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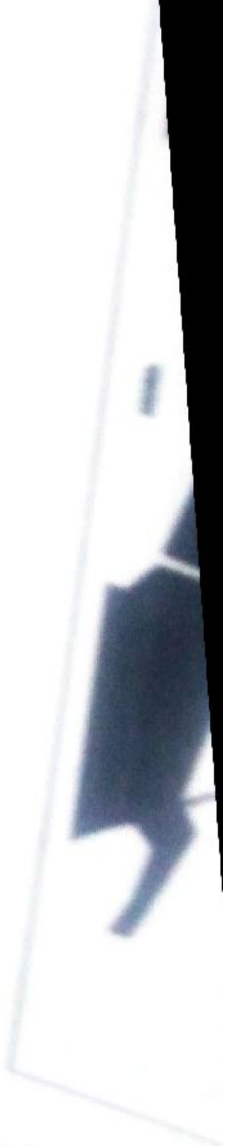

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Manuscript should be typed doubled-spaced on one side of A4 paper with generous margins, at least 2.5cm. it should not exceed 15 pages, including tables and illustration. 12 point font size and Time New Roman style should be used.

- The title page, abstract, and references should be typed on separate sheets. The title page should include the title of the paper, the full name(s) of the author(s), postal address, telephone and fax numbers, Email address and the institutional affiliation.
- The paper proper should start on page 2, with Title, Abstract, Introduction, etc.
- The Abstract should contain objective, materials and methods, major findings, conclusion and keywords.
- The paper should contain abstract, introduction, methodology, results, discussion, conclusion, recommendations (if necessary).

2 Table, Illustration and Plates

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3. References

The APA reference format should be followed. Citation in the text should be authors names and year, e.g. Olorunfemi (2001) where it appears at the end of a sentence. For two authors Oriola and Adesina, 1988 and et al for citing more than two authors. Where reference is made to multiple authors, a semi colon should separate them (eg: Olorunfemi, et al 1995; Bello, et al. 1997; Oriola and Adesina, 1988; Olorunfemi, 2001). All reference cited in the text must be cited alphabetically by authors surname followed by initials under 'Reference'.

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Vol. 4, 2011

CONTENTS

4 **Assessment and Public**

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Effects of Climate on Malaria and Typhoid Fever in Ilorin, Nigeria.

By

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Department of Geography and Environmental Management, Faculty of Social Sciences, University of Ilorin, Ilorin, Nigeria.

Abstract: *Climate plays an important role in the propagation of diseases. Indeed diseases of various types vary in prominence from one climatic belt to the other. This research examines the effect of climate on human health in Ilorin Kwara State. The data used for this work are mainly from secondary sources. They are maximum and minimum temperature, rainfall, sunshine, wind speed and relative humidity. These were collected from Nigerian meteorological Agency (NIMET) office, Ilorin International Airport. Data on diseases types and casualties were collected from the University of Ilorin Teaching Hospital, Ilorin. Both descriptive and inferential statistics were used for data analysis. The descriptive methods used are mean, standard deviation, variance, range and coefficient of variation. The inferential methods include principal components analysis, multiple correlations and regression analysis in addition to analysis of variance (ANOVA). The results of the multiple correlation showed that all the diseases types and their cases of casualties were strongly associated with one climatic variable or the other as the results of the multiple regression shows that climatic variables are strong predictors of diseases in Ilorin. The results of the factor analysis further suggest the prominent causes of diseases are mostly temperature and moisture variables*

Keywords: Climate, Diseases, Effect, Malaria, Typhoid Fever, Nigeria.

Introduction

According to Ayoade (2004), the effects of climate on human health are, however, not all negative. Favorable climatic conditions can help the human body in warding off disease and in promoting recovery from illness. Fresh air, mild temperature, moderate relative humidity and sunshine all have therapeutic values (Critchfield, 1974). For instance, fresh air and sunlight will help recovery from tuberculosis. Rickets and some skin diseases do respond to Sunshine. Favorable climatic conditions only aid recovery; they are no substitute for proper medical attention, good nutrition and cleanliness.

Studies so far carried out, indicate that the capacity of a society to absorb adverse climatic impacts is not a simple linear function of its wealth or degree of development. It has been hypothesized by Burton et al (1978) that the most vulnerable societies to adverse climatic impacts are neither the poorest and least developed nor the wealthiest and most highly developed, but those societies in the process of rapid transition or modernization where the traditional social mechanisms for absorbing and sharing losses among the community have virtually disappeared but have not yet been replaced by the accumulated wealth and response capacities of modern developed societies.

There are several ways in which climate and climatic variations exercise an influence on man and his activities. The essentials of life for mankind on this planet, namely air, water, food, clothing and shelter, are all weather dependent or weather related. Human health, energy and comfort are affected more by climate than by any other element of the physical environment (Critchfield, 1974). The physiological functions of human body respond to changes in weather; certain illnesses are climate induced while several diseases that afflict man show a close correlation with climatic conditions and season in their incidence. The climatic elements, which directly affect the physiological functions of the human body include radiation (sunshine), temperature, humidity, wind and atmospheric pressure.

Human physiological comfort is determined mainly by temperature, wind and humidity (Ayoade, 2004). Generally, high temperature and humidity tend to decrease physical vigour as well as mental vigour. Very dry air or extremely low temperatures may also impact physical vigour and adversely affect attitude to mental work.

Severe epidemics of cholera strike regularly in many parts of the developing world (Huq, 2001; Lobitz, 2000). The timing of these epidemics is partly explained by environmental and ecological conditions that are influenced by climate. In particular, a significant reservoir of the cholera – causing organism, "vibrio cholerae" appears to reside in marine ecosystems where it attaches to 200 plankton (Colwell, 1996; Huq, 2001). Populations of these small crustaceans in turn depend on the abundance of their food supply (phytoplankton). Phytoplankton populations tend to increase (boom) when ocean temperatures are warm. The result is that cholera outbreaks are associated with warmer ocean surface temperature via a series of ecological relationships.

Githeko et al (2001) compared monthly climate and malaria data in highland Kakamega and found a close association between malaria transmission and monthly maximum temperature anomalies over three years (1997-2000).

Patz and colleagues studied the effect of soil moisture to determine the effects of weather on malaria transmission. Compared to raw weather data, hydrological modeling has several potential advantages for determine mosquito-breeding site. High soil moisture conditions and vector breeding habitats can remain long after precipitation events, depending on factors such as watershed, run-off and evapotranspiration. For Angambiae, the soil moisture model predicted up to 45% and 56% of the variability of human biting rate and eritomological inoculation rate respectively (Patz, 1998).

The Study Area

The study area for this research is Ilorin, Kwara State, Nigeria. The city is situated in the transition zone between the deciduous woodland of the south and the savanna to the North. It is about 300km away from Lagos and 160KM from Ibadan. The climate of Ilorin is humid type characterized by dry and wet seasons. The seasons are controlled by two surfaces opposing winds i.e. the south east maritime and the North-east continental wind. The height of the land in Ilorin ranges from 250m to 400m above sea level. The lowest level is along the river valley of Asa and Oyun while the highest point is Sobi hill, north of Ilorin town which is about 390m above sea level. This shows that landscape of Ilorin is characterized by undulating surface with low trend and high land. Ilorin is drained majorly by river Asa, which originates from Osun State and passes through Ilorin. The study area is well drained and planned with the use of natural gift of streams and rivers.

Methodology

Data required in this study can be classified into two. These are Health information records on diseases and their casualties. These diseases are malaria fever and typhoid fever. Climatic data are minimum and maximum temperature, rainfall, sunshine hours, wind speed and relative humidity. Data used in this study were obtained from secondary sources. The data on diseases and their casualties were obtained from University of Ilorin Teaching Hospital, Ilorin. The choice of this health institution was basically because of availability of reliable data. The climate variables namely minimum and maximum temperature, relative humidity, rainfall amount, wind speed and sunshine hours were collected from the Nigerian Meteorological Agency (NIMET) Ilorin Airport. These records were collected using world acclaimed equipments and standard procedures.

Both descriptive statistics (mean, variance and standard deviation) and inferential statistics (multiple regression, correlation analysis and principal component analysis) are employed for the analysis of this work.

Analysis and Discussions

Multivariate relationship between climate parameters and malaria fever

According to Table 1, some levels of relationship between climate variables and malaria fever are measured. Thus, four parameters of climate i.e maximum temperature ($r = 0.52$), ($r = 0.17$), minimum temperature ($r = 0.52$), sunshine ($r = 0.12$) and winds (0.34) have positive relationship with incidence of malaria. Suggesting that as these variables increase, incidence of malaria increases.

Two parameters, namely: winds (r = -0.51) and relative humidity (r = -0.25) are inversely correlated with malaria fever which means that as these variables increase, cases of malaria will decrease, that is the breeding capacity of mosquitoes that transmit malaria vectors will increase at low relative humidity and low rainfall giving rise to mosquito bites. The positive relationship of malaria with maximum temperature, sunshine, and winds speed is expected because these variables encourage the formation of rainfall during which incidences of malaria fever are common. Githeko et al (2006) findings in highland of Karamega support a close association between malaria transmission and monthly maximum temperature. Because this shows a strong relationship between climatic variables and cases of malaria fever.

Table 1: Intercorrelation between Climate Parameters and Malaria Fever

Malaria	Max T°	Min T°	Sun	Rain	Wind	Rel h	
1	.17	.52	.12	-.24	.34	-.09	Malaria
	1	.43	-.34	.23	.11	-.45	Max T°
		1	-.32	-.20	.05	-.30	Min T°
			1	-.40	.14	-.20	Sun
				1	-.64	.69	Rain
					1	-.43	Wind
						1	Rel. hum

Table 2: Multiple Regression between Malaria Fever and Climate Parameters

Model	R	R^2	Adjusted R^2	Std error
1	0.878	0.772	-0.599	3.549

Source: Author's Survey, 2011 .

Table 2 shows the results of multiple regression analysis on incidence of malaria in Ilorin. R is 0.878. R^2 is 0.772, and adjusted R^2 is -0.599 with standard error of 3.549. This implies that 77.2% of cases of malaria in Ilorin are due to climatic factors.

Causes of Malaria Fever in Ilorin

According to Table 3, three factors are responsible for malaria in Ilorin, and these three factors explain 78.3% of the variance. Component 1 is tagged wet index, it contributed 32.9% to the explanation in variance with three climatic variables (Rainfall, wind, and relative humidity), being highly loaded. Component 2 is highly loaded with maximum temperature and sunshine. These factors contribute 24.5% to the explanation in the variance and called heat index. Factor 3, is highly loaded only on minimum temperature. It contributes 20.8% of the variance to the incidence of malaria and tagged low heat index. Heat index has the highest loading of 32.9% of the three indices that responsible for malaria in Ilorin. This finding support Patz and colleagues studies in 1998 on the effects of soil moisture content to determine the effect of weather on malaria transmission in Kenya and eventually concluded that increase temperature and high relative humidity is a building ground for malaria transmission.

Table 3: Component Loadings, Eigen Value, Cumulative Variance on Malaria Explained by Climatic Factors

Variables	Components		
	1	2	3
Malaria	-.155	-.044	.932
Max T°	-.164	.882	.090
Min T°	-.115	.532	.699
Sun light	-.389	-.677	-.032
Rainfall	.874	.261	-.186
Winds	-.732	-.073	.231
Rel. Humidity	.888	-.347	.059
Total eigen value	**2.558**	**36.546**	**36.546**
% of Variance	**1.865**	**26.639**	**63.186**
% of Cumm. Variance	**1.054**	**15.060**	**78.245**

Source: Author's Survey, 2011.

The Multivariate Relationship between Climate Parameters due to Malaria Fever

Table 4 reflects the relationship between death rate on malaria fever and climate parameters in Ilorin during the years under study .The result shows maximum temperature -0.023, sunshine -0.336 and relative humidity -0.445 are inversely related to the malaria fever death rate, suggesting that as these variables are increasing, death rate on malaria fever will decrease. This means that death on malaria fever normally increase in an environment where heat is relatively low. In addition, minimum temperature 0.434, rainfall0.226 and winds 0.113 are positively related to death rate on malaria suggesting that as these variables increase, death rate will increase. In rainy season mosquitoes that transmit plasmodium through which people contact malaria fever are developed and this condition is much favoured with minimum temperature, rainfall and low wind speed. Paltz (2001) in his research work supports this finding that soil moisture content is a determinant factor on the effect of weather on malaria transmission and high soil moisture condition is a breeding site for malaria breeding vectors.

Table 4: Intercorrelation between Climate Parameters and Malaria Mortality

Malaria Death	Max T°	Min T°	Sun	Rain	Wind	Rel h	
1	-.02	.43	-.34	.23	.11	-.45	Malaria Death
	1	.32	-.20	.30	.05	-.28	Max
		1	-.36	-.20	.14	.51	Min
			1	-.74	-.64	-.20	Sun
				1	.06	.70	Rain
					1	-.43	Wind
						1	Rel. humidity

Source: Author's Survey, 2011.

Relationship between Malaria Mortality and Climate Indices

According to Table 5, the level of relationship between malaria mortality and climate parameters is reflected. R is 0.980, R^2 is 0.960, and adjusted R^2 is 0.722 with standard error of 1.403. This suggests that there is a positive relationship between malaria mortality a and climate parameters as explained by 98% level of association. The implication of this result is that the adverse effect of climate, when rainfall is excessive above the threshold will enhance vectors that transmit malaria in the environment. However, Kalkstein (1984) agreed with this finding while comparing winter mortality rates for 13 cities in USA that the Southern cities seemed to exhibit the greatest increase in mortality during cold weather, while little or no response was found in the northern cities with moderate weather.

Table 5: Multiple Regressions between Malaria Mortality and Climate Parameters

Model	R	R^2	Adjusted R^2	Std error
1	0.980	0.960	0.722	1.403

Source: Author's Survey, 2011

Causes of Malaria Mortality in Ilorin

According to Table 6, there are three main components in explanation of malaria mortality in Ilorin. In component 1, there are two factors that are highly loaded; these are rainfall 0.834 and relative humility 0.824. They contribute 38.6% to the explanation in the variance and therefore tagged the index of wetness. In component 2, the only climate factor that is highly loaded is winds -0740 and contributes 26.9% to the explanation in the variance. It is therefore tagged index of winds. Maximum temperature 0.862 and sunshine -0.752 are highly loaded in component 3 and contribute 14.7% to the explanation in the variance; hence index of heat is used to tag these variables.

During the rainy season, high soil moisture is a breeding ground for mosquitoes that transmit malaria vectors and in dry season when temperature ought to have been risen, some part of the tropics still experience cloud cover leading to low insulation on the surface, most especially in Ilorin when wind was statistic. Ilorin is surrounded with 2 major water sources, Agba dam and Asa dam, let alone surrounded stagnant waters during the period of rainy season (wet index). All these are directly altering the timing of pathogen development and time history. This assertion is supported by Harb (1993) and Thompson (1996) that an inverse in soil moisture associated with irrigation development in the southern Nile Delta, following the construction of Aswan high dam has caused a rapid rise in the mosquito culex pipens and consequential increase in the mosquito borne disease.

Table 5: Component Loading Eigen Values and Cumulative Variance of Malaria Mortality

Variables	Components 1	2	3
Casualties	.103	.932	.060
Max T^0	-.217	-.100	.862
Min T^0	-.605	.432	.513
Sun light	-256	-.128	-.752
Rainfall	.834	.295	.372
Winds	-.469	-.740	.009
Rel. Humidity	.824	.298	-.153
Total eigen value	2.703	1.888	1.034
% of Variance	38.6	26.9	14.7
% of Cumm. Variance	29.8	55.5	80.4

Source: Author's Survey, 2011.

Multivariate Relationship between Climate Parameters and Typhoid Fever

Table 7 displays the pattern of relationship between climate parameters and typhoid incidences. All these parameters have inverse relationships with typhoid fever with the exception of relative humidity (r = 0.61) and rainfall (r = 0.541). This implies that as all the other parameters with the exception of relative humidity and rainfall increase, typhoid incidences decrease. The positive relationship between relative humidity and rainfall is acceptable as it is an established fact that typhoid normally spread at the period of high moisture content in the environment. The work of Lisle and Rose (1995) also supports this assertion that heavy rainfall events can transport terrestrial microbiological agents into drinking-water sources resulting to the outbreaks of cholera, typhoid, amoebiasis and other infections.

Table 7: Intercorrelation between Climate Parameters and Typhoid Fever

Typhoid	Max T⁰	Min T⁰	Sun	Rain	Wind	Rel h	
1	-.47	-.65	-.16	.54	-.63	.61	Typhoid
	1	.43	-.34	.23	.11	-.45	Max T⁰
		1	-.32	-.20	.05	-.28	Min T⁰
			1	-.36	.14	-.20	Sun
				1	-.64	.70	Rain
					1	-.43	Wind
						1	Rel. hum.

Source: Author's Survey, 2011.

Relationship between Cases of Typhoid and Climate Parameters

Large numbers of people were affected of typhoid fever in which some people died. Table 8 shows the level of relationship between typhoid and climatic variables in Ilorin. R is 0.980, R^2 is 0.960, and adjusted R^2 is 0.717 with standard error of 0.407. This shows that there is a positive relationship between climate and cases of typhoid fever suggesting that environmental factors which are the products of climate have critical effects of 98% on the incidence of typhoid in Ilorin. Birmingham (1997) in his work supported this finding when he concluded that epidemiological evidence has pointed to a widespread environmental cause for recent outbreaks of cholera and typhoid rather than a point source contamination as seen in Peru in 1991 and East Africa in 1997/1998.

Table 8: Multiple Regressions between Typhoid Fever and Climate Parameters

Model	R	R^2	Adjusted R^2	Std error
1	0.983	0.960	0.717	0.341

Source: Author's Survey, 2011

Causes of Typhoid Fever in Ilorin

From the Table 9, two major components are very relevant to explain the causes of incidence of typhoid fever in the study area. These two components contribute 71.3% to reported cases of typhoid fever. In component 1, three important variables are highly loaded; these are rainfall 0.902, winds -0.775 and relative humidity 0-783. These variables are tagged index of wetness and contribute 44.5% to the explanation in the variance. In component 2, two variables that are highly loaded are maximum temperature 0.849 and minimum temperature 0.768. These variables are tagged index of heat contributing 26.8% to the explanation in variance. Hence, in explanation of causes of typhoid fever, wet index and heat index are the major contributor to the explanation in the variance. This means that climate variable is a function of typhoid fever in Ilorin which is supported by WHO (2002) that climate can increase directly the amount of pathogen in water by increasing the biotic reservoir of the infectious agent (cholera) or by decreasing the amount of water in a river or pond and thus raising the concentration of bacteria (tryphoid).

Table 9: Component Loadings Eigen Value, Cumulative Variance of Typhoid Fever Explained by Climate Factors

Variables	Components 1	2
Typhoid	.787	-.494
Max T^0	-.094	.849
Min T^0	-.259	.768
Sun light	-.455	-.627
Rainfall	.902	.186
Winds	-.775	.015
Rel. Humidity	.783	-.281
Total eigen value	**3.118**	**1.874**
% of Variance	**44.539**	**26.764**
% of Cum. Variance	**44.539**	**71.303**

Source: Author's Survey, 2011.

Multivariate Relationship between Climate Parameters and Mortality Due To Typhoid Fever

Table 10 reflects the degree of relationship between climate and death rate on typhoid fever in the study area. Minimum temperature (r = -0.047) and sunshine (r = -0.168) are inversely related to the rate of death on typhoid fever, suggesting that when these variables are decreasing in value, death rate on typhoid will increase. This is true in real sense because during the period of rainy season, cloud is formed and sun output is reduced with low temperature on the surface. Maximum temperature (r = 0.551), rainfall (r = 0.459), winds (r = 0.316) and relative humidity (r = 0.203) are proportionally related with the rate of death on typhoid fever suggesting that increase value of these variables will increase the death rate. This is as a result of many fruits that thrive well with these climatic variables in Ilorin in which large number of people live on. These fruits mighty have being affected with one disease or the others and once they are eating by man, the resulted case is typhoid fever in many places. All the same, stream water might have been contaminated by surface run-off and wells may be affected by winds deposits. All these contribute to the causes of typhoid in which many lives were claimed in Ilorin. High temperature brings about cloudiness; a process of rain formation, when excess water are dropped on the surface. Cowell (1996) agreed with this assertion that Copepod Zooplankton provides a marine reservoir for cholera pathogen and thereby facilitate its long term persistence and disseminated spread to human consumers via marine food-web. However, cholera and typhoid epidemics are associated with positive surface temperature anomalies in coastal and inland lake waters.

Table 10: Intercorrelation between Climate Parameters and Mortality on Typhoid Fever

Typhoid	Max T^0	Min T^0	Sun	Rain	Wind	Rel h	
1	.55	-.05	-.17	.46	.32	.20	Typhoid
	1	.43	-.34	.23	.11	-.45	Max
		1	-.32	-.20	.05	.28	Min
			1	-.36	.14	-.20	Sun
				1	-.64	.70	Rain
					1	-.43	Rel. humidity
						1	

Source: Author's Survey, 2011

Relationship between Mortality on Typhoid Fever and Climate Indices

Result of multiple regression on climate parameters and typhoid fever mortality in Ilorin shows R is 0.975, R^2 is 0.916, adjusted R^2 is 0.413 with standard error 0.178 respectively Table 11. This result suggests that there is a positive relationship between the climate and death rate on typhoid fever. About 98% level of association explains that death rate on typhoid fever in Ilorin is as a result of influence of climate.

Changes in these variables have significant effect on the incidence of typhoid, the adverse impacts of which resulted to death probably due to poor environmental planning in the study area. Burton (1993) explained that there is extensive evidence that an extreme climatic event will result in higher losses of life in a developing countries than in the developed countries because of limited coping ability and poor environmental planning.

Table 1: 1: Multiple Regressions between Mortality on Typhoid Fever and Climate Parameters

Model	R	R^2	Adjusted R^2	Std error
1	0.975	0.916	0.413	0.178

Source: Author's Survey, 2011

Causes of Mortality on Typhoid Fever

From Table 12, there are two major components that are closely connected to the explanation of mortality rate on typhoid fever in Ilorin. In components 1, there are three climate factors that are highly loaded; these include rainfall 0.903, winds. -0.782 and relative humidity 0.839. These contribute 33.8% to the explanation in the variance and then tagged index of wetness. Maximum temperature 0.70, minimum temperature 0.830 and sunshine 0.70 are highly loaded in component 2. They contribute 24.5% to the explanation in the variance and then tagged the index of heat. These two indices contribute 58.3% to the explanation of the causes of mortality on typhoid fever in the study area.

From the findings of Moore (1992), he agreed with this assertion when he concluded that some vector borne diseases e.g. malaria and dengue fever show significant seasonal pattern, whereby transmission is high in the month of heavy rainfall and humidity.

Table 12: Component Loadings, Eigen Value and Cumulative Variance of Death Rate on Typhoid Fever Explained by Climate Factors

	Components		
Variables	1	2	3
Typhoid	1.125	.021	.973
Max T^0	-0.141	.685	.606
Min T^0	-.218	.830	-.121
Sun light	-.393	-.653	-.148
Rainfall	.903	.080	.369
Winds	-.782	-.155	.422
Rel. Humidity	.839	-.318	.057
Total eigen value	**2.368**	**1.717**	**1.668**
% of Variance	**33.824**	**24.533**	**23.824**
% of Cumm. Variance	**33.824**	**58.357**	**82.181**

Source: Author's Survey, 2011.

Conclusions

This study work examined the responses of Typhoid and Malaria Fever to Climate change in Ilorin. The results indicate that climate change has significant effect on health behavior of people as there exist a perfect positive relationship between climatic variables and these diseases. . The study also shows that low temperature with high rainfall and relative humidity encourages the vectors that transmit malaria. However some climatic variables are responsible for incidence of certain diseases why others are less effective. Disorderliness in body system is as a result of increase or decrease in temperature due to changes in weather condition. Meanwhile the effects of climate change on human health are not all negative because favorable climatic conditions can help the human body in warding off diseases and promote recovery from illness.

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Towards Better Performance of Infrastructure Management in Developing Countries

By

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Abstract: *The developing countries have allocated on average one-third to over one- half of public investment to infrastructure sectors, yet many still lack adequate services like water and sanitation, electricity, roads, storm water drainage, telecommunication and wastes disposal. It is against this background that this paper attempts to discuss new management and financing approaches for better performance of infrastructure especially in the developing countries. Consequently, the paper discusses the role of infrastructure in development and identifies reasons for its poor performance. New management approaches which include application of commercial principles of operations, broadening of competition and users involvement are proposed. Similarly new financing options which include Public-Private partnership (PPP), self-help and the use of bonds are recommended for better performance of infrastructure in developing countries.*

Keywords: Infrastructure, Development, Public-Private Partnership, Urban Finance, Urban Management

Introduction: In virtually all the existing urban centers in developing countries the provision of basic infrastructure of water and sanitation, electricity, roads and stormwater drainage, telecommunication and safe disposal of wastes to communities do not meet the demands of their rapidly growing population (World bank, 1994, Kaigama, 1995). In realization of this fact, governments of developing countries are making effort in the provision of infrastructure both in urban and rural areas so as to enhance societal welfare and foster economic growth and development. For example, World Bank (1994) reports that developing countries invest $200 billion a year in new infrastructure, which is 4 percent of their national output and a fifth of their total investment. The result has been a dramatic increase in infrastructure services for transport, power, water sanitation, telecommunication and irrigation. Despite the strong emphasis, however, the full benefits of past investments are not being realized, resulting in wastage of scarce resources and loss of economic opportunities.

Similarly, McNeil (1993) reports that the developing countries have allocated on average one-third to over one-half of public investment to infrastructure sectors, yet many still Lack adequate services. This is because traffic clogs urban streets, water and sewerage facilities are non-existent or vastly overworked, and facilities fail to provide reliable sources of power. Also, the World Bank (1994) reports that one billion people in developing World still lack access to clean water and nearly two billion lack adequate sanitation and that in the rural areas especially, woman and children often spend long hours fetching water (Fawehinmi, 2003). It reports further that inadequate transport networks are deteriorating rapidly in many countries, white electric power has yet to reach two billion people and in may countries unreliable power constraints output. The report concluded that the demands for telecommunications to modernize production and enhance international competitiveness far outstrip existing capacity.

The condition of Nigeria infrastructure is generally poor. For example, World Bank (1996) reports that Nigeria's urban infrastructure is crumbling because water supply, sewerage, sanitation, drainage, roads, electricity, waste disposal all suffer from years of serious neglect. Similarly, a Federal Republic of Nigeria (1997) report that the rate at which community infrastructure and social services are provided in Nigeria doesnot commensurate with the pace of population growth and expansion. As a result, infrastructure problems now plaque all the urban centers in Nigeria and these included irregular water supply, unreliable energy supply, poor drainage, inefficient waste disposal system, grossly overstretched intra-city, inter- city and inter-state transportation systems. It was equally noted that in most Nigerian cities, urban infrastructure, are poorly provided and maintained. Consequently, the inadequacy and poor quality of urban infrastructural facilities and services undermined economic efficiency and compromise the competitiveness of Nigerian cities in the global economic arena (Federal Republic of Nigeria, 2012). It is against this background that this paper attempts to discuss new management and financing approaches for better performance of infrastructure especially in the developing countries.

Concept of Infrastructure

Fox (1994) defines infrastructure as those services derived from the set of public work traditionally supported by the public sector to enhance private sector production and to allow for household consumption. Ugwu (1993) identifies three typical characteristics of infrastructure. These include technical characteristic which is indivisibility and long Life span among other; economic characteristic that is external effects and economy of scale, high fixed capital and social costs, high risk investment; and institutional characteristic which include absence from market prices, central planning and allocation, control among others.

World Bank (1994) states the composition of economic infrastructure to include public utilities which consist of power, telecommunication, piped water supply, sanitation, and sewerage solid water, waste collection and disposal and piped gas; public works which consist of roads and major dam and canal works for irrigation and drainage; and other transport sectors which consist of urban and inter-urban railways, urban transport, ports and waterways and airports.

Obateru (2003) distinguishes between physical infrastructure comprising transportation facilities and public utilities and social infrastructure comprising social (community) facilities and services. Examples of public utilities include electricity, water and gas supply sewerage, storm water drainage and telephone service; white examples of social or community facilities include educational, health, recreational and cultural facilities. Examples of social services include police and fire protection.

Schubeler (1996) differentiates between urban infrastructure services and social infrastructure. Urban infrastructure refers to services traditionally provided by the public works, transport sectors and utilities. Examples of the above include roads, mass transportation, water supply, drainage and flood protection, sewage, solid waste collection and disposal, power distribution, Street lighting and telecommunication. The social Infrastructure on the other hand refers to health, educational, recreational and cultural facilities.

Impact of Infrastructure on Development

The impact of infrastructure on development of a community or a nation cannot be over emphasized. However, the precise linkages between infrastructure and development are still open to debate (World Bank, 1994). Firstly, infrastructure can deliver major benefits in economic growth. McNeil (1993) argues that adequate infrastructure reduces the cost of production, which affects profitability, levels of output, and employment, particularly in small-scale business and that when infrastructure "works" productivity and labour increase and when it does not work, economic renewal can be postponed or even halted. Similarly, World Bank (1994) reports that good infrastructure raises productivity and lowers production cost, but it has to expand fast enough to accommodate growth. However, it has been established that infrastructure capacity grows step by step with economic output that is a

1 percent increase in the stock of infrastructure is associated with 1 patent increase in gross domestic product (GDP) across all countries. (World Bank, 1994;Fawehinmi, 2003).

Secondly, apart from economic considerations, inadequate infrastructure affects the health and well-being of citizens (McNeil, 1993). With infrastructure in place and performing, there is a great chance of healthier citizens. The most obvious example is the provision of improved water supply. Several diseases are caused by the scarcity of drinking and bathing water especially water- borne diseases like typhoid fever, cholera, dysentery; water-washed diseases like scabies; and water related diseases such as schistosomiasis, guinea worm and so on (Fawehinmi 2003). Fawehinmi (2003), reports that improved water and sanitation in developing countries on average reduces diarrhoea by 22 percent, round worm by 28 percent, Guinea worm by 76 percent and schistosomiasis by 73 percent and that diarrhoea death rates were typically 60 percent lower among children with adequate sanitation water. World Bank (1994) reports that poor management of solid wastes complicate urban street drainage and has been linked with the proliferation of disease bearing mosquitoes in standing water.

Thirdly, provision of infrastructure, its sustenance and flow of services from it all have direct effect on the level of poverty of individuals in those communities (Fawehinmi 2003). Infrastructure, thus affects the dimensions of poverty and in the developing countries it has become a central poverty issue. Infrastructure has the power to determine the quality of life for residents, particularly in urban areas. (McNeil, 1993). This is because neighborhoods often arise around infrastructure services and they contribute to community's cohesion and livelihood. Mabogunje (1993), reports that urban planning was also transformed to take account of the need to extend infrastructural facilities and services to individual plots of land within the city. Consequently, the links between urban infrastructural provision, urban land management thus became an intricate and essential web in the development of modern city.

Performance of Infrastructure in Developing Countries

In developing countries, governments own, operate and finance nearly all infrastructure, primarily because its production characteristics and the public interest involved were thought to required monopoly and hence government provision. Consequently, the record of success and failure in infrastructure is largely a story of governments performance (World Bank, 1994).

McNeil (1993) reports that the static concept of infrastructure has failed to recognise that infrastructure is an ongoing process of delivering services. Consequently, funding of operation and maintenance, training and rewarding of staff to run the facilities, and institutional and policy reform often have not be given adequate attention in project design. Emphasis instead has been on resources to construct and expand physical assets white much time has not been devoted to thinking through infrastructure's long time up-keep, or even genuine demand for the services. Similarly, Schuttenbelt and Lorentzen (1994) argue that the traditional supply orientation to infrastructure policy has tended to over emphasize public sector provision and excessive political involvement in decisions about investment and pricing.

Wegelin (1996) reports that infrastructure investments too often have been made without adequate attention to cross-sectorial linkages. As a result many cities are burdened with capital projects that can no longer function at their designed capacity or allocated in wrong places. Consequently they often require so much funding that they displace other more useful projects. These developments, in turn, have resulted in haphazard investments in new assets, inadequate operation and maintenance, non-sustainability and unreliability of services, constraints to economic productivity and environmental degradation.

New Reform for Management and Financing of Infrastructure in Developing Countries

Schuttenbelt and Lorentzen, (1994) report that experiences of the past decades confirm that the solution to infrastructure problems is not merely to expand capacity by making new investments. The key reform is to deliver infrastructure services that users need and are willing and able to pay for infrastructure service delivery which should respond to providers whose demand, can be identified; services should then be provided in a sustainable way. This requires a level of management and financial resources often beyond the reach of Local Government in developing Countries. It is in realization of the above that World Bank (1994) advocates three measures to reform the provision of infrastructure services namely, the wider application of commercial principles to service providers, the broader use of competition and increased involvement of users where commercial and competitive behaviour is constrained.

Applying commercial principles of operation involves giving service providers focused and explicit performance objectives, well-defined budgets based on revenues from users, and managerial and financial autonomy; while holding them accountable for their performance. Consequently, this implies that governments should not only refrain from adhoc interventions in the management but should provide explicit transfers where needed, to meet social objectives such as public services obligations. In other words, private sector involvement in the management, financing or ownership will in most cases be needed to ensure a lasting commercial orientation of infrastructure.

Secondly, broadening competition means arranging for suppliers to compete for entire market (World Bank,: 1994). .Ezirim(2003), reports that a fundamental characteristics of competitive markets is that they provide incentives, and disincentives for effective institutional performance. Competition causes pressure thereby reducing discretionary behaviour in an organization. and imposing a discipline that leads to improved performance.

For these reasons, the simplest most effective way to achieve a demand orientation is to expand the realm of competitive markets. The larger the proportion of infrastructure services, that operated in reasonably competitive the better. Thirdly, involving users more in project design and operation of infrastructure activities where commercial and competitive behavior is constrained provides the information needed to make suppliers more accountable to their customers. Involvement of users and other Stakeholders can include consultation during project planning, direct participation in operation or maintenance and monitoring. It should be noted the people as consumers and producers of infrastructure services, and as citizen influence the flow and quality of infrastructure services available to them (Ezerim, 2003).

World Bank (1994) reports that numerous example of past failures in public provision, combined with growing evidence of more efficient and user- responsive private provision argue for a significant increase in private involvement in financing operation, and in many cases ownership. However, the rate at which to increases private involvement in the provision of infrastructure in any country will depend on the strength of the private sector, the administrative capacity of the government to regulate private suppliers, the performance of public sector. providers, and the political consensus for private provision. With this in mind, menu of four main options for ownership and provision, which must be tailored to fit country's need as set out by the World Bank (1994) are proposed bellow:

(i) Option A: Public ownership and Public Operation.

Public provision by a government department, public enterprise, or parastatal authority is most common form of infrastructure ownership and operation. Successful public entities run on commercial principle and give managers control over operations and freedom from political interference, but they also hold managers accountable, often through performance agreements or management contracts. This option follow sound business practices and is subject to the same regulatory, labour law, accounting, and compensation standards and practices as private firms. Tariffs are set to cover costs, and any subsidies to the enterprise are given for specific services and in fixed amounts. The success level of option A is usually [ow because of its vulnerability to changes in governmental support.

(ii) Option B: Public ownership with private operation

This option is typically implemented through lease contracts for full operation and maintenance of publicly owned infrastructure facilities, or through concessions, which include responsibility for construction and financing of new capacity. Arrangements between the owner (government) and the operator (firm) are set out in a contract that includes any regulatory provisions. The private operator typically assumes all commercial risk of operation and shares in investment risk under concessions. Concessions also include contract to build and operate new facilities under BOT arrangement and its variants.

(iii) Option C: Private ownership and private operation.

The use of this option is increasing both through new entry by private firms in infrastructure markets and through divestiture of public ownership of entire systems. Private ownership is straight forward when services can be provided competitively and in many infrastructure sectors, it is possible to identify such activities and allow private provision. Private firms are able to respond to local needs efficiently and flexibly, and market forces and competition encourage innovation and economy to ensure responsiveness to demand. This is largely because the private sectors survival depends on meeting the needs of consumer on a competitive basis. It should be noted that while it is becoming widely acceptable that the private sector can be effective in improving infrastructure productivity, it can be difficult for them to function well if a dear framework and a favourable business climate are not in place (World Bank, 1994; Ezirim, 2003).

(iv) Option D: Community and users provision.

This option is most common for local, small scale infrastructure such as rural feeder roads, community water supply and sanitation, distribution canals for irrigation; and maintenance of local drainage systems and it often compliments central or provincial services successful community provision requires users involvement in decision making, especially to set priorities for expenditures and to ensure an equitable and agreed sharing of the benefits and cost of service provision. Technical assistance, training, and compensation of service operators are also very important. When these elements are present, community self-help programmes can succeed ó\er long periods.

Implementing the above institutional options and mobilizing funds to expand and improve services required carefully designed financing strategies (World Bank, 1994), Consequently, foreign and domestic sources of finance will need to be tapped but are limited to the capacity of any economy to obtain funds from abroad especially debt finance. With the above in mind the following are proposed:

(I) Public Private partnership(PPP): Public Private Partnerships are based on involving different actors of stakeholders which include the public sector, the formal private sector, the informal private sectors and the community and its representatives in financing infrastructure (Schuttenbelt and Lorentzen, 1994). The most common type of partnership arrangement in developing countries is contracting out. However, with increasing greater responsibilities by the government, a broader range of partnership options should be considered, these include Build-Operate Transfer (BOT) and its variants. BOT is a partnership between public and private sectors whereby the private firm is authorized to build, operate an asset or service which will be transferred to the public sector after a period of time, The BOT variants include BOO (Build-Own-Operate) in which there is no transfer back to the public sector, BOOT (Build-Own-Operate Transfer) with special 1 for transfer and training, BROT (Build-Rent-Operate-Transfer) DBO (Develop Build Operate) and ROT (Refurbish

Operate- Transfer).

(ii) Self-help:Mobilizing labour and capital to construct small scale local infrastructure is one the most common technique for supplementing public resources with varying degree of organization and varying amount of state support (Ezirim, 2003). At the implementation stage, two distinct features will have to be considered, namely sharing of cost and furnishing of labour. Cost sharing is achieved by making those residents who will benefit bear the cost or to let them freely make donations according to their perceived interests. However, it should be noted that for projects aimed at improving essential facilities it should be by means of compulsory cost sharing while free donation method should be adopted for construction of non-essential infrastructure facilities. Sharing of labour is also achieved by a direct contribution of labour or costing the monetary equivalent of one share of Labour and then getting the money back in form of wages by personally participating in the work.

(iii) Bond:Municipal bonds can be issued to the public as way of financing infrastructure project. Bond is Long-term debt instrument where by holders are creditors. The private sector enterprises for infrastructure development if well positioned can adopt this arrangement of infrastructure financing. This method of financing is suitable for large projects such as road construction and urban water supply. The contract agreement is usually tailored to the needs of the sponsors of the project as well as the needs of potential suppliers of capital (or creditors) who may even be the beneficiaries of the project. It should be noted that to ensure sustainable delivery of infrastructure services, provision should be made in the contract debt to exert some influence upon the direction of the company in respect of the project.

Conclusion

The developing countries have allocated on average one third to over one-half of public investment to infrastructure sectors. Yet many still lack adequate services like water and sanitation, electricity, roads, storm water drainage, telecommunication and wastes disposal (McNeil, 1993, World Bank, 1991). This paper has attempted a discussion of approaches for better performance of infrastructure in developing countries. New management approaches which include application of commercial principles of operation, broadening of competition and users' involvement are proposed, while new financing options which include Public-Private Partnership, self-help and the use of bond are recommended. It is hoped that the approaches discussed in this paper will be more efficient, more user- responsive, more environment friendly, and more resourceful in using both the public and private sectors for better infrastructure performance in the developing countries.

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