

## Implication of Transport Development Models on Agricultural Development in Nigeria: An Empirical Review

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### ABSTRACT

Among the highlights of the Sustainable Development Goals (SDGs), the main focus is the eradication of extreme poverty and hunger in the world. This cannot be achieved without placing a high priority on agricultural development which is catalyzed by rural transport development. Nigeria has a huge prospective for agriculture and agribusiness as the sector produces about half of the GDP. Nevertheless, the perspective of agriculture may not have been fully tapped in Nigeria. Nigeria can feed itself should in case proper agricultural inputs and drives such as rural road transport are put in place. This study aimed at stressing the implication of transport development models on agricultural development with an emphasis on rural transport. Poverty and hunger are critical issues that needed urgent attention. This can easily be identified due to the sorry state of rural transportation networks, low agricultural productivity, and increasing the price of agricultural products. The poor condition of the transport network results in reduced low agricultural outputs and increasing the price of agricultural outputs. With the increasing population growth and the level of urbanization, there is a need to activate giant indices that will catalyze agricultural outputs. Among the relevant models that support the significance of transport development on agricultural transformation are spatial interaction model, the theory of regionalization, and transport phase theory. It is therefore concluded that the revitalization of rural transportation is vital to enhance agricultural output.

**Keywords:** Transport; Development; Transport Model; Agriculture; Agricultural Inputs; Agricultural Outputs

### INTRODUCTION

#### Background to the Study

The central focus of the Sustainable Development Goals (SDGs) is embedded in the supreme goals of eradicating poverty and hunger in the world. A country cannot survive without banishing hunger and minimizing poverty, hence this revealed the high significance attached to agriculture. It should be noted that without agriculture, there cannot be raw materials and without raw materials, there cannot be produced. The role of transport is very crucial most especially in the agriculture and production process as the two cannot be completed unless agricultural products and finished products get to the final consumers.

Generally, various studies have confirmed that transport infrastructure is essential for improving the quality of human life and also a

catalyst that enhances agricultural development. Although transport infrastructure projects involve huge capital investments, high incremental capital-output, high risk, and low rate of returns on investments, it also has a positive and strong nexus with agricultural development by enhancing access to the farmer, investment and markets, and increasing crop yields, thereby improving agricultural growth. Transport infrastructure has the prospect to convert subsistence farming into a commercial and dynamic farming system. The importance of transportation in agriculture cannot be far-fetched from or beyond economic purpose, spatial interaction, and social integration involving farmers, agricultural products, and livelihood of rural areas through rural-urban interaction.

Unlocking the potentials embedded in rural transport infrastructure permits farmers to obtain

farm inputs and information at a reasonable cost and to sell their farm outputs in urban areas at reasonable prices which cover their overall cost with profit-making. High quality and well-managed transportation systems in rural areas ensure smooth flow of agricultural goods and services which to some extent alleviates the adverse effects of spatial and social inequity. The major transport mode for moving agricultural goods and services within rural areas is road transportation, it offers door-to-door transport service through which agricultural produce gets to the final consumers, and also links all other modes of transport. This study focused on investing in road transport infrastructures in rural areas as it enhances the realized movement of raw materials from rural areas (where most farms are located) to urban areas where raw materials are processed and marketed at a higher value, and vice-versa.

The impact of developing rural transport infrastructure for the overall agricultural activities of the nation is measured on the level of improved, effective, efficient (time factor), accessible, affordable, reliable, safe, and integrated rural transport system that was delivered to enhancing or facilitating agricultural development. All these functions make transportation a derived demand as it is demanded the purpose of agriculture, and it is responsive to forces generating production and consumption of agricultural produce.

### Problem Statement

In an ideal situation, the development of transport infrastructure is an indispensable inducement for improving agricultural productivity in rural areas. Nigeria is principally an agrarian country such that most of the goods transported are agricultural related. Oladosu, Kolawole, and Mensah (2018) noted that most of the goods are often bulky, low-priced, and highly perishable. Most of the agricultural goods are usually transported from rural areas that are faced with an unstructured road network. In the study of Ogunsanya (1981), the three types of routes identified in the rural areas are; bush paths, un-surfaced rural roads, and surfaced rural roads.

The most dominant among all is the bush path and the least developed. It is a path that connects villages with farmlands and they are characterized with narrow, windy, and occasionally outgrown by weeds during the rainy season. Filani (1993) also observed that

where motorable roads exist in the rural areas, they are predominantly narrow width, unpaved surface, windy and low quality. This usually results in increased transport charges, reduced vehicle availability, increased travel time, high costs of sales of agricultural outputs, and reduced agricultural productivity, among all.

Oladosu, Kolawole, and Mensah (2018) observed that the meagreness of rural transport infrastructure is a fundamental reason for stumpy agricultural productivity and the increased level of rurality. The available transport option and its network will have a significant effect on the spatial pattern of agriculture practice. Most of the subsistence farmers may not be able to sell agric surpluses because of the poor transport system. According to World Bank (1997), it was estimated that 15 percent of the agricultural output has vanished during the transfer process from the farm to the consumer; this is due to the poor road network and unstructured storage facilities alone.

It is crucial to note that the position of rural dwellers in any nation cannot be substituted because of their huge involvement in agriculture. In fact, according to the Nigerian Bureau of Statistics (NBS), agriculture contributed around 20.63 percent, 20.98 percent, 25.08 percent, and 25.13 percent to Nigeria's GDP in 2015, 2016, 2017, and 2018 respectively. Despite this significant role in the nations' economic development, the development of rural areas was neglected. This neglect has made life difficult for rural dwellers, and unattractive to reside in by people interested in practicing agriculture. Also, rural area is known to be impoverished area because of huge neglect which has increased poverty level. Most rural areas in Nigeria fall into this category. They are faced with multifarious challenges of basic social amenities like good roads with road fittings and furniture, electricity, water, internet access, telecommunication, among others. It is also saddening to note that some rural dwellers live as if they are in the primitive era while the elites mostly political gladiators keep squandering the wealth of this nation living in affluence and keeping wealth for their unborn generations. Indeed, this cheating is not only applicable to Nigeria but other developing countries in Africa.

The enormous increase in oil revenue as a consequence of the Middle-East war of 1973 created unprecedented, astonishing and

unplanned wealth for Nigeria, and then began the swift policy shift from a common approach to benchmarking them in respect to the position of the oil sector. Furthermore, when creating an enabling environment for businesses and new investments, Oladapo and Faboya (2012) noted that the government invested the newfound wealth in socio-economic infrastructures across the country, especially in the urban areas, while most rural areas were abandoned. As the services sector grew, the relative attractiveness of the urban center's made many active and vigorous Nigerians migrate away from the hinterland, thereby abandoning their farmlands for the cities so that they can partake in the wealth of urban economy (Adeniran and Ben, 2018). This created social problems of congestion, pollution, unemployment, and crimes which when elongated; resulted in a technical recession that was announced in the year 2016.

The immediate past economic recession that the country experienced was an eye-opener to the fact that agriculture seems to have been abandoned, and that there is limited investment in rural transport infrastructure. These might have reduced the mobility of people and goods in the rural areas, and reduced the rural-urban complementarity. Limitation in rural mobility is a major hindrance to agricultural development, meanwhile, poverty is inevitable, which is in line with the axiom of Wilfred Owen, who is a prominent transport analyst states that *"Immobility Perpetuate Poverty"*. This study buttressed the fact that immobility and lack of commitment to agricultural development perpetuate poverty as evidenced in Nigeria during the recession. Hence, there is a need for rapid and significant investment in rural transport infrastructure and agricultural development, as the development of one resulted in the development of the other.

The status of transport infrastructure in most developing countries including Nigeria is far from sufficient and much poorer than in developed countries. The problem of poor transport infrastructure is particularly severe in the least developed countries. For example, while 73 percent of the road transport infrastructures were paved in OECD countries in the year 1990, only 16 percent were paved in the least developed countries. Worse still, the percentage of paved roads decreased to 13 percent in the least developed countries during the 1990s and increased to 88 percent in OECD

countries (World Bank 2005). A comparison between the road density in Africa in the early 1990s and the road density in India in 1950 provides a powerful illustration of the infrastructure problem facing Africa. Many of the African countries are landlocked and the very limited rail system reflects colonial times priorities to link mines to harbors.

Road density according to the Data Catalogue of World Bank (2013) is the ratio of the length of the country's total road network to the country's land area. It includes all roads in the country such as motorways, highways, national roads, regional roads, urban roads, and rural roads. It can be simply put as km of road per 100sq.km of land area. In the Benin Republic, 36km<sup>2</sup> was constructed as in 1990, while 291km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Cameroon, 38km<sup>2</sup> was constructed as in 1990, while 168 km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Côte d'Ivoire, 94km<sup>2</sup> was constructed as in 1990, while 258km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Ghana, 17km<sup>2</sup> was constructed as in 1990, while 429km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Mozambique, 17km<sup>2</sup> was constructed as in 1990, while 135km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Nigeria, 97 km<sup>2</sup> was constructed as of 1990, while 718km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Sierra Leone, 80km<sup>2</sup> was constructed as in 1990, while 391km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Tanzania, 66km<sup>2</sup> was constructed as in 1990, while 181km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Zambia, 36km<sup>2</sup> was constructed as in 1990, while 110km<sup>2</sup> are needed to be constructed before it can match that of India in 1950. In Madagascar, 67km<sup>2</sup> was constructed as in 1990, while 137km<sup>2</sup> are needed to be constructed before it can match that of India in 1950 (World Bank, 2003). From the illustration, it can be seen that the road densities in most African countries as of the 1990s do not match that of India in the 1950s. Hence, the need for urgent actions because of increased population and the aftermath of rising mobility.

Recently in Nigeria, the World Bank, French Development Agency, and African Development Bank offered \$243 million in

grants for the construction, rehabilitation, and maintenance of rural feeder roads in four Nigerian states. This scheme is referred to as Rural Access sans Mobility Project (RAMP) under the National Coordinator, Ubandoma Ularamu who listed the four participating states under the agreement as Adamawa, Enugu, Niger, and Osun, which are expected to pay three percent of the total project costs under as counterpart funding.

The RAMP is an agency encapsulated under the Federal Ministry of Agriculture and Rural Development that is targeted at constructing, rehabilitating, and maintenance of rural feeder roads to enable farmers to evacuate their farm produce and facilitate efficient flow to the market. The scheme is targeted at constructing 500 kilometers of rural roads would be constructed in each of the participating states.

It is pertinent to note that construction has begun and the vision is becoming executed in the selected rural roads in the states. The major importance of RAMP is the significant effects on transforming the agricultural sector and ensuring food security in the country under the Agricultural Transformation Agenda (ATA) which is a key to realizing the vision of Sustainable Development Goals.

This study is therefore carried out to stress the implication of transport development models on agricultural development with an emphasis on rural transport. It is believed that this study is capable of giving a more plausible result and a robust outcome for policy formulation and implementation.

### LITERATURE REVIEW

#### Conceptual Clarification

The two major constructs that were examined in the study are “*development*” and “*transportation*”. They will be established from their definitions.

#### *Development*

Development is a term that has been defined according to different scholars and it is therefore difficult to define or rely on one definition. The development has a surfeit of interpretations from the various schools of thought across a board of multidiscipline researches. According to Todaro (1977), the context of development has advanced from its narrow conception in terms of narrow economic indices such as a rise in per capita income in the 1950s and 1960s, to a broader one. Given this that Okowa (1997)

described the development as the process whereby a society changes in all its ramifications in a direction that is beneficial to all her citizens or at least to a majority of them. According to Gboyega (2003), development is an idea that embodies all attempts to improve the conditions of human existence in all ramifications.

It implies an improvement in material well being of all citizens, not the most powerful and rich alone, in a sustainable way such that today’s consumption does not imperil the future, it also demands that poverty and inequality of access to the good things of life be removed or drastically reduced. It seeks to improve personal physical security and livelihoods and expansion of life chances (Tolu and Abe, 2011). The first definition of development by Akpakpan (1987), modified definition of Akpakpan by Wilson (2005), and the remodified definition of Wilson by Adeniran (2019) were adopted in this study. They defined development is a process of improving the general welfare of the citizenry which is usually marked in the various aspects of the life such as a reduction in the level of unemployment; reduction in the extent of inequalities; reduction in hunger and poverty; rise in real output of goods and services and improvement in techniques of production; improvement and affordable education, health, housing, and government services; improvement in the level of social and political consciousness and participation of the people; greater ability to draw on local resources (both human and material) to meet local needs; and reduction in pollution and/or environmental degradation, ensuring that politics is not a do or die affair, ensuring that judiciary remains the last hope of common man, among others.

#### *Transportation*

Akintayo (2010) defines transportation as the physical movement of passengers and goods from one geographical location to another to enhance their utility. In the context of agriculture, transportation is a system which comprises of various sub-systems that facilitates the physical balance of demand and supply of agricultural products from one location to the other, thereby fulfilling the idea of spatial flow. Akintayo (2010) further stated the assertion of Economists that goods have not been produced until they have been transported to the final consumers who will satisfy their want (utility) by the consumption of such products. Therefore,

moving goods from point of production to the point of consumption is the fulfillment of production.

The transportation system has several elements or essentials without which it cannot function, the elements are Way or infrastructure which is the path or network which the vehicles ply such as roads, railways, airways, canals, pipelines, etc; Vehicle which is the carrying capacity (unit) such as automobiles, trains, airplanes, etc; Operation which deals with the planning, organizing, controlling, and directing of the entire transport system such as traffic, signal, and ramp meters, railroad switches, air traffic control, etc, as well as significant transport policies, such as transport financing and management; Nodes or terminals for fragmentation and consolidation of goods. Examples are airports, railway stations, bus stations, and seaports.

### Historical Overview of Transport Development in Africa and its Importance

The history of transport infrastructural development is traceable to the colonial era when Frederick Lugard (1858-1945), a British Soldier, an explorer, and a diplomat played a crucial role in Britain's colonial development of Africa attributed the main issue of Africa to transportation. The summary of his emphasis was hinged on this phrase "*give them transport, and the problem of Africa will be solved*"<sup>1</sup>. The aftermath of this phrase was the development of transport infrastructure in Africa which some are still pointed at till today, especially the old Oyo road that was constructed in 1901. The development of transport infrastructure in Africa led to the following enhancements:

1. Exploration of agricultural produce and natural resources from the African countries into the domain of the colonial master;
2. Facilitation of effective colonial administration; and
3. Facilitation of effective security and national defense (Adeniran, 2016; Adeniran and Ben, 2017)

Moreover, because consumers are geographically separated from agricultural production areas, transportation is the basic activity that can make it possible for those residing outside the production areas to have access to the finished products. This enhances rural-urban and urban-rural relationships. The

development of transport cannot be far-fetched from or beyond the following: Economic purposes; Spatial interaction; and Social integration.

These three reasons are encapsulated in the theory of spatial interaction which was postulated by Edward Ullman (1957). A spatial interaction is a realized movement of people, freight, or information between an origin and a destination. It is a transport demand/supply relationship expressed over geographical space. Spatial interactions cover a wide variety of movements such as journeys to work, migrations, tourism, the usage of public facilities, the transmission of information or capital, the market areas of retailing activities, international trade and freight distribution (Jean, Claude, and Brian, 2006). Economic activities such as agriculture are generating (supply) and attracting (demand) flows.

### METHODOLOGY

This section entails the review of transport theories for improving agriculture. In the construction and reconstruction of a region or a nation, transport systems invariably play a vital role. The growth and development of transportation provide a medium, contributing to the progress of agriculture, industry, commerce, administration, defense, education, health, or any other community activity. There is a need to understand some basic economic and social principles that support transport development. The present-day transport network has evolved out of the past framework because as trail evolves successfully into the pioneer dirt road, then into the improved farm road and finally, into the present day paved highways with heavy motor traffic which enhances the smooth flow of agricultural inputs and outputs.

### Models Targeted at Economic Aspect of Transport Development

#### *Spatial Interaction Model with an Emphasis on Agriculture*

According to Jean, Claude, and Brian (2006), the spatial interaction model is the assumption *that movement or flows are a function of the attributes of the locations of origin, the attributes of the locations of destination, and the friction of distance between the concerning origins and destinations*. The general formula of the model is  $T_{ij} = f(V_i W_j S_{ij})$ . Where  $T_{ij}$  is the interaction between location I (origin) and location j (destination), the units of

measurement are varied and can involve people, tons of freight, traffic volume, etc. It also concerns a period such as interactions by the hour, day, month, or year.  $V_i$  is the attributes of the location of origin  $I$ , variables often used to express these attributes are socio-economic, such as population, number of jobs available, agricultural input and output, gross domestic product.  $W_j$  is the attributes of the location of destination  $j$ , it uses similar socio-economic variables to the previous attribute.  $S_{ij}$  is the attributes of separation between the location of origin  $I$  and the location of destination  $j$ , this is also known as transport friction, variables often used to express these attributes are distance, transport costs, or travel time.

The conditions for spatial interaction to occur in agricultural economics are:

### *Regional Complementarity of Agricultural Inputs and Outputs*

There must be a demand for agricultural inputs and outputs, and a supply of agricultural inputs and outputs respectively between interacting locations. An urban area is complementary to rural area in-terms of farm inputs and outputs because the urban area is supplying agricultural inputs which are demanded by farmers in rural areas where most farms are located, also rural area is supplying farm outputs to the urban areas which demanded farm output for processing and consumption. The same can be said concerning the complementarity between the urban area that is demanding for farm outputs from the rural area while the rural area is supplying farm outputs, also the rural area is demanding for farm inputs while the urban area is supplying more of farm inputs (movements of agricultural inputs and outputs is facilitated). According to Jean, Claude, and Brian (2006), if location  $B$  produces/generates something that location  $A$  requires, then the interaction is possible because a supply/ demand relationship has been established between those two locations; they have become complementary to one another. The same applies in the other direction ( $A$  to  $B$ ), which creates a situation of reciprocity common in commuting or international trade.

### *The Intervening Opportunity of Agricultural Inputs and Outputs*

There must not be another location that may offer a better alternative as a point of origin or as a point of destination. For instance, to have an interaction of consumer to farm outputs,

there must not be a closer farm that offers a similar array of farm outputs. Locations  $A$  and  $C$  are different farms located in rural areas while location  $B$  is the urban area. Jean, Claude, and Brian (2006) state that if location  $C$  offers the same characteristics of farm outputs (namely complementarity) as location  $A$  is also closer to location  $B$ , an interaction between  $B$  and  $A$  will not occur and will be replaced by an interaction between  $B$  and  $C$ .

### *Spatial Transferability of Agricultural Inputs and Output*

Agricultural inputs being transferred from urban-rural areas or outputs being transferred from rural-urban areas must be supported by transport infrastructures, implying that the origin (rural areas or farm) and the destination (urban areas) or vice-versa must be linked by transport infrastructures. Costs to overcome distance must not be higher than the benefits of related interaction, even if there are complementarity and no alternative opportunity. Transport infrastructures (modes and terminals) must be present to support an interaction between  $B$  and  $A$  or  $A$  and  $B$ . Also, these infrastructures must have a capacity and availability which are compatible with the requirements of such an interaction.

The model above expressly explained the significance of transportation infrastructure in agricultural development as transportation is a means that facilitates the distribution of agricultural inputs and outputs which enhances pre-planting by moving farmers from their destinations to farm, planting by moving seedlings and fertilizers, post-planting by moving harvested outputs to where they will attract higher value of exchange for money or by turning produce into finished goods and value chain, and get to the final consumers. Transportation is highly important in physical distribution management whereby raw materials are physically transported from point of manufacture to the point of processing and to the point where it will be turned into finished products. Ajiboye and Afolayan (2009) stated that the availability of the transport facility is a critical investment factor that stimulates economic growth through increased accessibility. All affect the basic function of production, distribution, marketing, and consumption in many ways. Transportation also influences the cost of the commodity consumed and the purchasing power of the consumers.

**Theory of Regionalization**

The continuity of social life is dependent on interactions with and between others who are co-present in time and space (Giddens, 1984; Peet, 1998); this is regionalization according to Gregory *et al.* (2009). The concept of regionalization help explains that the dairy farming practices of farmers being its production or marketing is sustained through interaction with others such as transport service providers, inputs providers, traders and agriculture extension officers, and other subsistence farmers.

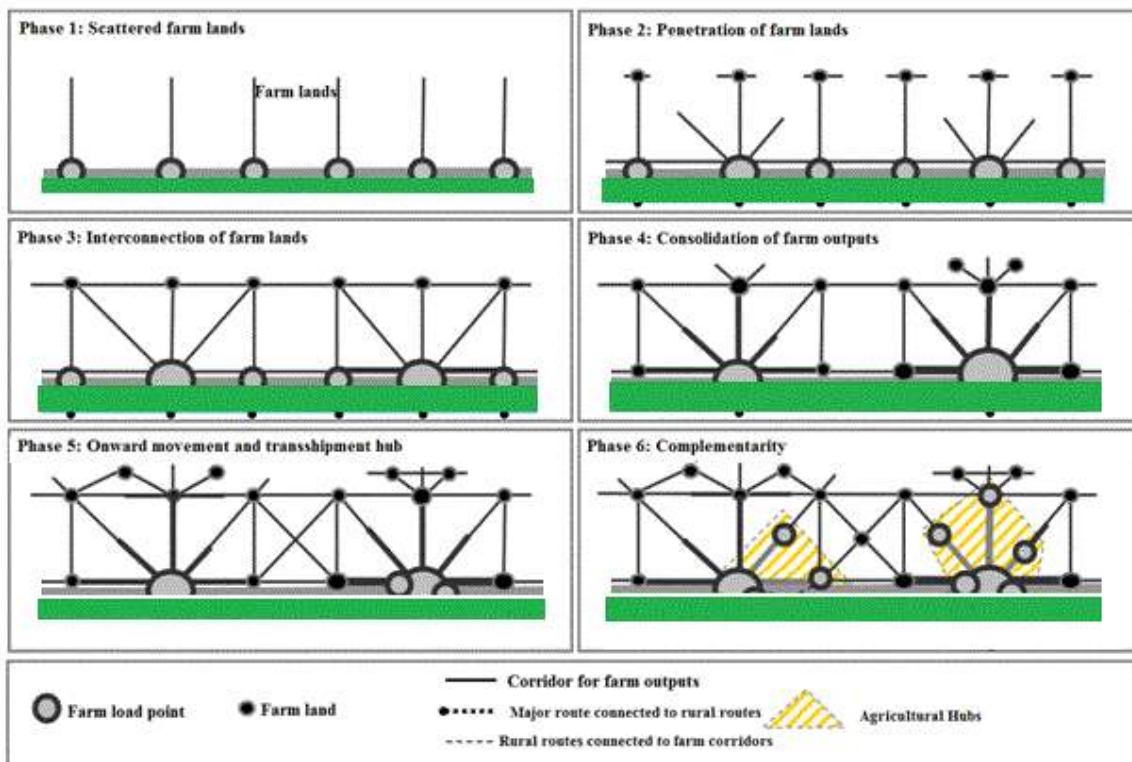
This idea elucidates the importance of farmers' daily interaction among themselves and with other actors through a means of transportation to shape agriculture. Effective and efficient interaction between people and places depends very much on the means of transportation. In a nutshell, the regionalization theory provides a framework for understanding the relationship between roads and agriculture through the study of the agency of farmers and their interactions

with others who are co-present in time and space.

Agricultural hubs are moving beyond their own facilities to help contain more traffic of farm inputs and outputs, and the convolution of farm output distribution, which is enhanced by the improvement of rural transportation.

Agricultural hub is realized as a result of integrating rural farm lands with rural transport systems and with urban transport systems.

It is pertinent to note that rural transportation systems can be efficient particularly by using rail and road transportation, which are best for moving high quantity of agricultural outputs. Rural transport accessibility is a cornerstone in agricultural competitiveness and rural development. Functional agricultural hub is characterized by the development of a specific load agricultural centre, and efficient management of physical distribution, agricultural inputs, and overall logistics. This is further explained in Figure 1.



**Figure1.** Agricultural hub and rural transport development

**Models Targeted at Infrastructural Aspect of Transport Development**

**Model of Ekstrom and Williamson (1971) on Transport Development for Rural Access**

In collaboration with the above theories which aid the understanding of the development of

transport systems on the economic side, the concept postulated by Ekstrom and Williamson (1971) was recognized as it has significant impacts on agricultural development.

The phases with emphasis on agriculture in the rural areas are:

1. Initial phase: This has to do with the introduction of a new road transport route in rural areas for agricultural development.
2. Spread phase: This has to do with spatial diffusion of the road network in various rural areas to increase the accessibility to agricultural farms.
3. Coordinating phase: This is where the new modes which were initially introduced and existing modes become integrated.

These three phases may be followed by:

4. Concentration phase: This involves an emphasis upon certain flows along selected routes. This might be a result of massive agricultural outputs emanating from a particular area which causes increasing flows.
5. Liquidation phase: This is the final phase which explained that certain routes may decline or demise. Some road transport routes in the rural areas may decline if agricultural outputs are not coming forth on a commercial scale.

It is worthy to note that as the economy becomes more developed and integrated, all the principal centers and many of the minor centers are linked in the transport system, while several high priority trunk routes develop which link the largest or most important centers.

### DISCUSSIONS

Fan and Zhang (2004) present econometric analyses on the infrastructure and regional economic development in rural China. Their estimates revealed that investment in roads and irrigation significantly contributes to agricultural growth.

At the same time, agricultural growth induces a much larger demand effect on irrigation than on roads. This may be because irrigation is sector-specific infrastructure and thus, its demand is more directly influenced by agricultural growth while the demand on roads depends on several other factors besides agricultural growth. Fan, Hazell, and Thorat (2000) find that public investment in rural roads has a large positive impact on agricultural productivity growth in India. Hence, the quality of infrastructure is an important determinant of the effects of infrastructure on agricultural growth and poverty reduction (Fan and Chan-Kang 2005).

Pinstrup-Andersen and Satoru (2006) examine the returns to total GDP to compare the effects of the quality of roads by measuring kilometer of the new road; they found that investment in high-quality roads in China has close to 50% higher returns to total GDP than investments in low-quality roads. However, investments in low-quality roads have the largest returns in total GDP (41.5% higher) in rural areas, while the effects of high-quality roads were almost twice as high as those of low-quality roads in urban areas.

Limi and Smith (2007), finds that transport infrastructural network is essential for the promotion of cocoa and coffee production.

The importance of infrastructural development was considered in China as highly significant following the huge investment of China government in the year 2008 by investing 100 billion yuan (\$14.7 billion) on social welfare projects, infrastructure construction, environmental protection, and industrial restructuring (Zongzhang and Xiaomin, 2009).

Ulimwengu, Funes, Heady, and You (2009), finds that road infrastructure enhances the improvement of agricultural production and wealth creation in the Democratic Republic of Congo.

Tunde and Adeniyi (2012), find that road transport has positive and negative impacts on agricultural development and farmers' income in the rural area of Kwara state. Kiprono and Matsumoto (2014), finds that investment in rural road transport enhances the productivity of rural smallholder farmers in Kenya. According to Amrit (2014), adequate infrastructure raises farm productivity and lowers farming costs and its fast expansion accelerates agriculture as well as economic growth rate. It is acknowledged that infrastructure plays a strategic role in producing larger multiplier effects in the economy with agricultural growth. It is estimated that a 1 percent increase in the stock of infrastructure is associated with a 1 percent increase in GDP across all countries. Lokesha and Mahesha (2017) emphasize that rural transport development stimulates agricultural productivity. Manggat, Zain, and Jamaluddin (2018) find a strong and positive relationship between railroad infrastructural development and cocoa production in Ghana.

Agriculture constitutes the heart of the economy of most low-income developing countries. In



heavily indebted poor countries, the agricultural sector generated thirty-three (33) percent of the Gross Domestic Product (GDP) and fifty-two (52) percent of total merchandise exports in 2002. The agricultural sector accounted for about sixty (60) percent of employment in low-income countries in 1995. Even in East Asia and the Pacific which have experienced rapid economic growth, the agricultural sector accounted for forty-six (46) percent of employment, generated sixteen (16) percent of GDP, and was responsible for ten (10) percent of total merchandise exports in 2000 (World Bank 2005). Such economic dominance of agriculture demonstrates the importance of agricultural development for economic growth and poverty alleviation in developing countries.

Moreover, although the relative contribution of agriculture to the overall economic growth decreases as an economy develops; agricultural development provides a crucial foundation for economic growth in both agricultural and non-agricultural sectors. Virtually every high- and middle-income country, except city nations such as Singapore and Dubai, has gone through a period of development when agricultural growth was essential to foster general economic growth and poverty alleviation. On the other hand, low-income countries with stagnant agriculture usually have a stagnant economy (Gulati, Fan and Dalafi, 2005) as evident in Nigeria. Endeavors to jump directly to modern industrialization without paying enough attention to agricultural development in the early stages of development have tended to fail economic growth and poverty alleviation.

In India, Binswanger *et al.* (1993) observed that investments in rural infrastructure lowers transportation costs and thus increases farmers' access to markets which results in substantial agricultural expansion. The studies carried out by the World Bank (1994) showed that the growth of farm productivity and non-farm rural employment is closely linked to infrastructure provision. This has considerable significance since most poor households in developing economies are in rural areas. According to Jaffee and Morton (1995) in Pinstруп-Andersen and Satoru (2006), the effects of transport infrastructure highlight the process of commercialization in agriculture. Fan *et al.* (2002) surveyed rural poverty areas that showed that transport infrastructure is not only an important driver for productivity growth but

also directly contributes to a substantial reduction in rural poverty.

Among several infrastructures impacting agricultural development, a study conducted by Thorat and Sirohi (2002) in Pinstруп-Andersen and Satoru (2006) attempted to analyze the impact of infrastructure on agricultural development using larger data, both in terms of the period and coverage of infrastructure variables that included ten (10) explanatory variables. The results indicated that transport, power, irrigation were four critical components that affected agricultural productivity in a significant manner. Transport infrastructures increase the adoption of agricultural technology by improving access to markets, enhances the more efficient allocation of resources, helps farmers to realize better input and output prices, provides better access to health care, education, and a credit facility, opens up employment avenues outside the rural areas thus improving the living conditions of the poor.

In one of the technical background documents for the World Food Summit, it was concluded that roads, electricity supplies, telecommunications, and other infrastructure services are limited in all rural areas, although they are of key importance to stimulate agricultural investment and growth (Food and Agriculture Organization of the United Nations (FAO) 1996). The studies conducted by Fan, Hazell, and Thorat (2000), Mundlak, Larson, and Butzer (2002), Fan, Zhang, and Zhang (2002), and Fan and Zhang (2004) demonstrates that investment in infrastructure is essential to increase farmers' access to input and output markets, to stimulate the rural non-farm economy and vitalize rural towns, to increase consumer demand in rural areas, and to facilitate the integration of less-favored rural areas into national and international economies, which is also in accordance to the result of the study conducted by World Food Summit (1994).

In a study of four African countries, Delgado *et al.* (1998) in Pinstруп-Andersen and Satoru (2006) estimated the income multipliers to be around \$2.5, meaning that each additional dollar of income from agriculture generates about \$2.50 of economic growth in the economy as a whole. In the more open economies of Asia, where rice was more tradable than most African staple foods and local prices more easily reflected border prices, the multiplier effects were close to \$2 in the early stages of

agricultural modernization when productivity gains were the fastest. Also, Gollin, Parente, and Rogerson (2002) used data for sixty-two (62) developing countries during 1960-1990, they found that agricultural growth, non-agricultural growth, and sectoral labor shifts explain 54 percent, 17 percent, and 29 percent of the growth of GDP per worker, respectively.

Market integration over space and time requires good transport infrastructure which enhances and the effectiveness of market institutions. This affects both the demand and the supply side. In the situation whereby spatial market integration is poor, favorable local growing conditions, improved production practices, or adoption of modern technologies that result in increasing marketable surpluses may result in drastic drops in local prices, while other areas may suffer from deficits and rapidly increasing prices. Such large spatial price differences and abrupt inter-temporal price changes are common in low-income countries with poor infrastructure and/or poorly functioning markets. For example, maize prices in Ethiopia tripled from 1997-1998 to 1999-2000 followed by an 80 % drop from 1999-2000 to 2000-2001. In Malawi, the price of maize quadrupled between April 2001 and April 2002 (Pinstrup-Andersen 2002).

Johnson (1973) indicated that an attempt to increase agriculture productivity is to a considerable degree attempts to give farmers what they want or need. But the case of roads has always been different even though it may fall under efforts by governments to give rural farmers what it is believed they want or need. None the less rural citizenry applauds governments for roads because they and the government assume roads assist subsistence agriculture productivity (Hoyle, 1973, Compact One, 2004).

In Nigeria, Ajiboye and Afolayan (2009) observed that inadequate supply and high cost of foodstuff is as a result of inefficient transportation and distribution. Inadequate transport provision leads to a total waste of 25% of the total agricultural foodstuff produced. Idachaba (1980) in his study of food production problems in the rural areas contended that transportation among other factors represents the most serious constraint to agricultural product and development in Nigeria.

Transport service in the rural area is referred to as “the forgotten problem” (Gwilliam *et al.*, 2010). There is a traditional assumption that

investment in rural roads will spontaneously lead to the provision of transport services by the private sector as passenger and freight operators benefit from lowered vehicle operating costs and travel time savings. Logically, it is perceived that this will bring cheaper and better transport for all, through competition (Hettige 2006) and even if the poor do not benefit directly, it is assumed they can benefit indirectly through the trickle-down of economic growth (Njenga and Davis, 2003).

It can, therefore, be recognized that the transport infrastructure impacts agricultural development directly or indirectly through the following ways: Irrigation and public access to water; Means of movement; Storage services; Agricultural commerce; Agricultural processing; Public services; Agricultural research and extension services; among others.

International Fund for Agricultural Development (1995) observed that construction of rural roads almost inevitably leads to increasing agricultural production and productivity by bringing in a new land into cultivation, intensifying existing land use to take advantage of expanded market opportunities. Hence, accessible roads lowered the costs of credit services which result in increased lending to farmers, higher demand for agricultural inputs, and higher crop yields.

### CONCLUSION AND RECOMMENDATIONS

The development of transport cannot be far-fetched from or beyond spatial interaction, economic purposes, and social integration. These three reasons are encapsulated in the theory of spatial interaction. The spatial interaction model comprises regional complementarity, intervening opportunity, and spatial transferability, which results in the development of transport infrastructure and agricultural development. The transport development concept by Ekstrom and Williamson (1971) was also recognized as it has significant impacts on agricultural development. The phases with emphasis on agriculture were initial phase which introduces new transport mode for agricultural development, spread phase which spatially diffused transport network in various rural areas to increase the accessibility to Agric farms, coordinating phase which integrates introduced modes and existing modes, concentration phase which emphasizes upon certain flows along selected routes as a result of massive agricultural produce emanating from a rural area that causes increasing flows, and liquidation phase which explained that

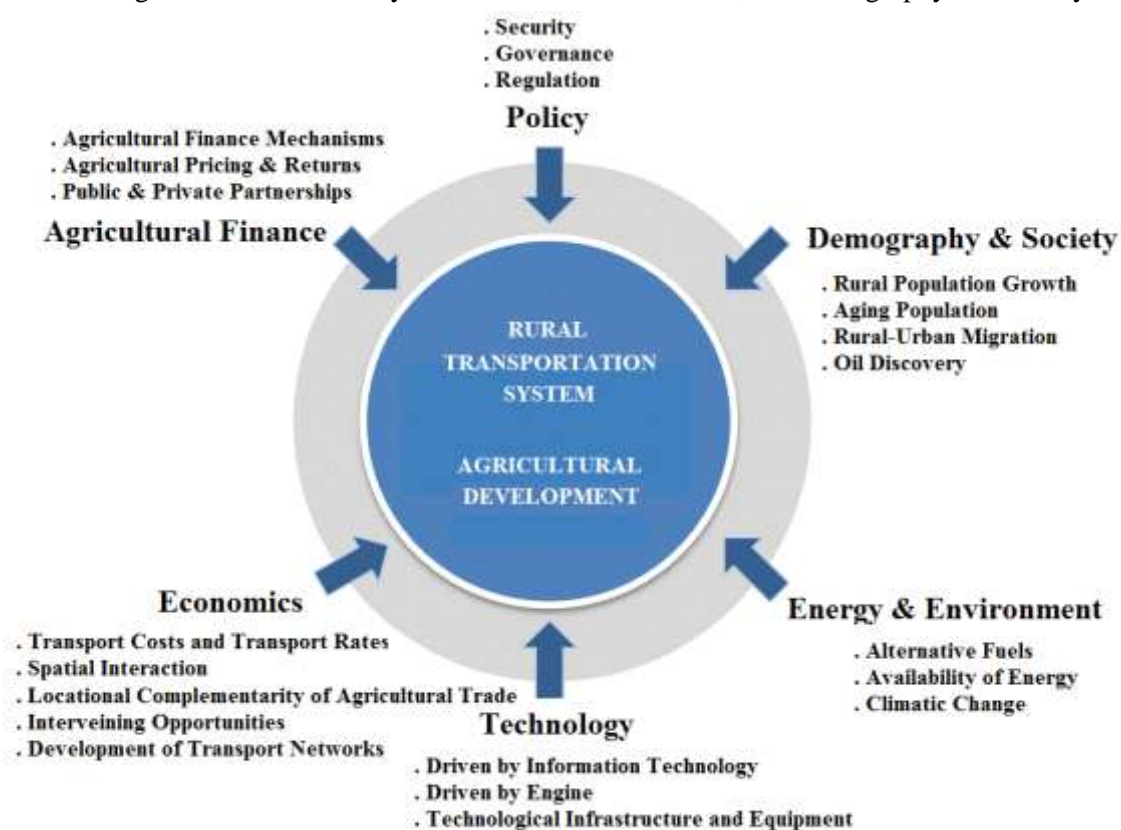
## Implication of Transport Development Models on Agricultural Development in Nigeria: An Empirical Review

certain routes may decline or demise as a result of agricultural produce not coming forth in a large or commercial scale.

Rural areas will continue to remain without adding any form of economic value to the nation unless the government catalyzes it by critically investing in the transportation infrastructure and deploying farm machinery (mechanization) to enhance commercial agricultural scale. Road transport investment is the most dominant transport mode that offers door-to-door service and also links all other modes. To prevent wastage of resources when constructing road transport infrastructures in the rural areas, the projected proceeds of agricultural produce in an area should be the basis for determining the quality of road transport infrastructures. As the proceeds of agriculture are usually bountiful

when commercialized, so also should the high quality of road transport infrastructure. In other to achieve this, there is a need for Public-Private Participation (PPP) in transport infrastructure and maintenance. As evidenced in the developed countries where the government invested in rail transport to complement road transport which enhances the mass exploration of agricultural products, the government of Nigeria should also invest in rail transport infrastructure to connect rural-urban areas.

This study is concluded by being summarized in the Figure 2 which is the factors driving rural transportation system and agricultural development. They are categorized into six major divisions which are; policy, agricultural finance, economics, technology, energy and environment, and demography and society.



**Figure 2.** Summary of the study

Finally, as Nigerians are reawakening to embrace agriculture, the roles of government cannot be overemphasized by ensuring quality social amenities in the rural areas, mechanizing the farms, and linking the rural areas to urban areas with accessible and efficient road and rail transport networks. This will help decongest the overpopulated cities and the nation will be a better place to live. Also, there will be efficient interaction between rural-urban and urban-rural

dwellers. Rural areas and the environs should be inclusive in government developmental plans and actions as they are food providers that will alleviate poverty and hunger in the nation for sustainable development. Also, when the road infrastructures are put in place, the rural dwellers can be empowered to monitor its usage so that any damage caused by negligence should be repaired by the offender.

## LIST OF ABBREVIATIONS

**GDP:** Gross Domestic Product

**IFAD:** International Fund for Agricultural Development

**OECD:** Organisation of Economic Co-operation

**PPP:** Public-Private Participation

**SDGs:** Sustainable Development Goals

## DECLARATIONS

### Ethics approval and consent to participate-

Not applicable

**Consent for publication** - Not applicable.

**Availability of data and materials** - Not applicable

**Competing Interest** - The author declares that there is no competing interests

**Funding** - Not applicable

**Authors' Contribution** - The author conducted the review and wrote the manuscript.

## ACKNOWLEDGEMENTS

I hereby acknowledge partners from BUTY Global Research Network ([www.butyglobal.com](http://www.butyglobal.com)) for help in proofreading the manuscript.

## NOTE

<sup>1</sup> A lecture note delivered by Professor Kolawole T. GBADAMOSI on Transport Development in 2015/2016 Master class of the Department of Transport Management Technology, Federal University of Technology, Akure, Nigeria.

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Contributed Paper Prepared for Presentation at the International Association of Agricultural Economists Conference, Beijing, China. August 16 – 22, 2009.

**Citation:** Adeniran, Adetayo Olaniyi & Oladun, Emmanuel Adesola. “Implication of Transport Development Models on Agricultural Development in Nigeria: An Empirical Review” *Open Journal of Economics and Commerce*, 7(2), 2020, pp. 28-41.

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