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Original Paper

The Impact of Subnational Internally Generated Revenue on Infrastructural Development: The Case of Kwara State, Nigeria

Olufunmilayo Temitope Alakija¹ ⁽¹⁾, Agboola Hammed Yusuf² ⁽¹⁾, Ganiy Adewale Elegbede³ ⁽¹⁾ ⁽²⁾, Abiola Shittu³ ⁽¹⁾, Javan Semana² ⁽¹⁾

> ¹ Yaba College of Technology, Lagos, Nigeria ² University of Lay Adventists, Kigali, Rwanda ³ University of Ilorin, Ilorin, Nigeria ⊠ elegbedeganiy@gmail.com

Abstract. The financial independence of state governments hinges on their ability to prioritize Internally Generated Revenue (IGR), which could help them to better achieve the social welfare and infrastructure needs of their citizens. The purpose of this study is to investigate the impact of internally generated revenue on infrastructural development in Kwara state. By decomposing IGR into tax and non-tax revenue, we hypothesize that there is no significant long-term and short-term relationship between tax/non-tax revenue and Kwara state infrastructural development. Due to its ability to avoid stationary data problems, Auto-Regressive Distributed Lag (ARDL) was employed to analyze the annual data which were extracted from the Kwara state financial statement report from 1999–2023. This study finds that IGR and loan have a significant positive influence on infrastructural development, both in the short and long run. However, tax revenue influence can only be felt in the short-run and the previous year's loan exhibits a negative effect on infrastructural development in the current year. Practically, these results imply that IGR is an essential source of revenue for the Kwara state government to finance capital projects, especially non-tax revenue, the effects of which tend to also be felt in the long-run. It can also be linked to the fiscal decentralization concept that supports the state government's fiscal autonomy. The study suggests that the Kwara state government should increase its tax base and rate in a form that would not yield negative consequences on the state economy, and diversify its non-tax revenue sources to cushion unexpected economic shocks.

Key words: internally generated revenue (IGR); infrastructural development; tax revenue; non-tax revenue; loans; ARDL estimation technique; Kwara state.

JEL E62, H54, H71, H72, O43, R58

1. Introduction

The popular belief is that states generating more revenue internally can better address the social welfare and infrastructure needs of their citizens. Therefore, achieving financial independence for state governments hinges on their ability to prioritize Internally Generated Revenue (IGR). Internally Generated Revenue (IGR) signifies the income that governments at various levels generate within their specific regions [1–3]. Internally Generated Revenue (IGR) encompasses efforts like levies, taxes, fines, and fees. The conclusion from researchers was that the economic progress and sustainability of Nigerian states hinge on their ability to generate IGR, in addition to the funds they receive from the federation account [4, 5].

Theoretically, this idea relates to fiscal decentralization, a pivotal concept within fiscal federalism, developed by Musgrave in 1959. The author posits that the transfer of authority and responsibility for public spending and revenue collection from the central government to regional or local governments can have a positive impact on economic development [6].

In the pursuit of sustainable economic development and growth within Nigeria, the deficiency in infrastructure stands as a significant impediment [7]. Adequate infrastructure provision is pivotal in supporting economic development, enhancing the quality of life, and ensuring national security [8–10]. All levels of government share the responsibility of delivering infrastructure that promotes economic growth. To achieve this, adequate funds are essential, particularly at the state level, where resources are necessary for planning, executing, and maintaining infrastructure projects.

The government's investment in infrastructure is often measured by its capital expenditure, which, in turn, relies on revenue generation. Since the 1970s, petroleum has contributed to more than 90 % of the annual revenue for all three levels of government, despite the availability of alternative revenue sources [11]. Despite the availability of various revenue sources, such as statutory allocations and corporate or individual contributions, it is expected that every state will fully utilize Internally Generated Revenue (IGR) to complement these funds [12].

However, the drop in crude oil prices has drastically reduced government revenues [13], directly affecting FAAC allocations. Consequently, state governments have had to cut back on socio-economic expenditures and governance expenses, as they struggled to fulfill their fiscal obligations. This situation led to States accumulating months of unpaid salaries and emoluments for certain employee categories [14], necessitating a shift towards internal revenue generation as the most dependable and sustainable financing option for state operations and lawful responsibilities. Moreover, government expenditure has consistently risen over the years, which further prompts state governments to devise strategies to enhance their revenue generation. Amah [15] reached the conclusion that unless various state governments across the federation proactively explore opportunities to maximize their internal revenue base, achieving financial self-reliance remains an elusive goal.

Numerous studies have examined strategies to diversify Nigeria state governments' revenue sources, aiming to reduce the heavy reliance on statutory allocation as their primary revenue generator. It is worth noting that many of these studies were conducted during the oil boom period, with expectations that did not account for the significant and current decline in crude oil prices. Furthermore, it is important to note that most researchers haven't placed significant emphasis on how Internally Generated Revenue (IGR) can be specifically utilized to fund capital expenditures like infrastructural projects, to thereby stimulate economic growth across diverse sectors of the economy.

This research aims to empirically examine the impact of internally generated revenue on infrastructural development from 1998 to 2022, specifically within Kwara State. In the case of Kwara State, generating internal revenue for infrastructure development presents a formidable yet essential task. It is evident from available data that the Kwara State Government has been diligently working towards revenue generation and its subsequent investment in infrastructure.

However, the researcher faces the challenge of ascertaining the extent to which the generated revenue has been efficiently utilized for infrastructural development by the Kwara State Government. The study by Kolawole & Kamaldeen [16] only examined the relationship between IGR and economic growth, while Ajadi et al. [17] only focused on how IGR support local government sustainability in Nigeria, using Kwara State as a case study. However, Adebayo et al. [18] conducted an investigation of how rural entrepreneurial development could be supported by improved infrastructural network in Kwara State. Based on these reviews, it is apparent that little is known about the nexus between IGR and infrastructural development in the Kwara State.

In addition, the study employs Auto-Regressive Distributed Lag (ARDL) estimation technique. This method is preferred to other estimation techniques, in that it can simultaneously estimate the long-run and short-run parameters of the model yet avoid stationary data problems. Previous studies in Nigeria on the relationship between IGR and infrastructural development in recent times rarely use the econometrics model and very few studies have been conducted in Kwara state.

The novelty of this work lies in the employment of the ARDL model to estimate the effect of IGR on infrastructural development in Kwara state. Based on the body of literature, no study has explicitly decomposed IGR into tax revenue and non-tax, especially in Kwara state. This paper fills this lacuna found in the literature.

The main purpose of this study is to empirically investigate the impact of internally generated revenue on Kwara state infrastructural development. The core null-hypothesis of the study.

H0: There is no significant long-term and short-term relationship between internally generated revenue and Kwara State infrastructural development.

Due to the decomposition of the IGR into tax and non-tax revenue, the core null-hypothesis is divided into two.

H1: There is no significant long-term and short-term relationship between tax revenue and Kwara State infrastructural development.

H2: There is no significant long-term and short-term relationship between non-tax revenue and Kwara State infrastructural development.

The remains of the paper are set up as follows: Section 2 provides a review of the empirical literature, Section 3 presents the research methodology, the empirical results are discussed in Section 4, and Section 5 provides the paper's conclusion and recommendations.

2. Literature Review

2.1. Theoretical Review

This study's foundation lies in fiscal federalism, a theoretical framework rooted in the broader concept of federalism. The theory of fiscal federalism, initially developed by Musgrave in 1959 centers on the rational allocation of roles and financial resources among various government levels within a federating state. Musgrave [6] argued that a federal system of government effectively addresses challenges faced by constituent units, providing the balance and stability needed to overcome issues like uneven wealth distribution and resource scarcity.

According to Musgrave [6], the management of federated revenues should flow from the federal to the state and then to local authorities based on needs. Fiscal decentralization, a pivotal concept within fiscal federalism, involves the transfer of authority and responsibility for public spending and revenue collection from the central government to local governments. Nigeria operates under a federal system, granting each level of government the autonomy required to fulfill its responsibilities.

A growing body of evidence suggests that fiscal decentralization can have a positive impact on economic development. For instance, Setiawan & Aritenang's [19] study on Indonesia revealed a significant positive effect of fiscal decentralization on economic performance.

Similarly, Chygryn et al. [20] found positive impacts of fiscal decentralization on GDP, GDP growth rate, foreign direct investment, and social contribution in selected European countries. However, some empirical studies have indicated a negative relationship between measures of fiscal decentralization and economic growth or development in various countries.

Pasichnyi et al. [21] and Xie et al. [22] indicated that fiscal decentralization did not contribute to economic development, however, Arif & Ahmad [23] and Mao & Ma [24] reported a positive impact of fiscal decentralization on economic growth. Ewetan et al. [25] discovered a mixed impact of fiscal decentralization on economic development through revenue decentralization (negative) and expenditure decentralization (positive) in Nigeria. These contrasting findings highlight the complexity of the relationship between fiscal decentralization and economic development, with outcomes varying across different contexts.

2.2. Empirical Review

A recent study by Kolawole & Kamaldeen [16] employed the Auto-Regressive Distributed lag technique to estimate the impact of revenue-expenditure gap on output in Kwara State. Their study shows that government expenditure exceeds its revenue, which eventually slows the growth of economic outputs in Kwara State. Therefore, the government should take the necessary steps to increase its internally generated revenue. According to a study by Ajadi et al. [17] who employed the Chi-Square Test of Independence to analyze primary and secondary data from Ilorin West local government area of Kwara State, IGR was identified as an indispensable source for ensuring local government sustainability in Nigeria.

After analyzing 148 primary data obtained across three selected local government areas in Kwara State, Adebayo et al. [18] identify poor infrastructure as one of the major factors that hinder the development of rural entrepreneurship in Nigeria despite government support for capacity building.

In a study conducted by Danbeki et al. [3] to assess the trend of IGR and its effect on infrastructural development in Taraba State spanning 2011–2019, an expost facto survey design was employed, and the data was graphically represented using Mintab 17. The findings indicated that the revenue generated fell short of financing infrastructural development.

To understand how state government revenue affects Bauchi state infrastructural development, Hammayo et al. [26] employed OLS regression to analyze annual data extracted from the government's annual financial report from 2006– 2018. The study's conclusions showed that while internally generated revenue has shown an inverse link with infrastructure provision, federal allocations and debt directly influence it.

Augustine et al. [27] studied data from 2011 to 2021 and estimated it using OLS techniques to examine the role of IGR in contributing to Lagos state's total revenue and fiscal stability. The study established IGR of been a key driver of Lagos state fiscal stability and recognized PayAs You Earn (PAYE) as the major contributor to the state IGR, followed by direct assessment and road tax, respectively. This finding was similarly supported by Akintola et al. [1]'s study, who reported that IGR significantly aided Lagos state's budget implementation after analyzing data from 2007 to 2022 using OLS techniques.

In agreement with this is the finding of Adenugba & Ogechi [28], who assessed the effect of internal revenue generation on infrastructural development in Lagos State. Relying on questionnaires and employing descriptive and inferential statistics, including Spearman's rank correlation analysis, a positive relationship was consequently established between internally generated revenue and infrastructural development.

With a focus on Oyo State, Adegbite [29] employed multiple regression and Pearson product moment correlation to investigate the connection between personal income tax and state revenue generation between 1990 and 2015. The study established that personal income tax directly and strongly influences government revenue.

Employing a linear regression design, Evans et al. [4] analyzed data from 2010 to 2021 and discovered that IGR positively correlated with River State's economic growth.

In a study on how state government revenue contributes to the development of infrastructure and socioeconomic investment in Nigeria, Adeleke et al. [30] posited most states in Nigeria find it difficult to attain any significant development in their infrastructure and socioeconomic activities as they are labelled to be inefficient in generating internal revenue due to their overdependence on federal allocation. The study analyzed data from 2011 to 2019 which were obtained from all 36 states in Nigeria and the Federal Capital Territory.

With a focus on the six states, each from the six geopolitical zones in Nigeria, Angahar & Olalere [31] employed a Panel Vector Error Correction Model (PVECM) to analyse annual panel data from 1986 to 2021 on how IGR affects Nigeria's state expenditure and their debt sustainability. The result from the Panel VECM impulse response indicated that state government expenditure is positively aided by IGR, and the state government's total debt stock variably reacts to shock in IGR.

After conducting a study on how recurrent expenditure is related to IGR by analyzing primary data from all 6 states in the southwestern part of Nigeria, Adegbite & Ishola [2] concluded that recurrent expenditure is significantly affected by IGR. Specifically, they decomposed IGR into personal income tax, direct assessment tax, and road tax, and only direct assessment tax was found to be statistically related to recurrent expenditure. Similarly, Efuntade et al. [32] reported that Nigeria's government expenditure has been fueled by tax revenue, crediting it to the effectiveness of the tax administrators.

Moreover, Owolabi [8] reported a positive impact of infrastructural development on Nigeria's economic growth after reviewing data from 1983 to 2013 using OLS techniques.

Conversely, Inyiama et al. [33] analyzed secondary data between 2006 and 2015 and reported that infrastructural development in Nigeria is positively but statistically insignificantly influenced by PPT, CIT, and VAT, advocating for a process that stimulates effortless tax collection to enhance the government tax revenue.

In support of the finding above, Osamor et al. [34] reported a similar result as they ascribed the insignificance of the relationship between tax revenue and Nigeria's economic growth to the taxpayers' indulgence in tax avoidance and evasion.

Akinola & Akinrinola [10] utilized ARDL techniques to analyse data from 1996 to 2021 on how economic growth benefited from tax revenue and infrastructural development in Nigeria. With the expectation of infrastructural development being a reward for tax revenue, the study established PPT as the major contributor to economic growth both in the short run and long run, while VAT, CIT, and Gross Capital Formation require more efforts in order to contribute significantly to the Nigerian economy.

Using similar estimation techniques, Oziegbe & Itua [35] recorded that Nigeria's infrastructural development benefitted directly from VAT, CIT, and Custom and Excise Duties (CED) after analysing data that examined Nigeria's infrastructural development and non-oil tax revenue between 1981 and 2021.

In response to the decadence in health care infrastructure in Nigeria, Mustapha et al. [36] analyzed secondary data from 2013 to 2020 to examine the role played by tax revenue collection. The findings showed that PPT and CIT are key drivers of healthcare infrastructural development in Nigeria, while the contributions of VAT and Education Tax (EDT) are not significantly effective.

Asaolu et al. [37] ascribed huge importance to taxation in driving Nigeria's economic growth after they investigated on how tax revenue is related to Nigeria's economic growth, utilizing ARDL techniques to analyse secondary data between 1994 and 2015. The study reported PPT to be unrelated to economic growth and CIT to be negatively related. However, VAT and CED were reported to be positively related to economic growth.

Similarly, the study by Egbunike et al. [38] supported the positive influence of tax revenue on economic growth after they conducted a panel data analysis on the economies of Nigeria and Ghana.

By employing infrastructural development as a proxy for economic development, Uhuaba & Siyanbola [39] recognized the important role played by tax structure in the process of economic development in Nigeria after analyzing primary data that were obtained through a structured questionnaire administered to senior staff of the Federal Inland Revenue Service and senior tax practitioners.

Using a Vector Autoregressive (VAR), Ogbonna [40] concluded that Nigeria's economic growth could forecast IGR after reporting a unidirectional relationship causality from economic growth to IGR. The study further discovered a positive influence of IGR on economic growth in Nigeria, employing ordinary least squares, the Generalized Method of Moments, and impulse responses to estimate secondary data from 2007 to 2021.

Omodero et al. [41] conducted a study on how Internally Generated Revenue (IGR) impacts Nigeria's economic development from 1981 to 2016. Secondary data were analyzed, and it was revealed that the total IGR — IGR from state governments, and IGR from local governments — significantly and positively influenced Real Gross Domestic Product (RGDP). Federal Government Independent Revenue (FGIR) also demonstrated a positive and noteworthy impact on RGDP.

In a similar but distinct study, Ihenyen & Ogbise [42] investigated the relationship between Nigerian tax revenues and economic growth in Nigeria. Their research identified three types of taxes; PPT, CIT, and VAT as having a positive influence on Nigeria's economic growth, while customs excise and duties were found to exert a negative impact.

Similarly, Onoja & Ibrahim [43] advised the government to curb corruption and address leakages in the tax administration system, alongside providing higherquality goods and services, after their study's findings revealed PPT, VAT, and CIT to be positively related with economic growth, while only PPT was found to be statistically insignificant (Table 1).

s/N	1. Tabular depiction of Author/Year	the empirical analysis Objective	Methodology	Findings
-	Akintola et al. [1]	To analyze the impact of IGR on Lagos State's budget implementation.	OLS techniques on data from 2007–2022.	IGR significantly aided Lagos State's budget implementation
7	Adegbite & Ishola [2]	To analyze the relationship between IGR and recurrent expenditure in southwestern Nigeria. State (2001–2020)	Pooled, Fixed effect, Random effect, and Feasible Generalized Least Squares (FGLS).	Recurrent expenditure is significantly affected by IGR, but only direct assess- ment tax was statistically related to re- current expenditure.
$\tilde{\omega}$	Danbeki et al. [24]	To assess the trend of IGR and its effect on infrastructural development in Taraba State (2011–2019).	Ex-post facto survey design, da- ta represented graphically using Mintab 17.	The revenue generated was insufficient for financing infrastructural develop- ment.
4	Evans et al. [4]	To examine the correlation between IGR and Rivers State's economic growth.	Linear regression on data from 2010–2021.	IGR positively correlated with Rivers State's economic growth.
S	Akinola & Akinrinola [10]	To investigate the relationship between tax revenue and economic growth in Nigeria.	ARDL techniques on data from 1996–2021.	PPT contributed most to econom- ic growth, while VAT, CIT, and Gross Capital Formation required more efforts to have a significant impact.
9	Ajadi et al. [17]	To analyze the role of Internally Generated Revenue (IGR) in ensuring local government sustainability in Nigeria.	Chi-Square Test of Independence on primary and secondary data from Ilorin West LGA, Kwara State.	IGR was identified as an indispensable source for ensuring local government sustainability.
2	Hammayo et al. [26]	To understand how state government rev- enue affects Bauchi state infrastructural development.	Ordinary Least Square (OLS) Regression Analysis	IGR negatively influences infrastructur- al provision, while federal allocations and debt positively influence it.
~	Augustine et al. [27]	To investigate the role of IGR in Lagos State's total revenue and fiscal stability.	OLS techniques on annual data from 2011–2021.	IGR was a key driver of Lagos State's fiscal stability, with PAYE as the major contributor, followed by direct assess- ment and road tax.

Findings	A positive relationship was established between IGR and infrastructural development.	Most states struggle to develop infrastructure due to inefficiencies in generating IGR and dependence on federal allocations.	State government expenditure is positively influenced by IGR, and total debt reacts variably to IGR shocks.	PPT, CIT, and VAT had a positive but statistically insignificant impact on infrastructural development.	The insignificant relationship was attributed to widespread tax avoidance and evasion.	VAT, CIT, and Custom and Excise Duties (CED) directly benefited Nigeria's infrastructural development.	PPT and CIT were key drivers of healthcare infrastructure, while VAT and Education Tax (EDT) had insignificant effects.
Methodology	Questionnaires, descriptive and inferential statistics, Spearman's rank correlation.	Data analysis (2011–2019) from all 36 states and the Federal Capital Territory using spatial statistics and stepwise linear regression.	Panel Vector Error Correction Model (PVECM) on panel data (1986–2021).	Secondary data analysis (2006–2015) using the multiple linear regression technique.	ARDL Techniques	ARDL techniques on secondary data (1981–2021).	Analysis of secondary data (2013–2020) using Multiple linear regression method.
Objective	To assess the effect of IGR on infrastruc- tural development in Lagos State.	To analyze the contribution of state government revenue to infrastructure and socioeconomic investment in Nigeria.	To examine the effect of IGR on state expenditure and debt sustainability in Nigeria.	To examine the impact of tax revenue on infrastructural development in Nigeria.	To analyze the relationship between tax revenue and economic growth in Nigeria (2011–2020)	To assess how non-oil tax revenue affects Nigeria's infrastructural development.	To examine the role of tax revenue in healthcare infrastructural development in Nigeria.
Author/Year	Adenugba & Ogechi [28]	Adeleke et al. [30]	Angahar & Olalere [31]	Inyiama et al. [33]	Osamor et al. [34]	Oziegbe & Itua [35]	Mustapha et al. [36]
S/N	6	10	11	12	13	14	15

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Methodology Findings	chniques on secondary PPT was unrelated to economic growth, e1-2015).PAT and CED had a positive influence.	rimary data from Tax structure plays an essential role in ed questionnaire economic development. red using descriptive and linear regression	toregressive (VAR),A unidirectional causality exists from economic growth to IGR, and IGR positively influences economic growth.	
Objective	To assess how tax revenue influences ARDL to Argeria's economic growth data (19)	To analyze how tax structure contributes Analyse, to Nigeria's economic development. a structu adminis statistics method.	To investigate the causal relationshipVector Abetween IGR and Nigeria's economicOLS, GIgrowth (2007–2021).analysis.	
'N Author/Year	6 Asaolu et al. [37]	7 Uhuaba & Siyanbola [39]	8 Ogbonna [40]	
S/]	16	1.	18	

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3. Methodology

3.1. Variables and Data Source

The study utilizes time series analysis and critically analyzed secondary data on Kwara State from 1999 to 2023 (25 years). Data was collected on Infrastructure development — the dependent variable, which is measured by the actual annual capital expenditure.

The core explanatory variables are tax revenue, and non-tax revenue (licenses, fines & fees, sales & earnings, rent property, and interest & dividends), which make up the internally generated revenue. While internal and external loans are employed as the control variable. The secondary data was mainly extracted from the Annual Financial Statements of the Kwara State Government. Table 2 provides a summary of the variable descriptions.

Variable	Symbol	Measurement	Source
Tax Revenue	TAX	Direct Tax (naira)	Kwara State Ministry of Finance,
Non-Tax Revenue	NTAX	Revenue from licenses, fine	Annual Financial Statement of the Accountant General of the Federation
Loan	IEL	Internal and external loans (Naira)	
Infrastructure Development	INFRD	Capital expenditure (Naira)	

Table 2. Variables Descriptions

Source: Authors' Computations

3.2. Model Specification and Research Methodology

To examine the impact of internally generated revenue on infrastructure development in Kwara State, this study employs time series models. The functional relationship for time series data investigation is:

$$INFRD = CAPEX = f(IGR, IEL),$$
(1)

$$IGR = f(TAX, NTAX), \tag{2}$$

$$CAPEX = f(TAX, NTAX, IEL).$$
(3)

The econometric model for equation (3) is specified as follows:

$$CAPEX = \alpha + \beta_1 TAX_t + \beta_2 NTAX_t + \beta_3 IEL_t + \mu_t.$$
(4)

Where: *INFRD* is infrastructural development measured by *CAPEX*, which is capital expenditure; *IGR* is internally generated revenue; *TAX* is tax revenue; *NTAX* is non-tax revenue; *IEL* is loan; α , β_1 , β_2 , and β_3 are slope coefficients of the respective variables; " μ " and "t" denote the error term and time.

3.3. Estimation Techniques

Numerous economic or financial variables exhibit nonstationary or trending behaviour, making it unlikely to get accurate results from trendy series. Pesaran et al. [44] highlighted that ARDL model can help in handling non-stationary time series data, by allowing the inclusion of variables with varying orders of integration. Moreover, it is not necessary to determine the order of integration between variables in advance [45].

This method is thus preferred to other estimation techniques, in that it can simultaneously estimate the long-run and short-run parameters of the model avoid stationary data problems. The appropriate lag lengths for the dependent variable and the independent variables in the model are determined using the Akaike Information Criterion (AIC), to adequately capture the dynamic relationship between infrastructural development and all of the IGR variables without overfitting.

The ARDL bounds testing procedure was then conducted to determine if cointegration (long-run relationship) exists among the variables. The presence of a cointegration relationship among the series showed that further investigation was required to estimate the long-run and short-run relationships. Thus, the ARDL error correction model (ECM) was used to predict the short-run connection. Under the general ARDL model framework, Equation (4) can be expressed as follows:

$$CAPEX_{t} = \alpha_{0} + \sum_{j=1}^{p} \alpha_{1}CAPEX_{t-j} + \sum_{j=0}^{q_{1}} \beta_{1}TAX_{t-j} + \sum_{j=0}^{q_{2}} \beta_{2}NTAX_{t-j} + \sum_{j=0}^{q_{3}} \beta_{3}IEL_{t-j} + U_{t}.$$
(5)

The model can be reparametrized as an Error Correction Model (ECM) system

$$\Delta CAPEX_{t} = \alpha + \sum_{j=1}^{p} \Delta \lambda CAPEX_{t-j} + \sum_{j=0}^{q_{1}-1} \Delta \gamma_{1}TAX_{t-j} + \sum_{j=0}^{q_{2}-1} \Delta \gamma_{2}NTAX_{t-j} + \sum_{j=0}^{q_{3}-1} \Delta \gamma_{3}IEL_{t-j} + \Theta ECM_{t-1} + U_{t}.$$
(6)

Where: Δ denotes first differences; γ , λ_1 , λ_2 , λ_3 represent short-run coefficients for the respective variables; θ is the error correction term (ECM) coefficient, which shows the speed of adjustment back to the long-run equilibrium; *ECMt-1* is the error correction term, usually derived from the long-run relationship.

Post-estimation tests like stability test, serial correlation test, heteroscedasticity test, and normality test were carried out to verify the validity of the estimated model.

4. Results

4.1. Descriptive Statistics and Correlation Analysis

The descriptive analysis of this study provides valuable insights through the presentation of summary statistics and a correlation matrix. Table 3 shows the summary statistics, encompassing the fundamental measures such as the mean, standard deviation, minimum, and maximum values of the variables under examination. The average values of capital expenditure, tax, non-tax revenue, and loan are approximately #21 billion, #4.7 billion, #5 billion, and #5.4 billion respectively.

It can be observed that non-tax revenue is slightly higher than tax revenue, meaning non-tax revenue has slightly contributed more to total IGR than tax revenue over the study period. Subsequently, all the variables possessed a high standard deviation, with non-tax revenue, possessing the highest with about #8 billion, then followed by loans. This indicates an extreme fluctuation in non-tax revenue, which might be due to the highly volatile nature of the source of non-tax revenue (licenses, fines and fees, sales and earnings, property renting and repayment) compared to the source of tax revenue (personal income tax, corporate income tax, and capital gain tax, etc.) which are most likely predictable.

The data shows a significant growth in capital expenditures and IGR, as the minimum and maximum values of all the variables can be located at the starting and ending years of this study, except loan, which has its maximum value in the year 2015. This might be caused by the simultaneous rise in capital expenditures and significant fall in IGR especially non-tax revenue in 2015.

Table 4 shows the correlation analysis among the variables under study. The results indicate that capital expenditure has a strong positive relationship with IGR (tax revenue and non-tax revenue), but exhibits a low positive relationship with loans. Although loans exhibit a negative association with IGR, but the association is extremely low. All the variables associated with capital expenditure are statistically significant except loans, which have all the variables associated with it to be statistically insignificant.

	CAPEX	NTAX	TAX	IEL
Mean	2.13E+10	5.02E+09	4.72E+09	5.35E+09
Median	2.08E+10	1.44E+09	4.08E+09	1.87E+09
Maximum	9.36E+10	3.32E+10	1.53E+10	3.05E+10
Minimum	7.17E+08	1.44E+08	68076500	53179527
Std. Dev.	2.02E+10	8.02E+09	4.29E+09	7.25E+09

Table 3. Summary Statistics

Source: Author's Computations

Probability	CAPEX	NTAX	TAX	IEL
CAPEX	1.000000			
NTAX	0.881610	1.000000		
	0.0000			
TAX	0.855999	0.859023	1.000000	
	0.0000	0.0000		
IEL	0.153926	-0.092541	-0.007483	1.000000
	0.4626	0.6600	0.9717	

Table 4. Correlation Analysis

Source: Author's Computations

4.2. Optimal Lag Selection

Before determining whether there is a long-time relationship among the variables, the optimal lag order of vector autoregression (VAR) model was employed to aid the selection of appropriate lag order. The lag length selection criteria in Table 5, particularly the AIC, indicate that the optimal model for analyzing the effect of internally generated revenue on infrastructural development in Kwara should include two lags. This choice minimizes the AIC, suggesting that it provides the best fit while avoiding overfitting, thus offering a robust model for this research analysis.

Table 5. Lag	Order	Selection	Criteria
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Lag	LogL	LR	FPE	AIC	SC	HQ
0	-2194.524	NA	1.25e+78	191.1760	191.3734	191.2256
1	-2125.656	107.7930*	1.30e+76	186.5788	187.5662*	186.8271
2	-2105.396	24.66477	1.04e+76*	186.2083*	187.9856	186.6553*

Source: Author's Computations

4.3. ARDL Bounds Testing & Co-Integration Results

Table 6 shows the result of the ARDL bound test that was conducted to determine the long-run association among the variables. The bounds test results present the F-statistic and the critical value bounds at different levels of significance. The test's null hypothesis states that there is no long run co-integration (or relationship), which can be verified by comparing the F-statistic value with the critical bounds.

The null hypothesis is rejected if the F-statistic value is greater than the upper bound [I(1)] of the critical bound, meaning that there is long run relationship, while it is not rejected if it is less than it, meaning that there is no long run relationship. Looking at the result in Table 6, the F-statistic value is 8.46, which is greater than the I (1) critical value bound at all significance level (1 %, 5 %, and 10 %).

Therefore, the null hypothesis is rejected, concluding that there is a long run relationship among the variables (Table 6 & 7).

Table 6. ARDL Bounds Co-Integration Test

Null Hypothesis: No long-run relationships exist					
Test Statistic	Value	K			
F-statistic	8.46	3			
Critical Value Bounds					
Significance	I0 Bound	I1 Bound			
10 %	2.01	3.1			
5 %	2.45	3.63			
2.5 %	2.87	4.16			
1 %	3.42	4.84			

Source: Author's Computations

Table 7. Short Run and Long Run Results

Cointegrating Form (Short Run Coefficients)						
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
D(NTAX)	1.981516	0.250430	7.912459	0.0000		
D(TAX)	2.450219	0.647965	3.781408	0.0016		
D(IEL)	0.582623	0.128281	4.541765	0.0003		
D(IEL(-1))	-0.248140	0.137433	-1.805531	0.0898		
CointEq(-1)	-0.324997	0.135723	-2.394565	0.0292		
	Long Ru	n Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.		
NTAX	6.097034	2.517869	2.421506	0.0277		
TAX	-5.215903	3.518619	-1.482372	0.1577		
IEL	2.700066	0.963814	2.801439	0.0128		

Source: Author's Computations

5. Discussion

5.1. Result Analysis

Table 7 shows the ARDL estimation results for the short and long-run relationship between IGR and capital expenditure for Kwara state. The IGR variables (tax and non-tax revenues) both have a positive and statistically significant short-run influence on capital expenditure, meaning an increase in IGR will increase spending on infrastructural development. However, tax revenue appeared to exert more effects on capital expenditure than non-tax revenue, which might be due to the predictability and less volatility nature of tax revenue. This finding finds backup from previous research like Akintola et al. [1], Augustine et al. [27], and Adenugba & Ogechi [28] for Lagos, Angahar & Olalere [31] for the six geopolitical zones in Nigeria, Oziegbe & Itua [35], Mustapha et al. [36].

However, in the long run, non-tax revenue still has a strong positive influence on capital expenditure, while tax revenue has no impact, as indicated by the statistical insignificance of its coefficient. This can be due to the predictable nature of tax revenue, subjecting it to recurring expenditure thereby providing remnant funds for capital projects. This result conforms with the findings of Osamor et al. [34] and Inyiama et al. [33] who ascribed the insignificance of the relationship between tax revenue and capital spending to the taxpayers' indulgence in tax avoidance and evasion and the complexity in the tax collection process, respectively.

Also, the government might find it hard to significantly increase tax rate or tax base to avoid its negative consequences, political unrest, and economic downturn — thereby reducing the tax revenue available to finance long term project. Consequently, since it is likely that most of the recurrent expenditure are financed through tax revenue, creating a room to spend less from revenue generated from non-tax activities, licenses, sales and earnings, and rent property — thereby making more fund available for infrastructure investment.

Moreover, loans exhibit positive effects on capital expenditure in the short and long run, while the effect is stronger in the long run than in the short run. This is expected as government budget deficits are mostly financed through loans, providing more funds to finance capital expenditure. Also, a loan directed toward productive investment like human infrastructure tends to bring long-term benefits to the state economy. However, it was observed that the previous year's loans negatively affected spending on infrastructure. This suggests a debt servicing problem, as last year's debt potentially reduces the funds available to finance capital expenditure in the current year.

Notably, the error correction term (COINTEQ01) is significant at the 1 % level and negatively signed, with a coefficient of -0.324997, which indicates that deviations from the long-run equilibrium are corrected at a speed of approximately 32.5 % per period. Thus, it takes the Kwara State economy 3.08 years to move back to equilibrium after experiencing a temporary fiscal imbalance.

The findings analyzed above lead to the rejection of the core null hypothesis (H0), which states that there is no significant long-term and short-term relationship between internally generated revenue and Kwara State infrastructural development.

Specifically, the study rejects the *H2* null hypothesis, as the long-term and short-term relationship between non-tax revenue and Kwara State infrastructural development were found to be statistically significant. However, the *H1* null hypothesis is a mix of accept and reject, as the tax revenue was found to be only significantly related with Kwara State infrastructural development in the short-run, but not significant in the long-run.

5.2. Post-Estimation Tests

To confirm that this study's regression result is consistent with certain assumptions of the classical linear regression model and is thus valid for making relevant conclusions and generalizations, some post-estimation diagnostics were carried out and are reported in this subsection. These tests include the Ramsey test for model stability, the Breusch-Godfrey LM test for autocorrelation, the Breusch-Pagan-Godfrey test for heteroskedasticity, and the Jarque-Bera normality test for residual normality.

Following the Ramsey RESET test, Table 8 presents the result of the model stability test. It shows that the corresponding probabilities of the F- and t-statistics exceed the 5 % significance level. As a result, the Ramsey RESET test's null hypothesis, which claims that the model's identification is straightforward and that its functional form is valid, was not rejected. It was concluded that the model used for the estimation is stable.

Table 9 shows the result of the autocorrelation test conducted following the test procedure of the Breusch-Godfrey LM test. The test yielded a F-statistic value of 0.841046 with a corresponding p-value of 0.4519. Given that the test's p-value is greater than 0.05, the null hypothesis of the serial correlation test which states that 'serial correlation is absent' is not rejected. This implies that the regression result is free from serial or auto-correlation problems.

Table 10 shows the result of the heteroskedasticity test conducted following the test procedure of the Breusch-Pagan-Godfrey test. The test yielded an F-statistic value of 0.708350 with a corresponding p-value of 0.6660. Given that the test's p-value is greater than 0.05, the null hypothesis of the heteroskedasticity test which states that 'there is constant variance' is not rejected. This implies that the regression result is free from the heteroskedasticity problem.

	Value	Df	Probability
t-statistic	0.649842	15	0.5256
F-statistic	0.422294	(1, 15)	0.5256

Table 8. Result of Ramsey RESET Test

Source: Author's Computations

Table 9. Result of Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.841046	Prob. F(2,14)	0.4519
Obs*R-squared	2.201548	Prob. Chi-Square(2)	0.3326

Source: Author's Computations

Table 10. Result of Breusch-Pagan-Godfrey Heteroskedasticity Test

F-statistic	0.708350	Prob. F(7,15)	0.6660
Obs*R-squared	5.714091	Prob. Chi-Square(7)	0.5735

Source: Author's Computations



Figure 1. Histogram for Normality of Residual Source: Generate by the Author

Figure 1 presents the histogram to show the distribution of the residual of the regression model and verify if the normality assumption of the classical linear regression model is not violated in the estimated result. Since a precise conclusion may not be achieved by looking at the diagram, the Jarque-Bera normality statistic is presented alongside the diagram to examine if the residual of the model is normally distributed. With the Jarque-Bera normality statistic value being 3.267067 and its p-value being 0.195238, the statistic is not significant at a 5 % significance level.

Therefore, the test's null hypothesis which states that the residual series is normally distributed could not be rejected and hence, the residual series of the regression result is normally distributed, and the normality assumption of the classical linear regression model is not violated.

6. Conclusion and Recommendations

This study examines the impact of internally generated revenue (IGR) on infrastructural development in Kwara state. Our dependent variable is infrastructural development, which was measured by capital expenditure, while IGR variables include tax and non-tax revenue. The sum of internal and external loans makes up the loan variable, which was employed as the control variable.

This study finds that IGR has a significant positive influence on infrastructural development, both in the short and long run. Explicitly, non-tax revenue is the only IGR variable that significantly influences infrastructure development both in the short and long run, while tax revenue influence can only be felt in the short run. Similarly, it was shown that infrastructural development significantly exhibits both short and long-run positive relationship with loans. However, it was observed that the previous year's loan negatively affected spending on infrastructural development in the current year. These results suggest that IGR is an essential source of revenue for the Kwara state government to finance capital projects, especially non-tax revenue, which its effects tend to also be felt in the long run. Also, a moderate and fiscal sustainable loan can bridge the budget deficit gap, providing additional funds to finance capital projects, thereby enhancing infrastructural development in the state.

Additionally, granting regional governments the authority to formulate and administer their fiscal policies independently could enhance economic development at the state level, which is in line with the fiscal decentralization idea in the fiscal federalism concept.

It is recommended that the Kwara state government should increase its tax base and rate in a form that would not yield negative consequences on the state economy. Also, the state government is encouraged to diversify its non-tax revenue source to cushion unexpected economic shocks or fluctuations from nontax revenue. By implementing these, the state government can reduce its reliance on loans to finance capital expenditures, thereby mitigating the problem of debt servicing, which will in return enhance the state's fiscal balance. However, if the government finds it mandatory to obtain loans, it should then be secured in a way that ensures the fiscal sustainability of the state economy.

This study recommends future research to further decompose the non-tax revenue variable and examine the effect of each component on infrastructural development in Kwara State.

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INFORMATION ABOUT AUTHORS

Olufunmilayo Temitope Alakija

PhD, Lecturer of Department of Statistics, Yaba College of Technology, Yaba, Lagos State, Nigeria (Yaba College of Technology, Herbert Macaulay Road, Opposite WAEC office, Yaba Lagos, Nigeria); ORCID <u>https://orcid.org/0000-0002-9108-3432</u> e-mail: <u>temitope.alakija@yabatech.edu.ng</u>

Agboola Hammed Yusuf

PhD, Lecturer of Department of Economics, Faculty of Economic Sciences and Management, University of Lay Adventists, Kigali, Rwanda (Gasabo Street, KK 508 ST, P.O Box 6392, Kigali, Rwanda); ORCID <u>https://orcid.org/0000-0001-5646-8479</u> e-mail: <u>agboolayusuf2007@gmail.com</u>

Ganiy Adewale Elegbede

BSc., Research Assistant, Department of Economics, Faculty of Social Sciences, University of Ilorin, Ilorin, Kwara State, Nigeria (P.M.B. 1515, Ilorin, Kwara State, Nigeria); ORCID <u>https://or-cid.org/0009-0009-2688-4426</u> e-mail: <u>elegbedeganiy@gmail.com</u>

Abiola Shittu

BSc., Research Assistant, Department of Economics, Faculty of Social Sciences, University of Ilorin, Ilorin, Kwara State, Nigeria (P.M.B. 1515, Ilorin, Kwara State, Nigeria); ORCID <u>https://or-cid.org/0009-0007-0127-0730</u> e-mail: <u>abiolaprecious16@gmail.com</u>

Javan Semana

PhD, Lecturer at University of Lay Adventists, Rwamagana Campus Coordinator, Kigali, Rwanda (Gasabo Street, KK 508 ST, P.O Box 6392, Kigali, Rwanda), ORCID <u>https://orcid.org/0009-0006-8804-7429</u> e-mail: javansemana@gmail.com

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Влияние субнациональных внутренних генерируемых доходов на развитие инфраструктуры: кейс штата Квара, Нигерия

О. Т. Алакия¹ ⁽^b), А. Х. Юсуф² ^{(b}), Г. А. Элегбеде³ ^{(b}) ⊠, А. Шитту³ ^(b), Д. Семана² ^(b)

> ¹ Технологический колледж Яба, г. Лагос, Нигерия ² Университет адвентистов-мирян, г. Кигали, Руанда ³ Университет Илорина, г. Илорин, Нигерия ⊠ elegbedeganiy@gmail.com

Аннотация. Финансовая независимость правительств штатов Нигерии зависит от их способности генерировать внутренние доходы (IGR), что может помочь им лучше удовлетворять потребности своих граждан в социальном обеспечении и инфраструктуре. Целью данного исследования является изучение влияния внутренних генерируемых доходов на развитие инфраструктуры в штате Квара. Декомпозируя IGR на налоговые и неналоговые доходы, мы предполагаем, что не существует существенной долгосрочной и краткосрочной связи между налоговыми/неналоговыми доходами и развитием инфраструктуры штата Квара. Благодаря своей способности избегать проблем со стационарными данными, авторегрессионное распределенное запаздывание (ARDL) было использовано для анализа годовых данных, которые были извлечены из финансового отчета штата Квара за 1999–2023 гг. Данное исследование показало, что IGR и кредит оказывают значительное положительное влияние на развитие инфраструктуры как в краткосрочной, так и в долгосрочной перспективе. Однако влияние налоговых поступлений ощущается только в краткосрочной перспективе, а прошлогодний кредит оказывает негативное влияние на развитие инфраструктуры в текущем году. На практике эти результаты подразумевают, что IGR является важным источником дохода для правительства штата Квара для финансирования капитальных проектов, особенно неналоговых доходов, последствия которых также имеют тенденцию ощущаться в долгосрочной перспективе. Это также может быть связано с концепцией фискальной децентрализации, которая поддерживает фискальную автономию правительства штата. В исследовании говорится, что правительство штата Квара должно увеличить свою налоговую базу и ставку таким образом, чтобы это не привело к негативным последствиям для экономики штата, и диверсифицировать свои неналоговые источники доходов, чтобы смягчить неожиданные экономические потрясения.

Ключевые слова: внутренние генерируемые доходы (IGR); развитие инфраструктуры; налоговые поступления; неналоговые поступления; кредиты; методика оценки ARDL; штат Квара.

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ИНФОРМАЦИЯ ОБ АВТОРАХ

Алакия Олуфунмилайо Темитопе

PhD, преподаватель кафедры статистики Технологического колледжа Яба, г. Яба, штат Лагос, Нигерия (Yaba College of Technology, Herbert Macaulay Road, Opposite WAEC office, Yaba Lagos, Nigeria); ORCID <u>https://orcid.org/0000-0002-9108-3432</u> e-mail: <u>temitope.alakija@yabatech.edu.ng</u>

Юсуф Агбула Хаммед

PhD, преподаватель кафедры экономики факультета экономических наук и управления Университета адвентистов-мирян, г. Кигали, Руанда (Gasabo Street, KK 508 ST, P.O Box 6392, Kigali, Rwanda); ORCID <u>https://orcid.org/0000-0001-5646-8479</u> e-mail: <u>agboolayusuf2007@</u> <u>gmail.com</u>

Элегбеде Ганий Адевале

BSc., научный сотрудник, факультет экономики, факультет социальных наук, Университет Илорин, г. Илорин, штат Квара, Нигерия (P.M.B. 1515, Ilorin, Kwara State, Nigeria); ORCID https://orcid.org/0009-0009-2688-4426 e-mail: elegbedeganiy@gmail.com

Шитту Абиола

BSc., научный сотрудник, факультет экономики, факультет социальных наук, Университет Илорин, г. Илорин, штат Квара, Нигерия (P.M.B. 1515, Ilorin, Kwara State, Nigeria), ORCID <u>https://orcid.org/0009-0007-0127-0730</u> e-mail: <u>abiolaprecious16@gmail.com</u>

Семана Джаван

PhD, преподаватель Университета адвентистов-мирян, координатор кампуса в Рвамагане, Кигали, Руанда (Gasabo Street, KK 508 ST, P.O Box 6392, Kigali, Rwanda); ORCID <u>https://orcid.org/0009-0006-8804-7429</u> e-mail: javansemana@gmail.com

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