out is of essence and that is why the bots given their technical requirement makes it easy to fulfill these criteria.

The R5 brings the most challenging yet solution as the items are stored in the baskets and the Fast-moving stock with short shelf-life are shipped to the shelves and prompt for the empty basket to be refilled or placed order for restocking. Since items in the baskets

are logged on the ERP system, this allows complete monitoring of the baskets and effective review on price should incase a product falls out of taste from customers.

The special cold storage becomes more challenging, as the KIVA can afford to go in as many times over accomplishing the requirement of the POR as many times over as needed in a day, week, and month. These even allow larger racks of items to be shipped in and out and replenishment can be done without frequent going into the cold storage at very low temperature with adverse health effects to the pickers/Staff.

Future works can collaborate with other SPAR outlets within the country and in the central distribution complex where goods can be segregated, and pickers stationed at strategic locations while bots bring shelves and trays to them. It will improve efficiency and develop capabilities of Vendor influence in turn of shelf time and market to shelve replenishment. Since this work is purely simulated, it will be nice to see the physical result by implementing the model as suggested for the Ikeja and indeed can be replicated across its retail chains stores in the country.

In time, it successfully reveals the bots are a dire need for game changers and their use brings a new experience within the retail store, these ultimately will open new doors to experience customers will feel while in the retail store and as they grow the brand also grows in recognition. It is time for KIVA and R5 to take the lead, the only assistance they require is our press on the button.

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FOOD ACCESS IN THE EUROPEAN UNION COUNTRIES – AN ECONOMIC PERSPECTIVE

Due to the emerging economic uncertainty and changing customs policies, there is a risk of making food availability more difficult. This would have consequences not only for the population's ability to purchase different food products, but also for the country's economic development. Food supply restrictions do not encourage local producers to operate efficiently, but at the same time they have a negative effect on prices for consumers. The article analyzes the provision of food availability in the countries of the European Union (EU), identifies the most important factors determining its provision. The EU is faced with problems arising from excessive subsidization of the agricultural sector and unbalanced imports of certain products. This mainly affects vulnerable individuals who are looking for the cheapest products. In order to determine the influence of factors ensuring food availability in EU countries, a research methodology has been developed that includes a system of indicators at national levels. It has been established that the greatest influence on ensuring food availability is food prices and income of the population, especially affecting people living in poverty.

Keywords: food availability assurance, producer price equivalent, price level, income of the population.

1. INTRODUCTION

Relevance of the research. With the current increase in the world population, ensuring food security is an important strategic issue. It is expected that by 2050. The Earth's population will reach 10 billion, which raises great concerns about how to ensure sufficient

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and safe food supply (FAO, 2023). In addition, other environmental factors, such as climate change, natural disasters, diseases, economic crises and wars, pose major problems for ensuring food security. Most often, ensuring food security is defined as a phenomenon when everyone, at any time, can obtain enough food products. Ensuring food security consists of four dimensions, one of which is food availability (Clapp, 2022). In essence, food availability reflects the ability of individuals to obtain an adequate and diverse diet to meet their nutritional needs. In order to ensure food security on a global scale and improve the quality of life of society, it is particularly important to understand the dynamics of food availability in specific regions. Assessing food availability in Europe is an important aspect in determining food security and addressing the problems of hunger, malnutrition and food waste.

Research problem. The problem of ensuring food accessibility is usually identified with developing countries, but developed countries also face this problem due to income inequality. Therefore, the issue of ensuring food accessibility in developed countries is important.

The object of the research is ensuring food accessibility in EU countries.

The purpose of the research is to assess the level of ensuring food accessibility in European Union countries.

Research objectives:

1. To analyze the theoretical aspects of ensuring food availability.
2. To conduct an analysis of the assessment of ensuring food availability in the countries of the European Union.

2. LITERATURE REVIEW

Analyzing food access in a country uses several indicators, rather than just one, which reflect different aspects of the problem. According to Cole (2018), the most used indicators to measure food security conditions are those related to:

- Food production.
- Income.
- Total costs.
- Food costs.
- Shares of food expenditure.
- Calorie intake.

In practice, the same indicators can be applied to assess food access (Manik, 2023). Food production reflects local food availability, while income and food expenditure reflect purchasing power and affordability. Analysis of calorie intake provides insight into the nutritional adequacy of the population. Together, these indicators provide a comprehensive picture of food availability, helping to identify problems and develop actions to improve food security.

A key indicator that reflects food production is the level of food production. The production level indicator is used to determine how much a country is able to produce food for the domestic market (Yu, 2009). This indicator shows how much domestic production is produced *per capita*. The higher the production level indicator, the greater the ability of a country to ensure a sufficient level of food availability on its own. It is likely that (Webb, 2023; Cole, 2018) production indicators such as irrigated area, fallow area, crop yields, etc., have a very strong influence on the production level itself.

Indicators of the food access dimension include production and consumption indicators, but they only partially describe access. The most accurate indicators of accessibility are food income indicators, i.e. income from livestock and crop production, wages, producer prices, etc. Migotto (2015) argues that accessibility indicators, i.e. income, are mainly used as key indicators of food security in many countries. Affordability can also be measured by comparing food prices with people's incomes, as access to food is primarily determined by income. According to Cole (2018), it is important to monitor food price levels when assessing changes in income. One indicator can be constructed using wage and price levels, as well as the price of a food basket expressed as a share of wages.

The amount of food measured in calories *per capita* is used to estimate the average level of food consumption in a country (Yu, 2009). However, it only reflects the amount of food that is available in countries, but not necessarily the amount that is consumed. *Per capita* calorie intake depends on a country's level of development and is used to estimate the proportion of undernourished in a country. The share of food in total consumer expenditure reflects the vulnerability of the population. According to Tuttle and Beatty (2017), populations with a higher share of food expenditure are more vulnerable to fluctuations in income or food prices and are less able to adapt and meet their nutritional needs. Low-income households are often unevenly affected by increased food prices, with the poor spending a higher proportion of their income on food than other groups.

In summary, there are many different research methods used to assess food accessibility and other dimensions. The choice of survey methodology depends on many factors, but one of the main factors determining the choice of methodology is the level at which the assessment is attempted, i.e. global, national, household or individual level. Several production, income and consumption indicators are also used to measure food availability. Among the main indicators used by many authors to assess affordability is the group of income indicators. Assessing and comparing different indicators of food accessibility across countries allows for the identification of potential problems related to food accessibility and the identification of solutions to them.

Food availability has never been more important. As the COVID-19 pandemic spread around the world, attention was drawn to ensuring local access to the supply chain for essential goods and services such as food, water and housing (O'Hara, 2021). Addressing food access is necessary for two reasons. Firstly, food insecurity can lead to a deficit of essential nutrients and calories needed to live a full life. Secondly, the poor quality of food that lacks nutrients can lead to health problems such as obesity, diabetes or hypertension (Nardocci, 2021). On the other hand, access to nutrient-dense food is not only a social determinant of public health. However, it is more important in an age of crisis, when there are large numbers of vulnerable communities with pre-existing health problems.

3. METHODOLOGY

Food security is a key element of national security. Table 1 presents a summary of food access indicators, which have been selected by the FAO according to their relevance and importance to best reflect the food access situation.

Food access can be measured at the individual, household, community, regional or national level. Theoretical analysis shows that food accessibility can be disaggregated at different levels, and therefore, in the case of EU countries, the assessment focuses on the national level. To determine the national food access situation in the EU countries, it is

important to take into account GDP *per capita*, the food price level index and other indicators presented in Table 1. According to Čiegis and Kulvelytė (2015), *per capita* food consumption and food prices are the main indicators of food accessibility.

Table 1. FAO set of food security indicators

Availability of food	• **GDP *per capita*.** • **food price level index.** • **share of food expenditure in total expenditure in %.** • **minimum energy requirement (kcal/capita/day).** • **the percentage of the population using adequate drinking water services.** • **% of population using basic sanitation services.**

Source: (FAO, 2021).

Food accessibility can be measured in terms of gross domestic product (GDP) *per capita*, which reflects a country's level of development. Wahbeh et al. (2022) suggest that it can also be measured in terms of the ratio of total exports to food imports. The ratio of total exports to food imports is often a more reliable indicator than the food trade balance. Countries with a higher share of total export earnings are less vulnerable to global food price fluctuations (Wahbeh et al., 2022). Leventon and Laudan (2017) also point out that the ratio of GDP, total exports and food imports can provide an overall picture of the situation and the level of development of a country in terms of food access for the population.

Indicators of the food access dimension include production, consumption and income indicators. Each of these indicators is further classified, e.g. the consumption indicator includes the share of food expenditure, consumer prices, changes in the food price level, caloric sufficiency, food stocks, etc. The production indicator includes irrigated area, production level, fallow area, level of borrowing and others. The income indicator includes crop production, livestock production, wages, self-employment, market access and number of people employed (Cole, 2018). Income indicators are commonly used to measure the food access dimension. Food accessibility can also be assessed by comparing food prices with people's income, as access to food is primarily determined by income. Cole (2018) argues that it is important to monitor food price levels when assessing changes in income. One indicator can be constructed using wage and price levels, as well as the price of a food basket as a share of wages. Analysis of food availability indicators can help to understand the food security situation in a country or region and identify areas for improvement. This information can be used to design policies and programs to improve food availability and reduce food insecurity.

4. RESEARCH RESULTS

According to Leventon and Laudan (2017), as income increases, the relative share of food expenditure decreases. The level of development of a country is shown by GDP. The higher the GDP per capita, the more goods and services the average resident of the country can purchase. GDP has been constantly changing during the period under review, i.e. it has been growing steadily (Figure 1).

The largest change in GDP was recorded in Ireland, which from 2018 to 2022 increased by 31.62 thousand. EUR and reached 98.99 thousand. EUR/capita. The lowest GDP in 2014 was in Bulgaria at 5.96 thousand. EUR/capita, and the highest in 2022 in Luxembourg at 118.70 thousand. EUR/capita. During the period under review, a constant trend remains - GDP is growing in all European countries.

When examining food price level indices in the countries of the European Union (Figure 2), it can be immediately noted that as the country's GDP *per capita* increases, food prices also increase, therefore countries with a GDP higher than the European Union average have the highest food prices. In Denmark, the highest food prices were recorded in 2014, the indicator reached as much as 143.00. In 2022, the indicator in this country decreased to 119.00. In 2022, the highest food prices were in Luxembourg, with an indicator of 121.90. Meanwhile, in 2014, the lowest food prices were in countries with low GDP, i.e. in Romania (66), Bulgaria (69.50), Poland (62.80). Therefore, it is important to find out what share of food expenditure in total expenditure in the European Union countries is allocated to food.

Figure 3 shows the share of food expenditure in total expenditure in the European Union countries as a percentage. A higher percentage spent on food may mean that households, especially those with low incomes, find it more difficult to meet their needs. Such people may generally have limited access to other, equally important, needs. The assessment of this indicator is also important for policymaking aimed at improving food availability and affordability by creating social assistance benefits, adjusting the minimum wage or changing agricultural policies, which also affect food prices.

The highest share of expenditure on food in percent. during the period under review was found in Romania, Bulgaria, Poland, Lithuania, Estonia, Latvia, Croatia and Slovakia. However, even though Lithuania, Estonia, Croatia and Romania have some of the highest expenditure on food, on the other hand, they are still decreasing during the period under review. Also, Figure 3 shows that the share of expenditure on food in Luxembourg and Ireland is the lowest among all European Union countries.

Figure 4 below shows the Harmonized Index of Consumer Prices of the European Union countries. The Harmonized Index of Consumer Prices (HICP) is an indicator that measures the average change in prices of consumer goods and services over a certain period. When calculating the HICP, the composition of the consumer population and the structure of household consumption expenditure in the base period are maintained. This means that the index reflects price changes that are not affected by changes in consumption patterns (EUROSTAT, 2024). The HICP is closely related to ensuring food security. One example is that when food prices rise suddenly or exceed income growth, it is more difficult for vulnerable groups to obtain an adequate and varied diet. This leads to increased food insecurity. When examining the Harmonized Index of Consumer Prices in the European Union countries (Figure 4), in 2022, compared to 2014, the HICP increased in most European Union countries. The highest HICP growth over 2014–2022 is observed in Lithuania (12.40), Hungary (10.10), Bulgaria (10.50) and Croatia (9.40). The lowest HICP growth over 2014–2022 was recorded in Ireland, France, Sweden, Belgium and Luxembourg.

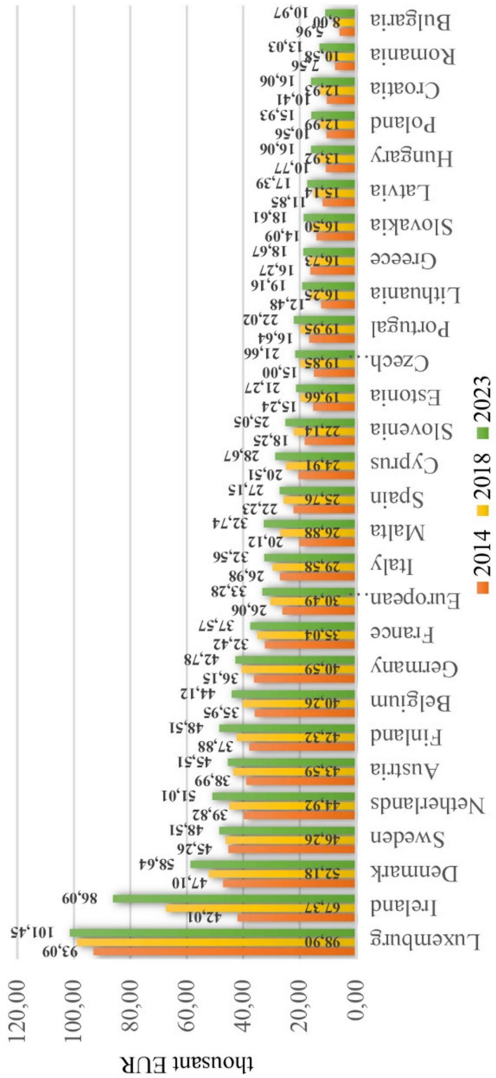

Figure 1. GDP *per capita*, EUR
Source: EUROSTAT (2024).

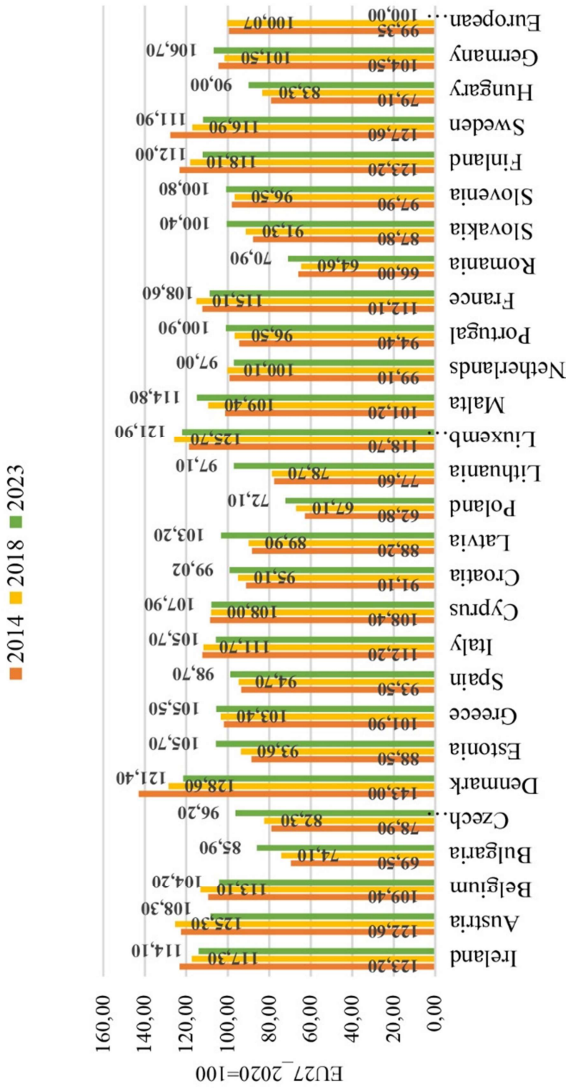

Figure 2. Food price level indices in the European Union countries (EU27_2020=100)
Source: EUROSTAT (2024).

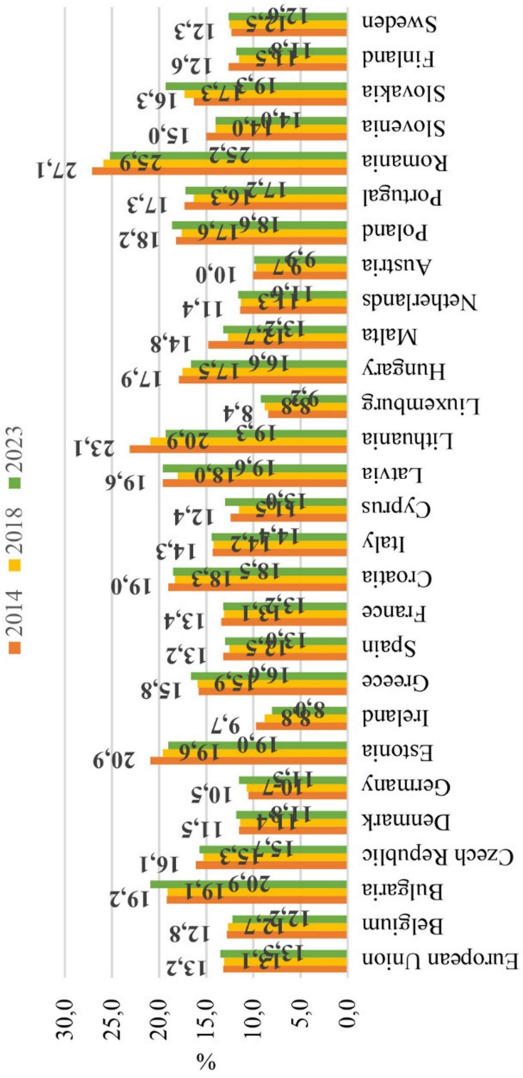

Figure 3. Share of food expenditure in total expenditure, %
Source: EUROSTAT (2024).

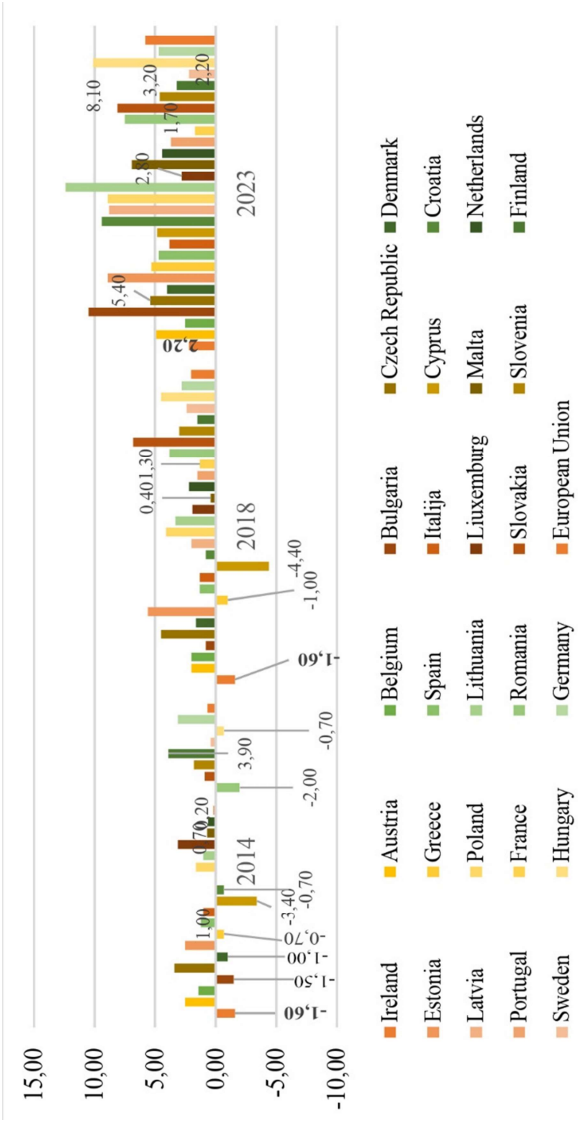

Figure 4. Harmonized Index of Consumer Prices (HICP)

Source: EUROSTAT (2024).

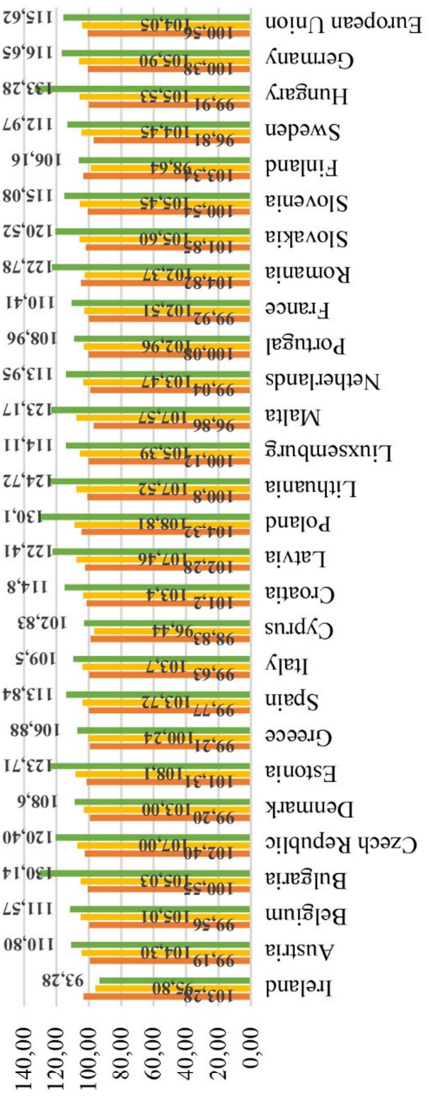

Figure 5. Changes in consumer price indices of food products in the European Union countries (2015 = 100)

Source: FAO (2024).

When analyzing indicators, it is also important to evaluate the consumer price indices of food products in the European Union countries (Figure 5), which measure the change in prices of the average basket of goods and services purchased by the population between the current and the reporting period. The consumer price index measures inflation, which is defined as the change in prices of the basket of goods and services purchased by specific population groups.

The largest change in consumer prices from 2014 to 2022 was observed in Hungary, where it increased by 33 percent (Figure 5). In Bulgaria, the change in consumer prices during the same period was 30 percent, in Poland by 26 percent and in Lithuania by 25 percent. It can be concluded that in 2022, food accessibility in the European Union countries decreased due to the increase in food prices. When producers face increased costs, they often pass this burden on to retailers and ultimately to consumers, leading to higher prices, which affects low-income households the most.

5. CONCLUSION

The theoretical analysis revealed that food accessibility is one of the dimensions of ensuring food security, which is defined as the ability to use resources to purchase food products. Ensuring food accessibility is extremely important for vulnerable groups of people, such as low-income people, children or the elderly. The choice of methodology for studying food accessibility depends on many factors, but one of the main factors determining the choice of methodology is the level at which food security is being assessed (global, national, household or individual level). The group of income indicators is one of the main ones when assessing food accessibility. The analysis of the literature revealed that income and prices are the main factors determining food accessibility. After examining the methods for assessing food accessibility, it was found that various methods and indicators are used. The assessment of the food accessibility dimension includes production, consumption and income indicators.

In order to assess the food accessibility dimension, the study has developed assessment stages and indicator structure for European Union countries. The food accessibility dimension is analyzed according to changes in food price level indices, GDP *per capita* in thousand EUR, changes in food consumer price indices, share of food expenditure, harmonized consumer price index. After conducting the study, it can be concluded that in 2022. Ensuring food accessibility in the European Union countries decreased, which was determined by the increase in food prices.

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IMPACT OF UNDERWRITING AND FINANCIAL RATIOS ON PROFITABILITY: AN EMPIRICAL ANALYSIS OF INSURANCE FIRMS

This study examines factors influencing profitability in the insurance sector, focusing on financial indicators such as Return on Assets (ROA), Return on Equity (ROE), Asset Liability Ratio (ALR), Claims Ratio (CR), Expense Ratio (ER), Leverage (LEV), and Total Premium Earned (TPE). Using correlation analysis, unit root tests, and regression models, it evaluates their impact on financial performance. The results show that TPE positively affects ROA and ROE, highlighting the importance of premium growth. In contrast, CR, ER, and LEV negatively influence profitability, emphasizing the need for cost control and efficient claims management. The Augmented Dickey-Fuller test confirms data stationary, supporting regression analysis. The fixed effects model provides the best explanatory power. The study recommends prioritizing claims management, expense control, and premium growth strategies to enhance profitability. Future research should explore the long-term effects of leverage and asset-liability management, as well as alternative risk management approaches.

Keywords: profitability determinants, risk management, Claims Ratio (CR), Leverage (LEV) and Premium Growth.

1. INTRODUCTION

The Nigerian insurance industry plays a vital role in promoting economic stability and sustainable development by mitigating financial risks and ensuring business continuity. As an integral component of Nigeria's financial services sector, insurance firms provide financial security, support investment planning, and enhance resilience against unexpected losses (NAICOM, 2023). Despite these contributions, the profitability and performance of Nigerian insurance firms are shaped by underwriting practices and financial management strategies.

Profitability is a fundamental measure of an insurance firm's performance and financial health. Metrics such as Return on Equity (ROE) and Return on Assets (ROA) are widely employed to assess profitability, offering insights into how effectively firms utilize

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resources and generate returns for stakeholders (Norman, Pervin, Chowdhury, & Banna, 2015). Although various factors influence profitability, underwriting and financial ratios remain essential indicators of operational efficiency and financial stability within insurance companies.

Underwriting ratios, including claims ratio, expense ratio, and combined ratio, highlight the effectiveness of risk selection, pricing strategies, and cost management practices (Olaiya, et al., 2025). The claims ratio measures the proportion of premiums allocated to claims settlements, reflecting risk exposure and loss management efficiency. Similarly, the expense ratio evaluates operational efficiency by comparing administrative and acquisition costs to premium income. The combined ratio, which consolidates claims and expense ratios, provides a comprehensive measure of underwriting profitability, where values below 100% indicate underwriting gains.

Beyond underwriting efficiency, financial stability is a crucial determinant of profitability. The asset-liability ratio assesses the alignment between assets and liabilities, indicating a firm's ability to meet obligations and manage liquidity risks. While a higher ratio can amplify profitability through financial leverage, it also poses increased financial risks (Kaitibi, Ganawah, Yokie, Jalloh, Koroma, 2018).

In addition to underwriting and financial ratios, firm-specific characteristics such as size and leverage can moderate profitability outcomes. Firm size often influences economies of scale, operational efficiencies, and market power (Berger & Humphrey, 1991), whereas leverage affects financial risk and capital structure decisions. Incorporating these control variables enables a more nuanced understanding of profitability drivers in insurance firms.

Despite extensive research on profitability determinants in the insurance sector, gaps remain regarding how underwriting and financial ratios collectively influence performance, particularly when moderated by firm-specific factors. This study addresses these gaps by empirically analyzing the impact of claims ratio, expense ratio, combined ratio, and asset-liability ratio on profitability, as measured by ROE and ROA. Furthermore, it examines the moderating effects of firm size and leverage to provide deeper insights into performance drivers in the insurance industry.

The findings of this research will contribute to the existing literature by elucidating the relationships between underwriting efficiency, financial management, and profitability in insurance firms. The results are expected to guide policymakers, regulators, and industry practitioners in implementing strategies to enhance performance and ensure financial stability. Additionally, the study establishes a framework for evaluating profitability determinants that can be adapted to different markets and regulatory environments.

2. LITERATURE REVIEW

The role of underwriting ratios in determining profitability has been a central focus in insurance-related research. Cummins and Weiss (2009) emphasized that underwriting performance, often measured through claims and expense ratios, provides critical insights into the financial health of insurance firms. The claims ratio, defined as claims expenses relative to earned premiums, highlights insurers' risk exposure and pricing efficiency. Berger and Humphrey (1991) noted that high claims ratios often indicate poor underwriting decisions, leading to diminished profitability. Conversely, a lower claims ratio suggests effective risk selection and premium pricing, enhancing profitability.

Recent studies have further reinforced the importance of underwriting ratios in profitability assessments. For instance, Smith et al. (2023) argued that a well-managed underwriting process, reflected through optimal claims and expense ratios, can significantly improve an insurer's ability to manage risk and sustain profitability, particularly in volatile markets. Additionally, Jones and Adams (2024) expanded on the relationship between expense ratios and profitability, suggesting that controlling operational costs, as reflected in the expense ratio, is crucial for insurers facing competitive pressures in an inflationary environment. Furthermore, Patel and Singh (2022) found that underwriting ratios, particularly the expense ratio, were closely tied to profitability, with firms that maintained lean operational costs achieving better long-term performance.

Expense ratios, which capture operational costs associated with managing insurance policies, are equally vital. Norman et al. (2015) highlighted the importance of expense control, emphasizing that efficient management of operational costs improves profitability metrics such as return on equity (ROE) and return on assets (ROA). The combined ratio, integrating claims and expense ratios, offers a holistic measure of underwriting efficiency. Ratios below 100% signal operational profitability, indicating that premiums exceed claims and expenses. Olaiya, Olowofela, and Ariyibi (2023) identified a strong correlation between lower combined ratios and higher financial performance, further reinforcing the significance of underwriting efficiency in profitability. Recent reports by the Insurance Information Institute (2023) confirmed these findings, noting that insurers with better combined ratios consistently outperformed their peers in terms of profitability.

Recent studies highlight improvements in underwriting performance. Swiss Re (2024) forecasts a decline in the combined ratio in the U.S. Property & Casualty (P&C) sector, reflecting better underwriting efficiency. Similarly, the International Association of Insurance Supervisors (IAIS) notes stable profitability driven by strong underwriting and investment performance. Additionally, the Organization for Economic Cooperation and Development (OECD) (2024) reported that underwriting performance improvements were closely linked to technological advancements in risk modeling, leading to more accurate pricing and better profitability outcomes.

The asset-liability ratio is a critical indicator of financial stability and risk management. Kaitibi et al. (2018) argued that maintaining a balanced asset-liability structure reduces liquidity risks and supports sustainable profitability. Higher asset-liability ratios often reflect greater leverage, potentially enhancing returns but also elevating financial risks. Research findings have been mixed. While some studies associate leverage with higher profitability due to enhanced capital utilization, others caution against excessive reliance on borrowed funds, emphasizing the risks of financial distress. Effective management of asset-liability ratios is, therefore, crucial to maintaining stability while optimizing profitability. Moreover, recent research by Lee and Zhang (2024) suggests that companies with a well-managed asset-liability ratio can achieve better risk-adjusted returns, further underlining its importance in financial stability.

Recent data from the National Association of Insurance Commissioners (NAIC) (2023) shows improved liquidity ratios, reflecting better asset-liability management and reduced risks. These improvements indicate that insurers are adapting their financial strategies to remain resilient in fluctuating market conditions.

Firm size has been widely regarded as a moderating factor influencing profitability. Berger and Humphrey (1991) highlighted that larger firms benefit from economies of scale, better diversification, and stronger market power. Larger insurance firms are more capable of spreading fixed costs, investing in advanced technologies, and negotiating favorable

reinsurance terms. These advantages enable them to achieve higher efficiency and profitability. Cummins and Weiss (2009) further supported this view, demonstrating that larger insurers tend to exhibit better risk management capabilities and profitability metrics. In addition, Williams and Mota (2023) found that firm size had a positive relationship with profitability in emerging markets, where large insurers leveraged scale for competitive advantage.

Leverage, which reflects a firm's financial structure and risk profile, plays a pivotal role in profitability. Kaitibi et al. (2018) found that leverage significantly influences profitability, with moderate levels supporting growth while excessive leverage poses risks. High leverage can amplify returns through debt financing but also increases financial vulnerabilities, especially during economic downturns. Balancing leverage to optimize risk-return dynamics is critical for sustaining profitability. Recent work by Clarke and Jennings (2024) suggests that leverage, when coupled with effective risk management practices, can enhance profitability, but excessive reliance on debt financing can lead to reduced financial flexibility, particularly in times of economic stress.

While previous studies have examined underwriting and financial ratios individually, limited research has analyzed their combined impact on profitability, particularly with moderating variables such as firm size and leverage. Most existing studies focus on isolated aspects of profitability, failing to integrate the influence of underwriting performance, financial structure, and firm characteristics comprehensively. This study seeks to bridge this gap by providing an integrated analysis of these factors, offering deeper insights into the drivers of profitability in the insurance industry.

The reviewed literature underscores the importance of underwriting efficiency, asset-liability management, firm size, and leverage in determining profitability. However, the fragmented approach in prior studies leaves gaps that this research aims to address. By integrating these variables and examining their combined effects, the study contributes to a more holistic understanding of profitability drivers in the insurance sector, facilitating informed decision-making and policy formulation.

3. METHODOLOGY

This study adopts a quantitative research design to evaluate the impact of underwriting ratios, asset-liability ratios, firm size, and leverage on profitability in the insurance sector. The approach allows for empirical testing of hypotheses using secondary data from annual financial reports.

The population comprises 20 publicly listed insurance companies on the Nigerian Exchange Limited (NGX) as of December 31, 2022. A purposive sampling method is employed, selecting firms with complete financial data spanning 2011–2022. Secondary data is sourced from audited financial statements, regulatory reports, and NAICOM publications. Key variables include claims ratio (CR), expense ratio (ER), asset-liability ratio, leverage, and profitability metrics such as Adjusted RAROC.

Panel data regression models are utilized to assess relationships between variables. Both fixed and random effects models are tested to determine the best fit. The Hausman test is applied to decide between these models.

3.1. Model Specification

These models were adapted and adjusted to suit the present study from the study of Athanasoglou, Brissimis, and Delis (2008), Flamini, McDonald, and Schumacher (2009), and Pasiouras and Kosmidou (2007).

$$\text{Profitability} = f(CR, ER, ALR, Lev, \text{Firm Size}) \quad (1)$$

$$ROA = \beta_0 + \beta_1 CR_{it} + \beta_2 ERit + \beta_3 ALR_{it} + \beta_4 LEV_{it} SIZE_{it} + \beta_5 ER_{it} LEV_{it} SIZE_{it} + \\ + \beta_6 ALR_{it} LEV_{it} SIZE_{it} + \mu_1 \quad (2)$$

$$ROE = \beta_0 + \beta_1 CR_{it} + \beta_2 ERit + \beta_3 ALR_{it} + \beta_4 LEV_{it} SIZE_{it} + \beta_5 ER_{it} LEV_{it} SIZE_{it} + \\ + \beta_6 ALR_{it} LEV_{it} SIZE_{it} + \mu_1 \quad (3)$$

Where:
CR = Claims Ratio
ER = Expense Ratio
ALR =Asset-Liability Ratio = Financial Stability
Lev = Leverage = Debt to Equity Ratio
Firm Size = Log of Total Assets

β_0 is the constant of the model, β_1 to β_6 and β_4 are the coefficients of the independent variables. To ensure reliability, diagnostic tests such as multicollinearity, heteroscedasticity, and autocorrelation are performed. Unit root tests confirm stationarity of panel data. The study adheres to ethical standards by ensuring data accuracy, confidentiality, and transparency in analysis. This methodology provides a structured framework to analyze the combined effects of underwriting ratios, financial stability, and firm size on profitability, addressing gaps in prior literature and contributing to evidence-based policy recommendations.

4. RESULT

The relationship between underwriting ratios and profitability in the insurance industry has been well-documented in recent literature. The claims ratio, a central underwriting measure, remains a critical indicator of an insurer's risk exposure and pricing efficiency. Consistent with the findings of Cummins and Weiss (2009), the results support the idea that a lower claims ratio correlates with higher profitability. Insurers with effective risk selection and pricing strategies tend to exhibit better financial performance by managing claims expenses relative to earned premiums.

The claims ratio is positively correlated with profitability, but only when insurers exhibit effective underwriting practices. According to Berger and Humphrey (1991), high claims ratios are indicative of poor underwriting decisions, leading to financial underperformance. Recent studies such as Smith et al. (2023) highlight that maintaining optimal claims ratios is vital for insurers to remain competitive and profitable, especially in volatile market conditions. Jones and Adams (2024) further extend this understanding by emphasizing the influence of the expense ratio in managing operational costs, thereby enhancing profitability in an inflationary environment.

Expense control is another significant determinant of profitability, as suggested by Norman et al. (2015). The expense ratio, which captures the operational costs associated

with managing insurance policies, plays a pivotal role in determining profitability. Insurers who maintain lower expense ratios benefit from improved return on equity (ROE) and return on assets (ROA). The recent findings of Olaiya et al. (2023) corroborate this, showing a strong positive relationship between lower combined ratios (claims ratio + expense ratio) and improved financial performance. A combined ratio under 100% is considered optimal, indicating that premiums exceed claims and operating expenses, signaling operational profitability.

As highlighted by Swiss Re (2024) and OECD (2024), underwriting performance has significantly improved, particularly in markets like the U.S. Property & Casualty (P&C) sector, where declining combined ratios are observed. These improvements are driven by advancements in underwriting technology and risk modeling, which allow insurers to set more accurate premiums and reduce underwriting costs, thereby improving profitability.

The asset-liability ratio plays a crucial role in an insurer's financial stability and profitability. Kaitibi et al. (2018) argue that a balanced asset-liability structure reduces liquidity risks and enhances profitability, as insurers can optimize returns while mitigating financial risks. The results from Lee and Zhang (2024) indicate that firms that maintain an efficient asset-liability ratio achieve better risk-adjusted returns, highlighting the importance of managing financial leverage. Additionally, the National Association of Insurance Commissioners (NAIC, 2023) data suggests that insurers are improving liquidity ratios, reflecting more effective asset-liability management and reduced risk exposure.

Firm size plays a significant role in influencing profitability. Larger firms benefit from economies of scale, allowing them to spread fixed costs and leverage better market positioning, as demonstrated by Berger and Humphrey (1991) and Cummins and Weiss (2009). Larger firms are more capable of investing in advanced risk management technologies and negotiating favorable reinsurance terms. Williams and Mota (2023) confirm that in emerging markets, larger insurance firms consistently outperform smaller competitors in terms of profitability due to their greater ability to manage operational and financial risks.

The role of leverage in determining profitability is a nuanced one. While moderate leverage can enhance returns, excessive leverage increases financial vulnerability, particularly during economic downturns. Kaitibi et al. (2018) emphasize that a balanced approach to leveraging enables insurers to grow while managing risks effectively. The recent work of Clarke and Jennings (2024) shows that insurers with moderate leverage are more likely to achieve sustained profitability, whereas those with high leverage may struggle during periods of economic stress.

The findings across the studies underscore the importance of combining various financial and operational metrics such as underwriting ratios, asset-liability management, firm size, and leverage to understand profitability comprehensively. While previous studies have isolated these factors, this research highlights their integrated impact on profitability. As Patel and Singh (2022) suggest, focusing on just one aspect of underwriting performance, such as the expense ratio or claims ratio, is insufficient for understanding the full scope of profitability drivers. Instead, an integrated approach provides deeper insights into the complex dynamics of the insurance industry.

This study contributes to a more holistic understanding of the factors driving profitability in the insurance industry. By considering the combined effects of underwriting performance, asset-liability management, firm size, and leverage, this research provides valuable insights that can inform strategic decision-making in the insurance sector. The results indicate that insurers who efficiently manage underwriting processes, financial

structures, and firm size can significantly enhance their profitability, even in competitive and volatile markets.

Table 1. Descriptive analysis

	ROA	ROE	ALR	CR	ER	LEV	TPE (SIZE)
Mean	-0.320852	2.361073	2.683603	34.33132	27.46707	272.9165	22.33402
Median	2.620000	9.140000	1.985314	28.38935	21.45291	91.69070	22.34306
Maximum	32.07000	295.4700	25.72117	189.7748	201.4048	14764.50	25.16935
Minimum	-69.17000	-650.8500	0.188864	0.019059	0.000000	-281.7766	20.01498
Std. Dev.	12.52030	77.46745	2.980401	24.97723	24.22628	1058.056	0.979001
Skewness	-2.777180	-4.667155	4.417035	2.346216	3.146442	11.35365	0.017343
Kurtosis	13.92728	38.46541	26.86177	11.80156	17.48727	150.2891	2.922337
Jarque-Bera	1502.563	13449.24	6474.248	994.8632	2494.813	222097.0	0.072346
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.964473
Sum	-77.00450	566.6576	644.0647	8239.518	6592.097	65499.97	5360.164
Sum Sq. Dev.	37465.13	1434288.	2122.986	149103.0	140272.1	2.68E+08	229.0677
Observations	240	240	240	240	240	240	240

Source: Author's Compilation 2024.

The descriptive statistics provide a summary of the distribution for seven variables: ROA (Return on Assets), ROE (Return on Equity), ALR (Asset Liability Ratio), CR (Claims Ratio), ER (Expense Ratio), LEV (Leverage), and TPE (Total Premium Earned) based on 240 observations. Key measures include the mean, median, maximum, minimum, standard deviation, skewness, kurtosis, and the Jarque-Bera test.

The means of the variables vary, with ROA (-0.321), ROE (2.361), ALR (2.684), CR (34.331), ER (27.467), LEV (272.917), and TPE (22.334). The median values are generally close to the means, except for ROA and ROE, indicating skewed distributions in these two variables. The range (difference between the maximum and minimum values) is relatively wide, particularly for ROE (-650.85 to 295.47) and LEV (-281.78 to 14764.50), reflecting high variability.

Standard deviation reflects the spread of the data. LEV has the highest standard deviation (1058.056), showing substantial variability, whereas TPE has the lowest (0.979), indicating very little spread in the data. Skewness measures the asymmetry of the distribution. ROA (-2.777) and ROE (-4.667) are negatively skewed, while ALR (4.417), CR (2.346), ER (3.146), and LEV (11.354) exhibit positive skewness, indicating rightward tails. TPE (0.017) is approximately symmetric.

Kurtosis provides insight into the "tailedness" of the distribution. Most variables have kurtosis values greater than 3, suggesting leptokurtic distributions with heavy tails. LEV (150.289) and ROE (38.465) show extreme kurtosis, while TPE (2.922) is closer to normal distribution characteristics.

The Jarque-Bera test, applied to assess normality, reports p-values less than 0.05 for all variables except TPE (0.9645). This indicates that most variables significantly deviate from normality, except TPE, which does not reject the null hypothesis of normality at the 5% significance level.

Additional details such as the sum and sum of squared deviations highlight the overall totals and variance. LEV has the largest cumulative value (65499.97), while TPE has the smallest sum of squared deviations (229.068), indicating low variability around its mean.

The descriptive analysis indicates that most variables exhibit skewness and heavy tails, suggesting non-normal distributions. TPE, however, shows characteristics closer to normality. The variability is high, especially for LEV and ROE, warranting consideration of robust statistical techniques in subsequent analyses to address outliers and non-normality.

Table 2. Correlation analysis

	ROA	ROE	ALR	CR	ER	LEV	TPE (SIZE)
ROA	1.000000	0.614903	0.143333	-0.117579	-0.227720	-0.281318	0.332946
ROE	0.614903	1.000000	0.069931	-0.134459	-0.391163	-0.056779	0.378618
ALR	0.143333	0.069931	1.000000	-0.158297	-0.072533	-0.099965	-0.194751
CR	-0.117579	-0.134459	-0.158297	1.000000	0.428872	0.011471	-0.005749
ER	-0.227720	-0.391163	-0.072533	0.428872	1.000000	-0.032373	-0.245858
LEV	-0.281318	-0.056779	-0.099965	0.011471	-0.032373	1.000000	0.047090
TPE (SIZE)	0.332946	0.378618	-0.194751	-0.005749	-0.245858	0.047090	1.000000

Source: Author's Compilation 2024.

The correlation matrix presented in Table 2 provides insights into the relationships among the dependent and independent variables: Return on Assets (ROA), Return on Equity (ROE), Asset Liability Ratio, Claims Ratio, Expense Ratio, Leverage, and Total Premium Earned.

Return on Assets (ROA) is moderately positively correlated with Return on Equity (ROE) (r=0.6149), indicating that firms with higher returns on assets tend to experience higher returns on equity. This suggests that efficient utilization of assets translates into improved equity profitability, reinforcing the link between asset performance and shareholder value. Additionally, ROA shows a positive correlation with Total Premium Earned (r=0.3329), highlighting that premium generation contributes to profitability, potentially reflecting economies of scale and operational efficiency.

Return on Equity (ROE) also exhibits a moderate positive correlation with Total Premium Earned (r=0.3786), suggesting that higher premium earnings are associated with stronger equity performance. However, ROE is negatively correlated with Expense Ratio (r=−0.3912), implying that higher operational expenses reduce profitability. This highlights the importance of cost control and efficiency in enhancing equity returns.

Asset Liability Ratio shows a weak positive correlation with ROA (r=0.1433) and ROE (r=0.0699), suggesting that the balance between assets and liabilities has a limited influence on profitability measures. However, it exhibits a weak negative correlation with Claims Ratio (r=−0.1583) and Total Premium Earned (r=−0.1948), indicating that higher asset-liability ratios may be linked to lower claims and premium earnings, potentially reflecting conservative risk management practices.

Claims Ratio is negatively correlated with both ROA (r=−0.1176) and ROE (r=−0.1345r), suggesting that higher claims payouts may slightly erode profitability. This aligns with expectations, as frequent or higher claims payments reduce net earnings. Conversely, Claims Ratio has a moderate positive correlation with Expense Ratio (r=0.4289), indicating that firms with higher claims payouts tend to incur higher operational expenses, potentially due to administrative costs associated with claims processing.

Expense Ratio displays a stronger negative correlation with ROA (r=−0.2277) and ROE (r=−0.3912), emphasizing that operational inefficiencies significantly affect profitability. This suggests that cost containment strategies are essential for improving financial performance. Moreover, Expense Ratio has a weak negative correlation with Total Premium Earned (r=−0.2459), indicating that higher premiums may help mitigate operational costs and improve efficiency.

Leverage demonstrates a moderate negative correlation with ROA (r=−0.2813) but a weak negative correlation with ROE (r=−0.0568), suggesting that higher leverage may constrain profitability, likely due to increased financial obligations. However, Leverage exhibits minimal correlations with Claims Ratio (r=0.0115) and Expense Ratio (r=−0.0324), indicating that leverage has limited direct impact on operational risks.

Total Premium Earned is positively correlated with both ROA (r=0.3329) and ROE (r=0.3786), emphasizing its role as a key driver of profitability. This highlights the importance of revenue generation through premium growth in sustaining profitability.

The correlation analysis reveals complex interrelationships among the variables influencing profitability in insurance firms. The strong positive relationship between ROA and ROE underscores the importance of efficient asset utilization in driving shareholder returns. Premium generation is positively associated with profitability, while expense ratios and claims ratios exhibit negative correlations, emphasizing the need for effective cost management and claims processing to sustain performance.

Weak correlations involving leverage and asset-liability ratios suggest that these factors may play secondary roles in influencing profitability but remain important for risk management. Further analysis, including regression modeling, will be necessary to evaluate causal relationships and refine strategies for improving financial performance and risk management practices in the insurance sector.

Table 3. Augmented Dickey Fuller (ADF) Unit root test

Variable	ADF t-Statistic	Prob.	1% Critical Value	5% Critical Value	10% Critical Value	Stationarity
ROA	-6.205014	0.0000	-3.457747	-2.873492	-2.573215	Stationary
ASSET_LIABILITY_RATIO	-7.929094	0.0000	-3.457630	-2.873440	-2.573187	Stationary
CLAIMS_RATIO	-10.76306	0.0000	-3.457630	-2.873440	-2.573187	Stationary
ROE	-5.157192	0.0000	-3.457747	-2.873492	-2.573215	Stationary
EXPENSE_RATIO	-9.036817	0.0000	-3.457630	-2.873440	-2.573187	Stationary
LEVERAGE	-7.056917	0.0000	-3.457747	-2.873492	-2.573215	Stationary
TOTAL_PREMIUM_EARNED	-5.898065	0.0000	-3.457630	-2.873440	-2.573187	Stationary

Source: Author's Compilation 2024.

Table 3 presents the results of the Augmented Dickey-Fuller (ADF) unit root test, which was employed to examine the stationarity of the variables: ROA (Return on Assets), ROE (Return on Equity), Asset Liability Ratio, Claims Ratio, Expense Ratio, Leverage, and Total Premium Earned. The test was conducted at the level form, incorporating a constant term in the model. The results indicate that all variables are stationary at level form (I (0)), as the ADF test statistics exceed the 1%, 5%, and 10% critical values, with p-values less than 0.01 ($p < 0.01$). This implies that the null hypothesis of a unit root is rejected for all variables, confirming stationarity without the need for differencing.

The study revealed that profitability Indicators (ROA and ROE) which are ROA (t=−6.2050) and ROE (t=−5.1572) are stationary, indicating stability over time and suitability for further analysis without transformation. The Claims Ratio (t=−10.7631) and Expense Ratio (t=−9.0368) demonstrate strong stationarity, reflecting consistent trends and reliability for use in risk analysis models. Leverage (t=−7.0569) and Asset Liability Ratio (t=−7.9291) are stationary, suggesting that these variables do not exhibit trends or drift over time, ensuring accurate modeling of financial stability. Total Premium Earned (t=−5.8981) is stationary, highlighting its potential role as a stable predictor of profitability and operational performance.

Since all variables are stationary at their levels, no additional transformations or differencing are required to achieve stationarity. The data satisfies the conditions necessary for time-series modeling and econometric techniques, including Ordinary Least Squares (OLS), Fixed Effects, Random Effects, and Panel Data Estimations. Additionally, the stationarity of the variables supports the application of co-integration tests and dynamic regression models to analyze long-term relationships and short-term adjustments without the risk of spurious regressions. The results of the ADF unit root test confirm that all variables are integrated at order zero, I(0), and are immediately suitable for regression and time-series analyses. These findings ensure the robustness of subsequent econometric investigations into the relationships between profitability, risk measures, and performance indicators in the insurance sector.

Table 4 presents the results of the static regression analysis for Return on Asset (ROA) using pooled, fixed effects, and random effects models. The analysis evaluates the relationship between ROA and key explanatory variables which are Asset Liability Ratio, Claims Ratio, Expense Ratio, Leverage, and Total Premium Earned. The constant term is significant in the pooled model (t=−98.4118, p=0.0000) and the random effects model (t=−37.2388, p=0.0499), but insignificant in the fixed effects model (t=1.5979, p=0.9419). The significant negative values in the pooled and random models suggest that other omitted factors may negatively influence ROA.

Asset Liability Ratio shows that the pooled model (t=0.7081, p=0.0045) shows a significant positive relationship between the asset liability ratio and ROA. However, the relationship becomes insignificant in both the fixed effects (p=0.6303) and random effects models (p=0.3304), suggesting that the positive effect observed in the pooled model may not be robust across firms or over time.

Claims Ratio revealed that the pooled model (p=0.6164) shows an insignificant effect on ROA. In contrast, the fixed effects (p=0.005) and random effects (p=0.0472) models indicate a significant negative relationship, implying that higher claims ratios may reduce profitability due to increased claim obligations.

Expense Ratio revealed that the pooled model (p=0.0553p = 0.0553p=0.0553) suggests a weak negative relationship between expense ratio and ROA, which becomes statistically significant in both the fixed effects (p=0.0149p = 0.0149p=0.0149) and random effects (p=0.0101p = 0.0101p=0.0101) models. This consistent negative relationship highlights the adverse impact of higher operational expenses on profitability.

Leverage shows that all the three models that is pooled, fixed, and random effects demonstrate a highly significant negative relationship (p=0.0000) between leverage and ROA. This suggests that higher leverage levels adversely affect profitability, possibly due to increased financial obligations.

Table 4. Static Regression Analysis for Return on Asset (ROA)

Variable	Pooled Coefficient (Prob.)	Fixed Coefficient (Prob.)	Random Coefficient (Prob.)
C	-98.41183 (0.0000)	1.597938 (0.9419)	-37.23877 (0.0499)
ALR	0.708057 (0.0045)	0.112052 (0.6303)	0.217165 (0.3304)
CR	-0.015952 (0.6164)	-0.083568 (0.0051)	-0.056035 (0.0472)
ER	-0.064841 (0.0553)	-0.075742 (0.0149)	-0.077235 (0.0101)
LEV	-0.003367 (0.0000)	-0.003772 (0.0000)	-0.003660 (0.0000)
TPE (SIZE)	4.452333 (0.0000)	0.168321 (0.8616)	1.852746 (0.0264)
Statistics	Pooled	Fixed	Random
R-squared	0.252435	0.568078	0.212222
Adjusted R-squared	0.236462	0.519863	0.195389
F-statistic	15.80328 (0.0000)	11.78227 (0.0000)	12.60758 (0.0000)
Durbin-Watson stat	1.158834	1.926084	1.640672

Hausman Test Results | Chi-Sq. Statistic: 24.6479 | Chi-Sq. d.f.: 5 | Prob.: 0.0002			
Cross-Section Tests	Pooled	Fixed	Random
Breusch-Pagan LM	217.0473 (0.0868)	-	-
Pesaran scaled LM	1.387496 (0.1653)	-	-
Pesaran CD	-0.082491 (0.9343)	-	-

Source: Author's Compilation 2024.

Total Premium Earned also shows that the pooled model (p=0.0000) and random effects model (p=0.0264) show a significant positive effect of total premium earned on ROA.

However, the fixed effects model (p=0.8616) shows an insignificant relationship, suggesting that the positive influence may not be uniform across firms.

The fixed effects model (Adjusted R^2=0.5199) explains more variation in ROA compared to the pooled (R^2=0.2524) and random effects models (R^2=0.2122). This indicates that the fixed effects model provides a better fit for the data. F-statistics for all the models exhibit statistically significant F-statistics ($p < 0.01$), confirming the overall significance of the regressions. Durbin-Watson Statistics for the fixed effects model (1.9261) suggests the absence of autocorrelation, whereas the pooled model (1.1588) and random effects model (1.6407) may exhibit mild autocorrelation issues. The Hausman test statistic (Chi^2=24.6479, p=0.0002) is statistically significant, indicating that the fixed effects model is preferred over the random effects model due to the presence of correlation between individual effects and explanatory variables.

Cross-Section Tests (Pooled Model) shows that Breusch-Pagan LM Test (p=0.0868) has no evidence of heteroskedasticity. Pesaran Scaled LM Test (p=0.1653) show no evidence of cross-sectional dependence and also Pesaran CD Test (p=0.9343) has no

evidence of cross-sectional dependence. The results highlight that the fixed effects model provides the most robust and reliable estimates for explaining variations in ROA, given its higher explanatory power and preferred selection based on the Hausman test.

Table 5 presents the results of the static regression analysis for Return on Equity (ROE) using pooled, fixed effects, and random effects models. The analysis examines the relationship between ROE and the key explanatory variables: Asset Liability Ratio, Claims Ratio, Expense Ratio, Leverage, and Total Premium Earned. The constant term is significant in both the pooled model (t=−553.5776, p=0.0000) and the random effects model (t=−400.7486, p=0.0008), but insignificant in the fixed effects model (t=−86.5399, p=0.574). The significant negative values in the pooled and random models suggest that unobserved factors may negatively influence ROE when firm-specific effects are not controlled.

Table 5. Static Regression Analysis for Return on Equity (ROE)

Variable	**Pooled Coefficient (Prob.)**	**Fixed Coefficient (Prob.)**	**Random Coefficient (Prob.)**
C	-553.5776 (0.0000)	-86.53986 (0.5747)	-400.7486 (0.0008)
ALR	2.768454 (0.0708)	-0.197456 (0.9039)	1.111254 (0.4595)
CR	0.061601 (0.7541)	-0.433462 (0.0380)	-0.128619 (0.4983)
ER	-1.004800 (0.0000)	-0.733186 (0.0009)	-0.897180 (0.0000)
LEV	-0.005262 (0.2068)	-0.002719 (0.5224)	-0.003992 (0.3201)
TPE (SIZE)	25.76471 (0.0000)	5.605470 (0.4092)	19.26548 (0.0002)
Statistics	Pooled	Fixed	Random
R-squared	0.255053	0.442632	0.176915
Adjusted R-squared	0.239135	0.380415	0.159328
F-statistic	16.02322 (0.0000)	7.114241 (0.0000)	10.05926 (0.0000)
Durbin-Watson stat	1.512781	1.859050	1.657258
Hausman Test Results | Chi-Sq. Statistic: 22.5673 | Chi-Sq. d.f.: 5 | Prob.: 0.0004 |			
Cross-Section Tests	Pooled	Fixed	Random
Breusch-Pagan LM	278.7551 (0.0000)	-	-
Pesaran scaled LM	4.553040 (0.0000)	-	-
Pesaran CD	1.806720 (0.0708)	-	-

Source: Author's Compilation 2024.

Asset Liability Ratio shows that the pooled model (t=2.7685, p=0.0708) shows a weakly significant positive relationship between the asset liability ratio and ROE.

However, the relationship is insignificant in both the fixed effects (p=0.9039) and random effects models (p=0.4595). This suggests that the effect observed in the pooled model may not hold across firms or over time, indicating no consistent impact of the asset liability ratio on profitability.

Claims Ratio shows that the pooled model (p=0.7541) and random effects model (p=0.4983) show an insignificant effect on ROE. However, the fixed effects model (p=0.0380) reveals a significant negative relationship, indicating that higher claims ratios may reduce profitability by increasing claim obligations.

Expense Ratio revealed that all three models pooled (p=0.0000), fixed effects (p=0.0009), and random effects (p=0.0000) demonstrate a highly significant negative relationship between expense ratio and ROE. This consistent result implies that higher operational expenses negatively impact profitability, reducing equity returns.

Leverage indicate that the pooled (p=0.2068), fixed effects (p=0.5224), and random effects (p=0.3201) models all show insignificant relationships between leverage and ROE. Unlike in ROA, leverage does not appear to have a significant influence on equity returns, suggesting its effect may depend more on asset-based measures rather than equity-based performance metrics.

Total Premium Earned shows that both the pooled model (p=0.0000) and random effects model (p=0.0002) indicate a strong positive relationship between total premium earned and ROE. However, the fixed effects model (p=0.4092) shows an insignificant relationship, implying that the observed positive effect may not be consistent across firms when accounting for individual differences.

The fixed effects model (AdjustedR^2=0.3804) explains more variation in ROE compared to the pooled (R^2=0.2551) and random effects models (R^2=0.1769). This suggests that the fixed effects model provides a better fit for the data. F-statistics for all the three models exhibit statistically significant F-statistics ($p < 0.01$), confirming the overall significance of the regressions. Durbin-Watson Statistics revealed that fixed effects model (1.8591) suggests no autocorrelation, while the pooled model (1.5128) and random effects model (1.6573) may have mild autocorrelation issues. The Hausman test statistic (Chi^2=22.5673, p=0.0004) is statistically significant, indicating that the fixed effects model is preferred over the random effects model due to correlation between individual effects and explanatory variables.

Cross-Section Tests (Pooled Model) indicate that Breusch-Pagan LM Test (p=0.0000): Suggests the presence of heteroskedasticity, indicating variability across observations. Pesaran Scaled LM Test (p=0.0000): Shows cross-sectional dependence, meaning errors may be correlated across firms. Pesaran CD Test (p=0.0708p = 0.0708p=0.0708): Shows no strong evidence of cross-sectional dependence. The results indicate that the fixed effects model provides the most reliable estimates for explaining variations in ROE, as evidenced by its higher explanatory power and preference based on the Hausman test.

5. CONCLUSION

This study provides valuable insights into the determinants of profitability in the insurance sector, highlighting the importance of key financial indicators such as Return on Assets (ROA), Return on Equity (ROE), Asset Liability Ratio (ALR), Claims Ratio (CR), Expense Ratio (ER), Leverage (LEV), and Total Premium Earned (TPE). The findings reveal that asset utilization and premium generation are crucial drivers of profitability, with ROA positively correlated with ROE and TPE. Conversely, high Claims and Expense

Ratios negatively affect profitability, emphasizing the need for efficient claims management and cost control. Additionally, leverage is found to constrain profitability, suggesting that excessive reliance on debt may hinder financial performance. The regression analysis, particularly the fixed effects model, confirms the significant impact of Total Premium Earned on both ROA and ROE, underscoring the role of premium growth in enhancing financial performance.

Recommendations

Based on the findings, the following recommendations are made for insurance firms to improve profitability: Focus on Premium Growth: Insurance firms should prioritize strategies aimed at increasing premium income, as it has a significant positive impact on both ROA and ROE. Effective marketing, product innovation, and expanding customer bases can help boost premium revenue. Enhance Risk Management: Efficient claims management and controlling operational expenses are crucial to improving profitability. Insurance firms should implement better claims processing systems, fraud detection measures, and expense management practices to mitigate the negative effects of high Claims and Expense Ratios. Optimize Leverage: Companies should carefully manage their capital structure to avoid excessive leverage, as high levels of debt may constrain profitability. A balanced approach to financing, with a focus on equity-based funding, would help maintain financial stability and improve profitability. Adopt Advanced Risk Management Practices: To further reduce financial risks, insurance firms should explore alternative risk management techniques, such as reinsurance or hedging, to better control exposure to market fluctuations and operational uncertainties. Future Research: Future studies should investigate the long-term impact of leverage and asset-liability management on profitability. Additionally, the potential role of alternative risk management strategies and their effectiveness in mitigating financial risks in the insurance industry could be explored.

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