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The Effects of Demographic Considerations on Public Infrastructure Expenditures in Nigeria's Rivers State Local Government Areas (2003-2017)

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Abstract:
Demographic factors though mostly neglected are noted to influence the capacity of capital investments on public infrastructure development. This study empirically assessed the effect of demographic factors on public infrastructure expenditures in Nigeria's Rivers state local government areas (LGAs) from 2003-2017. Secondary data were collected which included capital expenditure (capex) on one side and various demographic variables (population, population density, number of households, and per capita revenue) on the other, obtained from public expenditure records, yearly appropriation bill or budgets, national population commission, National Bureau of Statistics, Central Bank of Nigeria Publications, and some research articles. The population of the study is the 23 LGAs of Rivers state. Data analysis was carried out using mainly multiple regression method. At 5 % level of significance, the study reveals that there is significant relationship between aggregate capital expenditure and demographic factors in the Rivers state local government areas. However, in relation to individual demographic factors, only population density is significantly and positively related with Capex. The study concludes that Rivers state LGAs do give significant consideration to demographics in their capital allocation to infrastructural developments. Though this is true, a close investigation reveals that the adjusted R^2 value is 0.429 indicating a not too strong statistical association, also only population density is positively considered by the LGAs, the other demographic variables though significant are negative to capital expenditure. The Study recommended among others that the LGAs should give a much more holistic attention to demographic demands in the dissemination of capital allocation to public infrastructure developments through policy formulations and strict adherence to it; adequate planning, and systematic funding.

Keywords: Infrastructure, Capital expenditure, population, population density, number of households, per capita revenue, budget, local government areas

1. Introduction

Landing on the shores of any community, its industrialised or advanced state can easily be sighted via the physical infrastructure on ground. In the development of any nation, the foundation for a sustainable and durable economic growth is set by Infrastructural development (Akanbi, 2013). Investment in community infrastructure through local Government helps in creating jobs; assist communities to attract and retain key workers in local communities; improves community life; and enhances the experience of residents using these facilities (Austrian Local government Association, 2015).

Globally, there are specific determinants of government capital expenditures for public infrastructure development. From a summary of opinions by Edame (2014), Busilac & Deluna (2013), Sturm (2001), Aregbeyen & Akpan (2013), these determinants are grouped into three variables. The first is *Baseline or Structural variables*: total revenue of government, population size, population density, population growth rate, demographic age and household distribution, and degree of urbanization. The second is *Economic variables:* real economic growth, government budget deficits, government debt, private investment, foreign aid and direct investment, trade openness, average income of the populace, unemployment, inflation. The third is *Institutional/Political Variables:* regime or governance, corruption and economic sabotage, poor maintenance culture, electoral cycles, economic and political freedom, political/security instability, technological factors, and environmental concerns.

Aregbeyen & Akpan (2013) refer to the demographic determinants as base line variables, while Sturm (2001) calls them structural variables. Though demographic factors don't seem to be the sole issue that do (or should) shape

infrastructural decisions, policymakers ought to take into account demographics as they make choices about the kinds of infrastructural investments to form (Heller, 2010). The emphasis of the author is that demographic factors or baseline factors ought to be seen as primary factors in determining infrastructural investment by policy makers.In defining demographics as statistics about the population of a particular geography such as a town/city, state, or nation, French (2014) opines that demographics offer communities information they need for the planning of future investments and services. In other words, demographics profoundly affect how important decisions are made in line with community vision.

The existence of an undeniable link between public infrastructure spending and demographics is supported by a number of researchers. A study carried out by Edame & Fonta (2014) has shown that population density, rate of urbanization, government revenue, among others jointly or in isolation influence public expenditure on infrastructure in Nigeria. Others like Nugent & Seligman (2008) and Plotnicova (2005) agree on the fact that public infrastructure demand is greatly influenced by demographics. Knowledge of demographics according to African development Bank (2012) is crucial for both the planning and funding of infrastructure development. Nedozi, Obasanmi, & Ighata (2014) also opined that demographic factors have robust influence on public infrastructure demands. Advanced countries of the world have been found to plan infrastructure development with consideration of the significance of population and its seeming growth (Owhor, Ojo, Nkpurukwe & Abdul, 2015). The author's findings are based on the grounds that whatever facility is provided is not just adequate for the situation at present, but would on and on be capable of catering for the growing population within the projected life period of the infrastructure.

The Nigerian situation, as it stands, is devoid of such infrastructure-demographic positive relationship. Bello-Schünemann & Porter (2017) opines that Nigeria's population growth has not been matched by an increase in the delivery of water supply, sewerage and sanitation services. Infrastructure development of any local government area is basically dictated by the capital expenditure (public investment) capacity of the government. Decision on the establishment and financing of any public infrastructure by government must be based on specific factors. Agba, Ogwu, & Chukwurah (2013) opined that the major factors are: social, political and economic value to government in the short and long run; its impact upon the population of the community; its impact upon the land mass of the community in relation to population distribution (or population density); the availability of funds to execute it (a combination of internal and external sources). The importance of demographic variables as primary factors in determining capital expenditure for public infrastructure development is such that their consideration in public capital spending planning (through the instrument of budgeting) by government is worth examining in the 23 local government areas, and particularly of Rivers State being the most economically viable state in South-South Nigeria that is capable of effectively supporting infrastructure development. The research covered a period of fifteen years (2003-2017). The result revealed strengths and weaknesses in the capital spending system of the government in line with demographic factors which should alert government to take the appropriate steps in policy decisions on better infrastructure financing.

The study therefore explored and determined the possible connections between the changing demographic patterns in the local government areas of Rivers State and the infrastructural growth it has endured over a considerable period. The demographic variables considered for the study are: population, population density, per capita total revenue of government, and number of households. The Rivers State experience should indicate and be largely amenable to important policies for general infrastructural development in similar states.

1.1. Problem Formulation, Purpose and Hypotheses

The level of infrastructural development in Nigeria is poor compared to other parts of the world (Akanbi, 2013; Mohammed, 2011). This infrastructural deficiency can be linked to political, economic, priority or policy, debt burdens, corruption, demographic, and other reasons. The demographic reason has been identified as a notable factor in the Nigeria's infrastructure deficiency situation. PWC (2016), Bello-Schunemann & Porter (2017), and Onwuka (2006) specifically stressed that formulation and adherence to policy of government that deliberately moves infrastructural investment in line with demographic growth in a significant positive relationship is missing in the Nigerian context.

In 2017, Nigeria's population was about 194 million and growing at 2.7% per annum (Countrymeters, 2017). The population is projected to be about 204 million in 2020 by the Organisation for Economic Co-operation and Development, OECD (2012). The physical and social infrastructure that is expected to support this large population is quite big and requires enormous funding. Over time notably, Nigerian government has failed to marry population policy with overall planning of infrastructure development (Olaseni & Alade, 2012). In other words, the evident government neglect of relevant demographic consideration in the policy decisions of infrastructural development results in poor and insufficient infrastructure provision in the land. Amenities of 1960s to 1980s continue to be used today without looking at the rate at which population is growing. Owhor, Ojo, Nkpurukwe & Abdul (2015) postulates that the same amenities provided in the 1960s to 80s when population ranged between 39.2 million and 65.7 million are still being depended upon with little or no expansion in the current twenty first century, when the population is above 194 million and even growing.

How valid are these baseline (demographic) factors effect in the local government areas of Rivers State which total revenue (from federal allocation, internally generated revenue, and oil derivation funds) is considered the highest in the Country?An empirical budget analysis of capital expenditures of government over time in relation to demographic demands is likely to reveal the true situation, with particular reference to the local governments in Rivers State. The study aims to analyse the relationships between demographics and public infrastructure expenditures in Rivers State local government areas (2003-2017) with a view to improving funding of infrastructure in the area. This work therefore examined the aggregate demographic effect on capital expenditure and determined the individual demographic effects (of population, population density, per capita total revenue of government, and number of households on capital expenditure.

1.2. Hypotheses

The research hypothesis is structured on the following basis:

- H1: There is no significant aggregate Demographic effect on Capital Expenditure.
- H2: There is no significant Per Capita Revenue Expenditure effect on Capital Expenditure.
- H3: There is no significant Population Density effect on Capital Expenditure.
- H4: There is no significant Number of Households effect on Capital Expenditure.
- H5: There is no significant Population effect on Capital Expenditure.

2. Literature Review

2.1. Theoretical Issues

The four theories of Wagner's Law of Increasing State Activities (Shodhganga, 2006); The Peacock-Wiseman (1961) Hypothesis; Musgrave & Rostow's Development Model (The Strategist, 2013); and Solow model (Kasun, 2019); all collectively address public infrastructure financing in relation to demographic factors in a sense. These theories have an underlying suggestion that demographics influence infrastructural development and there must be a deliberate government effort in tying infrastructure financing to demographic growth. Negligence of this is harmful to a significant infrastructural advancement. This position is in harmony with the approach of this study.

2.2. Public Infrastructure and Demographic Considerations

Public infrastructure can be regarded as both hard and soft. Phuong (2013) explains that hard infrastructure refer to physical structures or facilities that support the society and economy, such as *transport* (this includes roads, railways, and ports), *energy* (examples are gas and oil pipelines, electricity generation, electrical grids), *telecommunications* (the telephone and internet systems are examples). Others are water supply, hospitals and health clinics, schools, irrigation, etc.which can be termed *basic utilities*. Non-tangibles which form the basis for the development and operation of hard infrastructure are referred to as soft infrastructure. They include the frameworks of policy, regulation, and institution; the mechanisms of governance; social networks, systems and procedures; financing and procurement systems of transparency and accountability (Phuong, 2013; Albert & Benon, 2016).

Environmental and social considerations are two areas among others put forward by the G20 as principles for quality infrastructure investment (Runde, Rayboke, & Ramanujam, 2019). Embedded within this concern is the issue of demographic considerations, as demography is subject to the environment and social array. Advanced countries demographic considerations for infrastructure investments could be one strong reason for their enviable infrastructural strength (Heller, 2010; Wilkins & Zurawski, 2014; Owhor, Ojo, Nkpurukwe & Abdul, 2015). Consistently Sub-Saharan Africa is positioned at the bottom of all developing regions in relation to the performance of infrastructure, and most people observe that deficient infrastructure is a major obstacle for national growth and the reduction of poverty across the region (Calderon & Serven, 2010). Infrastructural development in relation to demographic considerations is considerably poor in sub-Saharan Africa as most of the population lack adequate infrastructure that relate to their demographic interest (Kandiero, 2009; Sy, 2015).

The global rankings (Top 10 and Bottom 10) of countries in infrastructure according to World Economic Forum (WEF), 2010, cited in Akanbi (2013), puts Nigeria at the bottom tenth position with a ranking of 134, 6th from the least country, Bosnia with 139 ranking, as shown in table 2.1 below. The Rankings of SSA (Sub-Saharan Africa) Countries in Infrastructure, Based on the PII (physical infrastructure index) and World Economic Forum (WEF), cited in Akanbi (2013), placed Nigeria at the 2nd from bottom position with a ranking of 20 as against the least country, Congo Democratic Republic with 21 ranking, in the year 2000. The CIA World Fact Book, 2008, in Mohammed (2011) further compared the stock of infrastructure of Netherlands, Brazil, Turkey, India and Nigeria, and found Nigeria to be at a deplorable state. The wisdom in attaining a good infrastructural development in the midst of a challenging demographic scenario is the formulation and adherence to policy of government that deliberately moves infrastructural investment in line with demographic growth in a significant positive relationship. In the Nigerian context this is missing, as opined by PWC (2016), Bello-Schunemann & Porter (2017), Onwuka (2006).

In Rivers State, as opined by Otto & Ukpere (2014), the quantity and quality of social infrastructure in the State is not commensurable with the resources that had so far accrued to the State in the last 52 years of its creation. The authors further posited that many government projects carried out in Rivers State did not succeed to deliver the pre-designed objectives. The current infrastructural developments in the state are in no way tallying with the demographic growth of the state. There are large demographic populace scrambling with very limited infrastructure, most of which require immediate maintenance and updating.

2.3. Demographic Variables and their Effects on Investments for Public Infrastructures

Demographics are of key importance to the development of any nation, but most times this link is ignored. The demographic characteristics of the population are very necessary as it helps in determining investment; and of course for both public and private infrastructure, there will always be competing and urgent needs .The demographic variables considered in this study (population, population density, number of households, and per capita total revenue) are discussed in this section. Every infrastructure must serve a given population, a given population density, a given number of households, and be financed through a given total revenue.

The population size of the local government area is a strong determinant being that whatever development is located in an area must be geared towards meeting the needs of the population size. Population size influences the demand for local public infrastructure use and subsequently on local public expenditures. It is suffied to say that changes in population imply changes in whatever level of infrastructure are required and therefore, it is important for environment planners and providers of public facilities to consider population with projection into the future, while planning for sustainable infrastructural development (Owhor, Ojo, Nkpurukwe & Abdul, 2015).

The population density, which measures the concentration of population over an area, is another determinant of government public expenditure. Though the population factor is crucial, the extent of distribution of the population over an area determines the extent and cost of infrastructure to be provided for the area. The rate of population density has a significant effect on capital spending; and areas that have a high population density will require a lot of facilities and infrastructure as well so that local governments should allocate additional budget to build public facilities (Nurlis, 2016). The total government revenue per capita or gross government income per capita as a demographic variable plays major role in determining the financing of infrastructures. Expectedly, when revenue of government increases, her capital expenditure increases, and hence infrastructural investment increase. This is the ideal but may be the opposite in practical terms. There are situations where total government revenue increases but government does not correspondingly increase capital expenditure because of inattention to infrastructure demands. It takes an empirical analysis of data between capital expenditure and revenue per capita as a demographic variable to assess the nature of relationship.

The number of households in a population is very essential in determining the level of essential services to provide. National Population Commission (2014) explains household as related or unrelated group of persons, or even a person, that usually live with one another in the same dwelling place, cook and eat under one arrangement, and regard one of its adult members as the head of the household. The linking up of services like telecommunications, water, power, and sanitation to households will be very much dictated by the number of households in the community. Olasehinde & Olaniyan (2017) posits that household characteristics commonly influence healthcare expenditure in Nigeria significantly. Household estimates at the national level, geo-political zones, urban-rural breakdown, 36 states, and the Federal Capital Territory (FCT) are provided by the National Demographic and Health survey and also the General Household Survey carried out by the Nigerian Bureau of Statistics periodically based on a nationally representative sample of approximately 5,000 households.

2.4. Empirical Review

In studying the determinants of growth of government expenditure in Nigeria, Okafor & Eiya (2011) using ordinary least squares (OLS) found that inflation was not significant while population, total government revenue, public debt, and inflation were all statistically significant at 5% level. Edame (2014) studied the determinants of public infrastructure spending in Nigeria, using error correcting model (ECM). The results showed that population density, government revenue, rate of urbanization, type of government, and external reserves, together or individually influence public expenditure on infrastructure. Test results conducted by Nurlis (2016) showed that the variables of GDP, population density and per capita income have a significant effect on capital expenditure.

Nurlis (2016) further showed that the variables of GDP, population density and per capita income have a significant effect on capital expenditure. In their study, Fisher and Wassmer (2015) found a positive relationship between the level of government capital expenditure and income, population, population growth, the magnitude of federal grants, and the amount of depreciation of assets. The variables used in a regression to explain annual capital spending in the 48 contiguous United States for 1983 and 1984 by Temple (1994) are median income, federal grants, tax price, capital stock, debt share of capital expenditure, population growth, population density, the percent elderly, and a location control. A study by Shonchoy (2010) which focused on the recent pattern of government expenditure in developing countries and estimates the determinants which have influenced government expenditure using a panel data set for 111 developing countries from 1984 to 2004, found evidence that demographic variables, among others have significant power in explaining government expenditure in developing countries.

Reschovsky (2003, as cited in Mahabir, 2012) notes that regardless of the type of service, other factors such as topography, population size, population density and other geological characteristics influence costs of infrastructure services. Aregbeyen & Akpan (2013) pointed to the fact that higher population (mostly in urban areas) should lead to higher government spending. They deduced that the long-run behaviour of government expenditure in Nigeria does not respond (as expected) to the demographic structure of the nation. World Bank research by World Bank Group, (2010) also shows that the unit cost of infrastructure is highly sensitive to density and policymakers will need to be flexible in terms of the quality and standards of infrastructure they choose in order to accommodate the needs of lower density settlements. Focusing on the case of Germany, Büttner, Schwager and Stegarescu (2001) reconsidered the empirical relevance of density and population size effects on the cost of providing public services. For this purpose, they developed an approach for an empirical determination of cost functions of public services and applied it to the German states, aiming at empirical estimates of the impact that density and population size have on public services per capita cost. The results indicate that while there is evidence in favour of crowding effects in population no general relationship is found between density and the cost of public goods provided.

So far, a review of literature in the local government sphere particularly, suggests that quantitative analysis of the demographic effects on infrastructural investment is quite inadequate, and in the context of Nigeria's local governments, non-existent. The research inadequacy is based on the fact that quantitative analyses are basically of a conglomeration of demographic and other (economic, socio-political, fiscal, debt, etc.) effects on capital expenditure. A holistic study of demographic effects only on local government capital expenditure, and moreover with regards to Nigeria and Rivers state

to be specific is missing. The use of the multiple regression method to undertake such holistic study is intended to fill the gap of literature.

3. Methodology

Quantitative approach was adopted in this study. A causal research design was used in this study which determines the effect of certain independent variables (demographic variables) on a dependent variable (capital expenditure). The method of analysis used for this research is the multiple regression analysis using SPSS version 22.

In carrying out this research work, secondary sources of data were used. The sources include Central Bank of Nigeria's statistical bulletins, Ministry of Economic Planning (budget department), Ministry of finance, State budget department publications, National Population Commission, and National Bureau of Statistics. The population and sample size in this study is the twenty-three (23) local government areas of Rivers State. Data was collected for the period of twelve (15) years (2003-2017).The regression analysis shows that population and population density are highly correlated, with population density being the chosen contributor to the model and population excluded. The situation is actually notable since population (which changes yearly) is divided by land mass (which is constant yearly) to get population density. The exclusive SPSS regression analysis report for population is noted in this study but will not be included in the model.

3.1. Model Specification and Estimation

Regression analysis is a globally used technique useful for evaluating multiple independent variables. The equation for the multiple linear regression is as follows:

$Y = b_0 + b_1X_1 + b_2X_2 + … + b_nX_n$

Where: Y = predicted or expected value of the dependent variable

X_1 through X_n = n distinct independent or predictor variables

b_0 = value of Y when all of the independent variables (X_1 through X_n) are equal to zero

b_1 through b_n = the estimated regression coefficients.

Every regression coefficient represents a change in Y with respect to a unit change in the independent variable respectively. Based on the conceptual considerations, Local government aggregate capital expenditure can be expressed as a function of demographic variables as follows: Local government capital expenditure = f (government total revenue per capita, population, density of population, number of households). Hence the specification of the equation will be:

$Capex.i = b_0 + b_1Rev.i + b_2Pop.i + b_3Den.i + b_4House.i + e$

Where: Capex = Capital expenditure

Rev = Government total revenue per capita

Pop = Population

Den = Density of population

House = Number of Households

e = A random error term

b_0 = Constant

4. Results and Tests of Hypothesis

Regression analysis showcases the level of relationship between capital expenditure (CAPEX) as dependent variable and demographic factors (per capita revenue expenditure, population, population density, and number of households) as independent variables. The data presented below in table 1 shows the aggregate average values of all variables of this study for 23 LGAs of Rivers State in the space of 15 years (2003-2017). Figures for the total population of each LGA were computed using National Bureau of Statistics (2012) annual population growth rate of 3.46 %. The table establishes the fact that capital expenditure is dictated by the total revenue of government, but it is observable that from 2004 - 2012 there is a steady rise of capital expenditure (CAPEX), and from 2013 – 2017 a dovetailing of capital expenditure.

4.1. Test of Hypothesis

The main objective of this study seeks to determine the effect of demographic factors on aggregate capital expenditure in Rivers State local government areas. To achieve this, multiple regression statistical technique is used with the help of SPSS version 22.

- Hypothesis 1: States that there is no significant demographic effect on aggregate capital expenditure of Rivers State local government areas. The report of the SPSS analysis is shown in tables 2 - 4. The table shows an F-statistics value of 4.500 and p-value of $0.027 < 0.05$. This is indicative that aggregate capital expenditure is significantly positively related with demographics in Rivers State LGAs. Thus, the null hypothesis is rejected

	TOTAL REV EXP	CAPT. EXP.	PER CAP. REV EXP	POP TOTL	POP DENSITY	NO. HH
2003	624873777.7	154961305.4	3066.38	203782.6	452.37	43358
2004	586521926.4	147320398.9	2763.19	212262.7	471.19	54426
2005	897347375.5	287153026.1	4108.97	218387.6	484.79	50788
2006	1204365687	449621693.3	5328.32	226031.1	501.76	46129
2007	1512409369	618991821	6467.07	233863.1	519.14	63206
2008	2094147928	776222246	8650.78	242076.1	537.37	55017
2009	2584985394	1211611859	11218.88	250413.9	555.88	62604
2010	2790382691	1320280869	10769.07	259110.9	575.19	57580
2011	3191403880	1653136920	11911.93	267916.5	594.74	51522
2012	4146070723	2256447692	14955.59	277225.5	615.4	50405
2013	4328500532	2207398747	15091.55	286816.3	636.69	70741
2014	3382174694	1350154510	11397.77	296740.1	658.72	61821
2015	3008547922	980039687	9823.73	306253.1	679.84	62501
2016	2339537791	544421172	7367.19	317561.9	704.94	69035
2017	2381271271	621504258	7231.54	329289.5	730.97	88997
TOTAL	35072540962	14579266205	130151.96	3927731	8718.99	888130

Table 1: Expenditures and Demographic Variables for Rivers State Lgas
Source: Collated/Computed By Author (2019) from Local Government and National
Published Data

However, the coefficient of multiple determination (adjusted R^2) is 0.429; therefore, about 42.9% of the variation in the capital expenditure is explained by the demographic variables. This is suggestive of a weak association between aggregate capital expenditure and demographics. Thus, the regression equation appears not to be very useful for making predictions since the value of R^2 is not close to 1.

Model Summary[b]									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.742[a]	.551	.429	515,867,090.2978	.551	4.500	3	11	.027

Table 2: Model Summary of Aggregate Capital Expenditure and Demographics for LGAs
a. Predictors: (Constant), Number of Households, Per Capita Revenue Expenditure, Population Density
b. Dependent Variable: Capital Expenditure

On individual demographic basis, the coefficients table 3 below showcases the results for hypotheses 2-5.
- Hypothesis 2: States that there is no significant Per Capita Revenue expenditure effect on Capital Expenditure. The result suggests that the demographic variable – per capita revenue is significantly related with the aggregate capital expenditure of the LGAs with p-values: 0.035 < 0.05. But this relationship is in a negative direction indicated by a t-value of -2.339.
- Hypothesis 3: States that there is no significant Population Density effect on Capital Expenditure. The result suggests that the demographic variable –population density is significantly related with the aggregate capital expenditure of the LGAs with p-values: 0.004< 0.05. The direction of the relationship is positive with t-value 3.597.
- Hypothesis 4: States that there is no significant Number of Households effect on Capital Expenditure. The result suggests that the demographic variable –number of households is significantly related with the aggregate capital expenditure of the LGAs with p-values: 0.032 < 0.05. However, this relationship is significantly related in a negative direction with a t-value of -2.455. These negative directions call for more concern as they depict that as the said variables are increasing CAPEX is reducing.

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
1 (Constant)	-2019842438.452	1018126304.979		-1.984	.073
Per Capita Revenue Expenditure	-1324.728	552.162	-.588	-2.399	.035
Population Density	10367222.591	2882473.965	1.363	3.597	.004
Number of Households	-48621.222	19801.113	-.825	-2.455	.032

Table 3: Coefficients of Aggregate Capital Expenditure and Demographics for LGAs
a. Dependent Variable: Capital Expenditure

- Hypothesis 5: States that there is no significant Population effect on Capital Expenditure. The result for total population is showing the direction of relationship as insignificant (p-value = 0.523 >0.05) and negative (t-value = -0.661). See table 4 below.

Excluded Variables[a]					
Model	Beta In	T	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 Population	-5959.274[b]	-.661	.523	-.205	5.295E-10

Table 4: Excluded Variables in Aggregate Capital Expenditure Vs Demographics for Lgas
a. Dependent Variable: Capital Expenditure
b. Predictors in the Model: (Constant), Number of Households, Per Capita Revenue Expenditure, Population Density

The summary of the test of hypothesis results are presented in table 5.

5. Findings and Discussion

The main objective of this study is to determine the demographic effect on aggregate capital expenditure in Rivers state LGAs. Findings of the study indicate that from 2004 - 2012 there is a steady rise of aggregate capital expenditure (CAPEX), and from 2013 – 2017 a dovetailing of capital expenditure. The economic downturn of the nation could be a contributing factor to this dovetailing of CAPEX.

From the adjusted R square result shown in table 2 only 42.9% of the aggregate capital expenditure variance can be explained by the demographic variables. Simply put, the effect of demographics on aggregate capital expenditure in Rivers state LGAs is at a level of 42.9%. The association between CAPEX and demographics from this finding is a little below average. With a positive F-statistics value and p-value less than 0.05 the aggregate capital expenditure is significantly positively related with demographics.

Hypothesis	Statistical Tool	Location of Result	F/t Statistics	p (Sig.)	Remarks	Decision
H1: No sig. aggregate demographic effect on capital expenditure	Regression	Table 2	4.500	0.027	Significant	Reject H_0
H2: No sig. Per Capita Revenue expenditure effect on Capital Expenditure.	Regression	Table 3	-2.399	0.035	Significant	Reject H_0
H3: No significant Population Density effect on Capital Expenditure.	Regression	Table 3	3.597	0.004	Significant	Reject H_0
H4: No sig. Number of Households effect on Capital Expenditure.	Regression	Table 3	-2.455	0.032	Significant	Reject H_0
H5: No sig. Population effect on Capital Expenditure	Regression	Table 3	-0.661	0.523	Not Significant	Accept H_0

Table 5: Summary of Test of Hypothesis Results

An interesting finding that occurs here is that higher capex may not necessarily lead to significant relationship with demographics but the rate of capex change in relation to demographic change is the point of relevance. The local government position is evident that demographic considerations are felt in capital expenditure.

On individual demographic basis, it is found that all the demographic variables in the model – per capita revenue, population density, and number of households are significantly related with the aggregate capital expenditure of the LGAs. However, per capita revenue and number of households are significantly related in a negative direction. Population is found to be insignificant in relationship with capex but also negative. These negative directions call for concern as they depict that as the said variables are increasing capex is reducing.

T test results conducted by Nurlis (2016), earlier mentioned, showed that population density has a significant effect on capital expenditure. World Bank research by World Bank Group, (2010) also showed that the unit cost of infrastructure is highly sensitive to density. This means that, in determining the amount of income allocated for capital expenditures, local governments will consider, among others, regional population density. The finding of this study is in agreement with these literature stances.

6. Conclusion

The aggregate capital expenditure is significantly positively related with demographics. Regression equation that can be formed from the results cannot be adopted as a model equation to predict capital expenditures from demographic variables because of the weakness of the relationship. Considering individual demographic variables, only population density is positively and significantly related with aggregate capital expenditure. Thus, the study concludes that Rivers state LGAs do consider the demands of demography in their capital expenditure appropriation. Though this is true, a close investigation reveals that the adjusted R^2 value is 0.429 indicating a not too strong statistical association. Also, only population density is positively considered by the LGAs, the other demographic variables though significant are negative to capital expenditure.

7. Recommendations

The demographic effect on capital expenditure though found to be significant is a weak regression model judging from the adjusted R^2 value. An improvement of the local government's capital expenditure significant interplay with demographics towards enhancing effective public infrastructural development is strongly recommended as depicted in the flow diagram (figure 1 below). The wisdom of this flow chart is based on the conceptual framework of the study, the ingredients of literature, and the results and findings of this study. Figure 1 displays the following order of ideas:

- The local government being the financier of public infrastructure in the local areas carries out such task on the grounds of political, economic, social, environmental, technological, or institutional reasons.
- No matter the reasons for infrastructural development, the LGA must consider its financial capacity (total available revenue) and decides how much should be allocated to capital expenditure and for which sector of infrastructure. Such decision may be based on various background project evaluation factors.
- The capital expenditure should be examined whether it considerably relates to baseline capital expenditure determining factors (demographic variables), in the case of this study, population, population density, per capita revenue, and number of households.
- Such examination may involve using local government demographic data (LG should as a matter of policy, keep necessary demographic data and annually update them) to influence decision on capital expenditure; using inputs from citizenry participation that is usually geared towards meeting demographic needs; by policy, ensuring that project designers marry demographic needs with their designs, and this must not be interfered with by government authorities who seek to cut corners for selfish gains; ensuring that capital allocation respect information on demographic trend.
- Where no relationship is established go back to point of establishing it. Where it is established go ahead with infrastructure development if available fund is adequate.
- Where available fund is not adequate, consider infrastructure development in phases or consider other sources of finance such as thorough revenue drive, public/private partnership (PPP), external borrowing, and grants from Federal/State governments/International bodies to enable infrastructure provision.

Any relationship of number of households with capital expenditure is always negative, but number of households as a factor is a major player to capital investments. It is therefore recommended that the local government as a matter of concern should consider the value of number of households as a demographic variable that determine capital expenditures.

The fact that per capita revenue expenditure of government is relating negatively with capital expenditure is worrisome in the sense that while increase of revenue is expected to have relative increase in capital expenditure for effective infrastructure growth, capital expenditure actually decreases. It is recommended that local governments spend relatively more on public infrastructure as their revenue expenditure increases.
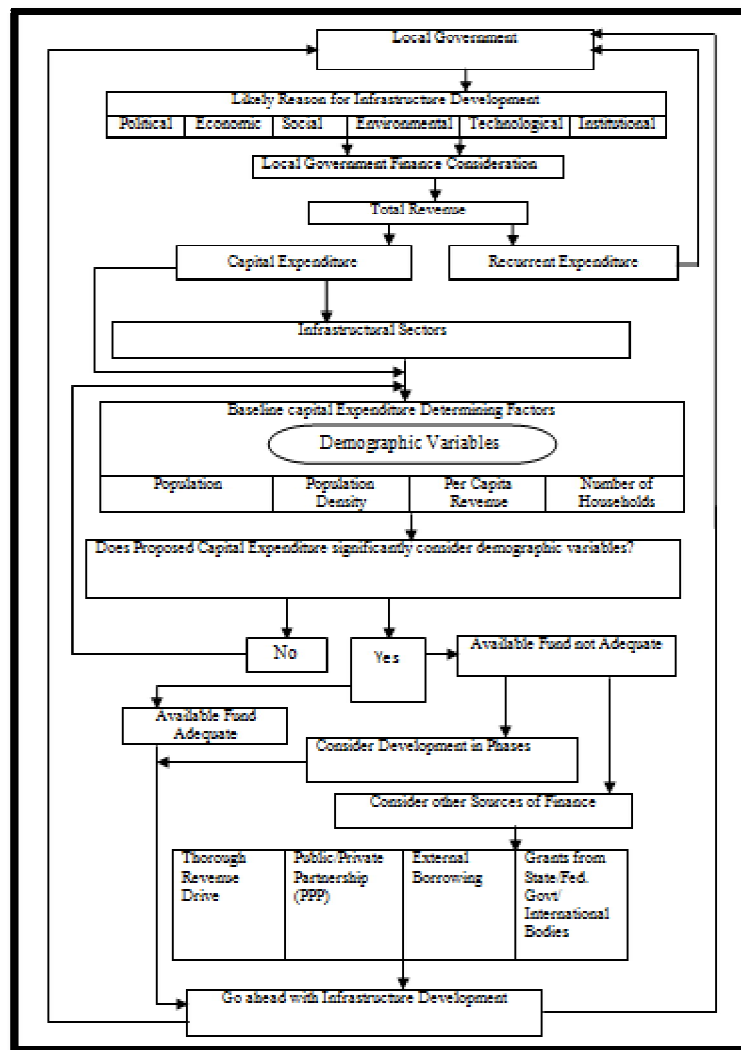
Figure 1: Recommended Flow Chart for Local Government Capital Budgetary System
Source: Author's Concept (2019)

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