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Socio - Economic Implications Of Climate Seasonality: A Comparative Assessment Of Road Transport Inequalities Between Rural And Urban Areas

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Abstract: Road transport is the oldest, most affordable and commonly used means of movement. The socioeconomic development of nations depends on it. In spite its benefits, it is still characterized with several setbacks in the developing countries. Though climatic forces are causative factors in this inadequacy but human negligence is also responsible. This study compared the impacts of climate seasonality and road transport inequalities on the socio-economic indices between the rural and urban areas vis-à-vis north and southern parts of West-Africa. 1,440 individual respondents were surveyed across six English-speaking countries of West Africa. The results revealed that significant differences exited on the roads conditions, transport costs-services and socioeconomic activities between the rural and urban areas as well as north and south due to climatic variations and government developmental inequalities. The study is an `eye-opener' for the government in each country to give more attention to rural roads development. The recommendations of this research will support the improvement of rural livelihood and reduce rural-urban drift challenges; hence promote the economic consolidation and diversification of the region. Subsequent studies on effects of climatic variations and poor roads on the intra-inter economic relations of the region is recommended.

Key words: Socio-economics, Road transport, climate seasonality, rural-urban drift, ECOWAS.

Introduction:

The development of motorised transportation has remarkably improved the living standard of the people over the past years. Road transport plays a critical role in today's world economy. According to Georgina Santos [1] the road share of passenger-kilometers was 89 per cent for the US and 85 per cent for the EU-25 in 2004 [2]. At present over 500 million motor vehicles are in use worldwide [3]. The benefits of improved personal mobility and easier accessibility to essential resources, goods and services even outside the reach of individuals have influenced every one's livelihood [4]. Today transportation especially road transportation is involved in every good and service produced in the economy [5]. Different factors such as geography, economic and socio-cultural to large extent affect the choice and degree of utilization of any form of transportation. Climate and weather are among the determining geographical factors when assessing movement of people and services. Climate conditions which consist of the atmospheric conditions that characterize a region primarily influence structural decisions since long-term cases are involved, while weather being short-term is associated with decisions of a situational or operational scenario [6]. Scientific statistics have revealed that the assessment of climate characteristics facilitates structural decision making for transportation management from a micro and macroeconomic perception [7],[8]. This study employed the use of questionnaires in examining the opinion of the people regarding the impacts of climate in their mobility. It followed the previous work of scientist in this field which used questionnaire in finding the characterization of traveller behaviour [9] and the influence of meteorological conditions on the choice of transportation mode [10],[11]. In the case of majority of people in the developing countries, the choice of transportation mode is strictly limited to the road transport mainly because of socio-economic reasons. Despite the need for road transport, it became worrisome and questionable that countries of the developing world are characterized by inadequate and poorly maintained road transport infrastructure [12]. Most of the roads in West Africa are highly dilapidated. In comparison with the urban centres, 95% of the roads in the rural areas of West Africa including Nigeria have become 'users death-traps' due to shortage of infrastructural facilities and zeal to maintain them by the government [13]. Although rainfall and heavy tropical storms devastate these feeder roads, poor response to repairs and delays in rehabilitation by the ministry of works aggravated the menace. In addition to high costs of vehicle operation and transport fare charges, there has been increase in the prices of agricultural-food items. These to large extent crippled the socioeconomic activities in this area [14]. The road transportation system is typically considered to involve three key interrelated components namely, the movement route, the vehicles and the terminal facilities. The need to strengthen the transport system in any part of the world cannot be reached without consolidating the transportation services [15]. Rural transport operations depend mainly on the commercial services supplied by either the government, NGOs or privately owned vehicles. Meanwhile, the efficiency of any transportation system can only be sustained by the existence of the appropriate infrastructures, transport services, maintenance and integrated traffic management

[16]. The challenges of poor conditions of roads in developing countries of West Africa in particular were enormous. The developing countries have rapid population increase, thus require more and improved infrastructures. On the contrary, road networks are not only bad but limited. This has led to: reduced ability to use or access high quality inputs; limited use of rural markets for farm-products exchange. Inequalities and unevenly distribution of the nation's resources have led to impoverished state of the essential amenities such as roads in most developing countries. Consequently, there has been mobility impediment, low access to other basic needs including trading and enterprising, farming and feeding, housing and medical [17]. Contrary to the situation in Africa and other developing countries, the government of the developed countries have continued to intensify action towards construction of more roads while the older ones are regularly repaired across the urban and rural areas [18]. In fact, hardly is there any existing boundary between infrastructural development between the rural and urban in the developed countries. Past Studies have revealed that in developing countries, non-uniformity in infrastructural developments across the rural and urban areas is one of the syndrome against the achievement of sustainable development [19].

Materials and Methods:

Study Area

West Africa is located in the western part of African continent with a landmass and population of about 5,112,903km^2 and 340,000,000 people respectively. The entire West Africa is associated with Economic Community of West African States (ECOWAS) excluding the Mauritania nation. The west and southwards of the area there lies the South Atlantic Ocean. The northwards of the region are the Sahara Desert. Eastwards of the region has inexact margin with the Benue Trough and a limit from Mount Cameroon to Lake Chad. The West African area's regal limits reveal the margins of Western Africa transverse by the cultural and civilizing. Many nations of West Africa share the ethnicities. West Africa covers about one fifth region of Africa. The larger part of the region is flat terrain which dominates the coastal areas. The north of West Africa is steppe identified as Sahel, an intermediary region linking the Sahara and the savannahs of the western Sudan forests. This research included all the English-speaking West African countries including Cameroon (Figure 1). The countries, their landmass and demography were Gambia (10500km^2, 1700000 persons); Liberia (110000km^2, 4707016 persons); Sierra-Leone (71740km^2, 6190280 persons); Ghana (238533km^2, 250009153 persons); Nigeria (923768km^2, 182202000 persons) and Cameroon (475442km^2, 22534532 persons). [20], [21]. Geographically, these countries do not only have same climatic seasons but almost similar biological, political and socio-economic characteristics. These features among other factors ignited the motivation of conducting a comparative-integrated study of them.

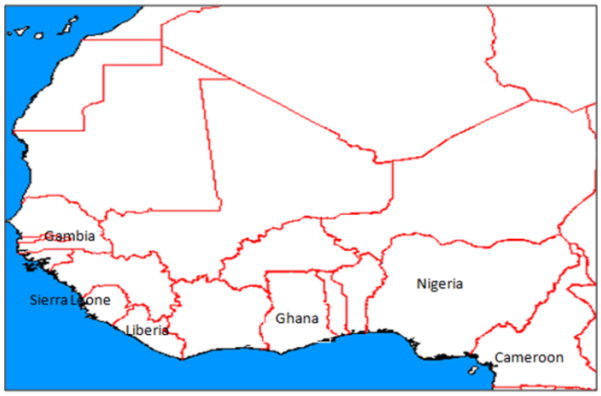

Figure 1: Study area-English speaking West Africa countries and Cameroon

Data Collection and Analyses:

A stratified-random sampling was employed. The data were collected from each country based on classified political regions or zones/constituencies or provinces. A total of 1440 respondents were interviewed with 240 from each of the countries. The participants cut across the geographical locations (north or south) and settlement types (rural or urban). Assessment criteria which focused on road transport facilities and services in respect to wet and dry season were formulated after thorough evaluation and unanimous agreement with all the co-research representatives of each country. These assessment criteria were rated between 1-5 (1= Excellent; 2 = Very Good or Very Satisfactory; 3 = Good or Satisfactory; 4 = Poor or Unsatisfactory; 5 = Very Poor or Very Unsatisfactory). This was introduced as to enhance the quantification of the respondents' views. In addition, several questionnaires used for the oral interview were employed to support the assessment criteria in achieving valid answers to the hypotheses. The respondents were selected among people who were at least 18 years old irrespective of gender. They included the civil servants, the traders, students and the general public. One or two research collaborators were involved in each country depending on the country's size. They helped in collecting the data from their respective countries as well as assisting interviewees who were illiterate in English by serving as local language translators. This approach however facilitated the entire process of data acquisition and was cost effective. To ascertain the reliability and validity of the data, effort was made to collaborate with only academically scientific researchers who have had previous knowledge in this field. The research was more effective and successful since the respondents especially in the rural areas were familiar with their interviewers. This was a two-year (2013-2014) project which covered four climatic seasons. The data were collated and analyzed using quantitative statistical methods (percentages, mean, standard deviation/variance) and qualitative techniques (such as Spearman's correlation and t-tests). The former methods were employed to measure the results from the oral interview while, the later were applied to measure the reports from the assessment criteria.

The hypotheses to be tested included:

Hypothesis I: No relationships or association existed between the countries regarding the impacts of climate seasonality on their roads, transport system and socioeconomic activities;

Hypothesis II: No significant differences or inequalities on roads and transport facilities/services between the rural and urban areas of the north and south of the countries during the dry and wet seasons.

Hypothesis III: Impacts of climate seasons on the socioeconomic activities DO NOT differ between the settlement types (rural/urban areas) in the north or southern part of the countries.

Results and Discussion:

The results analyses of this study were grouped into two sections namely, qualitative (table 1-4) and quantitative (table 5-7).

Table 1 : *Roads in your place are constructed, maintained and repaired regularly*

RESPONSES	RURAL AREAS		URBAN AREAS	
	North	South	North	South
Yes	192 (53%)	6 (2%)	336 (93%)	240 (67%)
No	168 (47%)	354 (98%)	24 (7%)	120 (33%)
Total	360 (100%)	360 (100%)	360 (100%)	360 (100%)

300 (8%)
60 (17%)
0
0
360 (100%)

Table 2: State of roads in your area during dry and wet season

	DRYSEASON				WETSEASON			
RATING	RURALAREAS		URBANAREAS		RURALAREAS		URBAN AREAS	
	North	South	North	South	North	South	North	South
Very Poor	12 (3%)	90 (25%)	0	54 (15%)	264 (73%)	348 (97%)	228 (63%)	300 (8%)
Good	126 (35%)	246 (68%)	66 (18%)	198 (55%)	90 (25%)	12 (3%)	132 (37%)	60 (17%)
Very good	204 (57%)	24 (7%)	222 (62%)	108 (30%)	6 (2%)	0	0	0
Excellent	18 (5%)	0	72 (20%)	0	0	0	0	0
Total	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360(100%)	360(100%)

South
312 (87%)
48 (13%)
360(100%)

Table 3: *High expenses in transportation costs (for paying commercial drivers or maintaining your vehicles as a commercial driver)*

	DRYSEASON				WETSEASON			
RATING	RURALAREAS		URBANAREAS		RURALAREAS		URBAN AREAS	
	North	South	North	South	North	South	North	South
Yes	18 (5%)	126 (35%)	6 (2%)	30 (8%)	270 (75%)	360 (100%)	240 (67%)	312 (87%)
No	342 (95%)	234 (65%)	354 (98%)	330 (92%)	90 (25%)	0	120 (33%)	48 (13%)
Total	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360 (100%)	360(100%)	360(100%)

Table 4*: Impacts of wet season (rainfall or heavy storms) on roads, transportation facilities/services and socioeconomic activities*

	RURAL AREAS		URBAN AREAS	
IMPACTS LEVEL	North	South	North	South
Strong negative	228 (63%)	318 (88%)	144 (40%)	282 (78%)
Negative Impacts	132 (37%)	42 (12%)	204 (57%)	78 (22%)
No Impacts	0	0	12 (3%)	0
positive impacts	0	0	0	0
Strong positive	0	0	0	0
Total	360 (100%)	360 (100%)	360 (100%)	360 (100%)

Roads Infrastructures and Management

Regarding the question on the frequency of roads construction, maintenance and repair (say 5-10 years interval), 98% of the sample population from the rural areas of the south said 'NO' while, 53% affirmed 'YES' in the rural areas of the north. In the urban centres, 67% and 93% respectively agreed in the south and north that their roads were regularly maintained between 5-10 years intervals (Table 1). Therefore, it could be concluded that the roads in the rural areas were in worst conditions compared to those in the urban. This confirmed documentation of [22], which stated that the urban people enjoy better motorable roads than the rural people. The rural roads where baskets of farm products are brought pathetically suffer great dilapidation than the city roads [23]. The irony of infrastructural development and distribution between the rural and urban areas is difficult to explain in the developing countries. A huge inequalities exist in the accessibility of basic amenities between the local people and those in the municipals. Sustainable development will be far achieved except the government changed their attitude towards development in the local councils where the majority live [24].

Climatic Seasonality and Road Status

The examination of the conditions of the roads in dry and wet seasons with respect to the socioeconomic implications between the north and south as well as rural and urban have been revealed. In the dry season, 92% acknowledged that the road conditions were either good or very good in the rural areas of the northern parts of the countries while, the south recorded 75%. On the other hand, in the urban centres, the north and south reported that four-fifth percent and 85% of the respondents agreed that in the dry season their roads were either good/very good respectively. In addition, one-fifth percent of the sampled population revealed that the urban centres have excellent roads during the dry seasons in the northern parts of the countries; though such was not obtainable in the southern parts. The wet seasons were discovered to have unfavorable roads conditions. For instance, in the southern parts, 97% and 83% of the people described the roads as very poor in the rural and urban areas. In the northern parts of the countries, 73% and 63% gave the same 'very poor' description of roads in their place. It could be concluded that the conditions of the roads became severely worst during the wet seasons than the dry seasons (Figure 2). In both the north and south, rural and urban areas, the rainy season was perceived to be unfavorable to the roads (Table 2). The majority of the rural roads in Nigeria and other West African countries have been described as being unpaved, narrow, circuitously aligned and with narrow bridges, full of pot holes and impassable during the raining seasons [25].

Figure 2: *Road Transportation Facilities. A= a typical example of the state of road during the wet season especially in the rural areas of the studied countries. B= an example of Road similar to most urban centres in the study countries. (Field survey, 2014).*

Climate Variability and Socioeconomic implications

The perceptions of the people were examined to know if variations in climate led to disparities in their transportation expenses and other socioeconomic activities. It was revealed that in the rural areas of the north and south, 75% and 100% respectively affirmed that transportation expenditures were significantly high in the wet seasons and relatively low in the dry seasons. Similar reports were recorded in the urban centres with 67% and 87% of the people who agreed that they spent higher amount on road transportation during the wet seasons than the dry seasons (Table 3). In summary, the effects of rainfall on the roads, transportation system and socioeconomics were compounded in the rural areas. All of the respondents confirmed that heavy rainfall has negative impacts on the roads. In the same vein, 95% in the cities also revealed that the impacts of rain were either strongly negative or negative to the transportation infrastructures and socioeconomic activities (Table 4). Studies have been documented on the devastating impacts of rain, bad road networks on the socioeconomic activities of the people [26]. The poor road statuses have directly or indirectly put constraints on the exploitation of other essential facilities such as education, health, recreation and tourisms [27].

Table 5: *Correlation matrix of the road status, transportation and socio-economic impacts*

RURAL AREAS

	Gambia	Liberia	Sierra Leone	Ghana	Nigeria	Cameroon
Gambia	1.0000					
Liberia	0.5965	1.0000				
Sierra Leone	0.5956	0.8695	1.0000			
Ghana	0.4042	0.7173	0.8012	1.0000		
Nigeria	0.5378	0.7909	0.8449	0.8628	1.0000	
Cameroon	0.4827	0.8387	0.8437	0.8335	0.8656	1.0000

URBAN CENTRES

	Gambia	Liberia	Sierra Leone	Ghana	Nigeria	Cameroon
Gambia	1.0000					
Liberia	0.8915	1.0000				
Sierra Leone	0.8657	0.9132	1.0000			
Ghana	0.7994	0.8431	0.8448	1.0000		
Nigeria	0.6872	0.7286	0.7850	0.7450	1.0000	
Cameroon	0.8042	0.8697	0.8243	0.9135	0.8263	1.0000

Similarities and differences among the countries

In the rural areas the survey revealed that Cameroon roads conditions, transport and other socioeconomic impacts of climate were strongly related to those of Nigeria (0.8656), Sierra-Leone (0.8437), Liberia (0.8387), and Ghana (0.8335), but weak relationship with Gambia (0.4827). Similarly, in exemption of Gambia (0.5378), Nigeria has a positively high correlation with other countries. For instance, Ghana (0.8628), Sierra Leone (0.8449), and Liberia (0.7909). Sierra Leone and Liberia showed a high relationship of 0.8695. On the other hand, Gambia depicted relatively weak association with all the other countries (Table 5). Contrary to the report from the rural areas of the countries studied, in the urban centres Gambia proved to

have experienced same socioeconomic and roads infrastructural developmental impacts as obtainable in other countries. For example, Gambia's correlation R was 0.8915, 0.8657, 0.7994, 0.6872 and 0.8042 with Liberia, Sierra-Leone, Ghana, Nigeria and Cameroon respectively. Remarkably, Cameroon and Ghana (R=0.9135), and Liberia and Sierra-Leone (R = 0.9132) accounted for the highest in the records (Table 5). Conclusively, the urban areas of all the countries revealed relatively same impacts of climate/weather on their roads, transport facilities and socioeconomic activities. This scenario has been reported in literature that most government of in the developing countries concentrated their development and social amenities provision in the urban metropolis whereas the sub-urbans are ignored (Maibach et al., 2000a).

Variations in regions, locations and settlement types:

The reports from each country were tested to measure the existing differences between their rural and urban areas in either south or northern parts. The results were used to support the test of the hypotheses of this study. It was revealed that at the one-tail and two-tail tests, the Pvalues were less than both 0.05 and 0.01 significance level for the rural south, rural north, urban south and urban north (Table 6). Therefore, the null hypothesis was rejected. However, the relationships recorded between the countries (Table 5) do not rule-out that differences existed between the rural and urban areas on the influence of dry and/or wet seasons on the roads and transport facilities. Furthermore, the effect of climate change or seasonality on the transport costs/ services and socioeconomic activities were evaluated. The results showed that at both one-tail and two-tail tests the P-values were less than either 0.05 or 0.01 for all the regions and settlement types (Rural south, Rural north, urban south and urban north) studied. This therefore revealed that significant differences existed on the roads conditions, transport costs and socioeconomic activities of the people due to climatic variations (Table 7).

Table 6: *Test of relationship, difference and inequalities in the road transportation facilities between dry and wet seasons Among the rural and urban areas in the south and north.*

	A: Rural-South		B: Rural-North		C: Urban-South		D: Urban-North	
	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
Pearson Correlation	0.1677[a]		-0.3123[b]		0.8066[c]		0.7720[d]	
t Stat	-9.9913		-13.8671		-32.0198		-23.3073	
Pvalue(one-tail)	0.001*		0.003*		0.004*		0.0002*	
Pvalue(two-tail)	0.0007*		0.001*		0.0025*		0.001*	

a= corr.coeff (R) between the roads status and transportation facilities as mediated by climatic seasons in the Rural areas of the South
b= corr.coeff (R) between the roads status and transportation facilities as mediated by climatic seasons in the Rural areas of the North
c= corr.coeff (R) between the roads status and transportation facilities as mediated by climatic seasons in the Urban areas of the South
d= corr.coeff (R) between the roads status and transportation facilities as mediated by climatic seasons in the Urban areas of the North
**Significant at 0.01 and 0.05 probability level; N=1,440*

Table 7: *Influence of climate seasonality on Roads conditions, Transportation costs/services and Socio-economic indices/activities*

	A: Rural South		B: Rural North		C: Urban South		D: Urban North	
	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season	Dry Season	Wet Season
Pearson Correlation	0.0132[a]		0.7340[b]		0.9647[c]		0.7809[d]	
t Stat	-16.2180		-34.8908		-29.1293		0.9854	
Pvalue(one-tail)	0.003*		0.001*		0.002*		0.003*	
Pvalue(two-tail)	0.001*		0.004*		0.004*		0.002*	

[a] (R) between climate seasonality effects on Roads, Transportation costs/services and Socio-economic activities in the Rural areas of the South
[b] (R) between climate seasonality effects on Roads, Transportation costs/services and Socio-economic activities in the Rural areas of the North
[c] (R) between climate seasonality effects on Roads, Transportation costs/services and Socio-economic activities in the Urban centres of the South
[d] (R) between climate seasonality effects on Roads, Transportation costs/services and Socio-economic activities in the Urban centres of the North
*Significant at 0.01 and 0.05 probability level; N=1,440

Conclusion and Recommendation:

Road transport has become an essential part of present day developed and developing societies. The roads in the rural parts of either the north or south of the countries were discovered to be in bad state. Generally, road network connectivity and level of road accessibility were discovered to be very poor in the area. Furthermore, transportation services were relatively unimproved and inadequate in rural areas of West Africa compared to the cities. The socioeconomic activities and the road transport services in the countries were negatively affected especially during wet seasons. The rural areas where majority live and where

most agricultural products were cultivated need good roads as one of the basic facility like their urban counterparts. If the rate of rural-urban migration in the developing countries has to be minimized, it is expedient that development be extended to the people in the local areas. Negligence in the development of rural roads on the part of respective governments militated against the achievement of sustainable development in the countries. Though meteorological factors contributed to the poor condition of roads in the less economic developed countries of the tropics yet, swift and regular maintenance culture on the part of the agencies concerned needed to be introduced to ameliorate these effects. More efforts should be put by the government to ensure that the basic infrastructures are equitably distributed across all the parts-rural or urban. Furthermore, it is pertinent to introduce interventions that will improve the provision of rural transport services. This can be achieved through the grant of credit and extension of the current government relieve measures in the transport sector to rural transport service operators. More programs should also be constituted for training and improving the skill levels of local artisans and technicians to accelerate respond to the needs of the rural transport sector. Thus, ensure adequate back-up services and supply of simple vehicle parts at reduced cost [17].

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