The Effect of Transportation Infrastructure on Economic Development

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Abstract

The essential component of any nation's transportation system is transportation infrastructure. The significance of transport as a driver for socio-economic growth has increased in conjunction with the instigation of society and the escalation of foreign relations due to the globalization processes. Diverse facets of transport infrastructure growth operations have become rapidly the focus of scientific research. Transport is an indicator of economic performance as an economic factor and, at the same time, transport is a function of economic growth. Therefore, the issues of evaluating the efficiency of transport infrastructure and the relation between transport infrastructure and economic development are the topics for debate in both academic and non-academic circles. This paper evaluates the role of transport infrastructure in world economic growth, explains the idea of transportation infrastructure as an essential component of the transport system in a nation. Trade practices both in the global and local sense play a key role in economic and social development. Efficient flow of goods hinges extensively on transport infrastructure. The transport infrastructure will promote economic growth by promoting the movement of goods. This paper addresses four common types of improvements in transport infrastructure, and how they impact economic development.

Keywords

Transport infrastructure, economic development, logistic operations, economic performance, and globalization.

1.0 Introduction

Transportation infrastructure, as a broad array, links cities and encompasses human actions coupled with the industrialization and population increase of the social economic, and environmental structures. The transport network also adds to socio-economic development and a higher quality of life by creating inter- or intra-city ties during urbanization (Ebara *et al.*, 2003; Hoff *et al*., 2010; Huang *et al*., 2016; Kaluza *et al.*, 2010). Therefore, objectives such as low-carbon, robust and sustainable growth should not be overlooked when extending the transport network (Huang *et al.*, 2016; Saretta *et al.*, 2019). In-depth, urban transport infrastructure contributes to urban convergence and dissemination, thus significantly improving national and international economic development (Holl & Mariotti, 2018; Tong & Yu, 2018). Nevertheless, unreasonable transport infrastructure planning also causes adverse effects, such as environmental destruction, massive traffic fatalities, environmental issues, CO2 pollution and reduced transport performance (Andrey *et al.,* 2014; Laurance *et al.,* 2014; Neeson *et al.,* 2015; Tong & Yu, 2018; Verburg *et al.,* 2011). Numerous effects on transport infrastructure from published studies need to be identified.

Recently, the influence of transportation infrastructure has become a contentious issue, and more focus and discussion has been given to the economic impact of transportation infrastructure, due to the promotion of significant economic development of both regions and industries (Cohen, 2010; Giang & Sui Pheng, 2011). Scientometric experiments were used to review the literature and identify patterns in certain particular subjects, like that of the transportation hypothesis and public transport, to investigate various impacts of transport infrastructure (Sun & Rahwan, 2017; Tsay & Lin, 2009).

2.0 Literature Review

In both the public and private sectors, particularly in developed countries, the growth of the transport infrastructure has firmly established itself and its relationship with economic development. Smith's economic vision centred on transport infrastructure growth. "No roads meant no transport, no trade, no skills, no economies of scale, no growth in productivity and no development" (Paganelli, 2011). The research conducted by Cigu et al., (2018) and Njoh (2012) has shown that investment in transport infrastructures such as rail, airports and seaports allows businesses (local, national and international) to develop their presence and transport facility to enjoy access to goods, distribution channels and customers' base. All of these link to economic clusters and fuel economic growth.

In several developing countries, such as Nigeria, economic development policies indicate weaknesses in describing the connection between transport infrastructure investments and economic growth and how economic growth can occur on different phases of the development concepts (Lemes et al., 2020; Lindsey & Santos, 2020; Transportation, 1996). Considering the current colonial road infrastructure system designed without a very long-term commitment to sustainable economic growth, economic development planning is viewed differently from transport planning, investment and execution in several developing nations (Batool & Goldmann, 2020; Development & Group, 2015; Onokala & Olajide, 2020). In these developing countries, roads infrastructure function as backbones for most transport infrastructures, without the help of feasibility analysis, economic research and environmental assessment reports which are generally correlated with the design and expenditure of transport infrastructure in the developed world. In the developed countries in general, much consideration has been devoted to transport development during the formative days of their industrial development, but now the inherited transport systems have been amended or renewed. From the other hand, developing nations, such as Nigeria, also strengthen their transport networks so that they grow economically faster (Agbigbe, 2016; Onokala & Olajide, 2020). This research aims to examine the connection between Nigeria's transportation infrastructure, especially the development of road networks and economic development. This research will guide developing countries like Nigeria to concentrate more effectively and in ways that better help economic growth on investments in road transportation infrastructure.

2.1 The Economic Key Role of Transportation Infrastructure

The transport infrastructure is the driving force behind economic development and social wellbeing through excellent production and private sector investment efficiency (Achour & Belloumi, 2016; Banister & Berechman, 2001; Subhra & Nath, 2017). In particular, transport infrastructure development could cut travel costs, encourage international investors and broaden the trade between common resources (Management & Kingdom, 2020; Salinas-jiménez, 2004). Transport infrastructure performs a crucial role in industrial development as far as social capital is concerned and has evident spillover effects on regional advancement, factor re-assignment and manufacturing efficient, which fosters the accumulation of industry, population and the economy (Dynamics & Development, 2019; Fageda & Gonzalez-aregall, 2017; Holl, 2004). The transport infrastructure, on the other hand, can have an economic effect only if certain economic requirements, requirements for investment and political and institutional requirements are fulfilled.

The extent of the effect on the domestic economy and regional economics of the transport system differs in rural and urban areas and is subject to economic growth. Besides, in some situations, incompatibility might occur between instant benefits and sustainable development. The size of its effects over various periods may be incoherent. However, transportation infrastructure contributes primarily to the development of the economy and productivity, but not continuously over time. Transport infrastructure encourages economic growth, cuts in commodity prices, offers access to global producers and customer markets and making global manufacturing more cost-effective by decreasing costs of transport and increasing accessibility (Agbigbe, 2016; Meersman & Nazemzadeh, 2019).

Transportation retains specialization efficiency benefits (E.T. Verhoef et al, 1997; Venables & Overman, 2014). Manufacturers need to be capable of contributing to their low-cost locations from strategic partners and deliver goods and services to long-term clients to get the full

economic value of trade. Effective transport infrastructure has made economic specializations in the US cost-effective, making US companies more productive, a desirable place for foreign firms and more competitive global economy producing goods and services (Trimbath, 2014).

2.2 Transportation Infrastructure Improvement

2.2.1 Four Types of Transportation Infrastructure Improvements and Economic Development Effects.

- **Highways**

Highways directly affect most major economic growth facets including efficiency, manufacturing costs, and interprovincial trade. It is because most economic operations either rely on or use highways in the transportation of goods engaged in trade (Duranton et al., 2013). For cases where a road expansion improves road systems to handle greater vehicles and volumes of traffic, the enhanced road system contributes to greater efficiency for product flow through regions. Such an upgrade also enables an area to handle output that depends on bigger vehicles to transport their goods and materials. This can promote urban economic growth and benefit most enterprises and individuals using the new road systems from cost reduction (Duranton et al., 2013).

- **Distribution Facilities**

Distribution facilities enhance maximum local profitability. As distribution facilities reduce congestion, they enable effective functioning of the economy of an area. Goods move quite efficiently and it takes lesser time for individuals to perform work-related commuting to areas where distribution facilities eliminate considerable big truck traffic from crowded roads (Bartholdi & Hankman, 2011). Distribution facilities can influence manufacturing geographical location by attracting production near where they are located. When industries or warehouses establish in the area of distribution centres they influence production geography. Increased productivity through segmentation at a central location as a result of inter-industry transaction effectiveness.

- **Ports**

Sea and inland ports provide regions with access to international markets and are typically a low-cost way of transporting large items to and from remote areas. Improvements to enhance ports ' effectiveness will therefore profit interregional international trade and contribute to development in employment and regional efficiency. Such efficiency gains affect profitability by increasing the transport of large quantities of goods to remote regions and by expanding the consumer reach of businesses and regions using the port facilities (Bartholdi & Hankman, 2011).

Airports affect several key elements of regional economic growth and promote the rapid distribution of important products and services. An airport benefits from delivery services and several professional services. Minimum-fare airports attract business to a location and lead to growth in employment, income and productivity in that region. Effective and reliable airport services minimize delivery times and increase area and business profitability. The provision of effective and reliable airport services will impact the position of a firm in an area.

- **Intermodal Connectors**

In the transport network, intermodal connectors, especially entry roads to ports and connectors that link roads to each other, play an important role. The transportation network is incomplete without them, and will not enable the effective movement of goods and people (J.-P. Rodrigue et al., 2019). Because of their significance in the transport network, they influence all facets of economic development and impact other transportation infrastructure. Intermodal connectors enable the system to function the way it should. Major roads to ports are intermodal connectors which enable regions to access port facilities and thus lower the cost of producing industries for companies using them (Laurence O'Rourke et al., 2015; Alex et al., 2015; Copper, 2018). By enabling greater access by heavy vehicles to ports, they

facilitate economies of scale in the flow of goods, reducing costs for the freight industries. They promote reliability in the flow of goods and boost regional profitability when they act as links in the transportation system.

2.3 The Effects of Transportation on Economic Development

The vision of President Dwight Eisenhower toward the vital position of transport, "we will be a pure coalition of several different sections" without the unifying transport force, is more pertinent today than it was in 1955 (Herbert Pankratz, 2005)**.** A report from the White House (concerning the long-term economic advantages of transport investment) begins: "A high-performance transport network is a key to a stable economy. Investments made by previous generations of U.S. citizens have helped pave the way for sustainable economic development, increased efficiency and an unrivalled national goods and services sector, and global competitiveness"(National Economic Council, 2014).

Global supply chains rely on vast freight networks to transport massive quantities of goods. For vast quantities of goods to travel over several long distances across different modes of transport, expanding world markets and enhanced competitiveness in the supply chain depends on a diversity of infrastructure, utilities, and participants. For effective global trade, it is important to engage infrastructure, services and participants. The value of US foreign trade increased from $3.4 billion to $889 billion (from 1990 to 2008) and rose by an average of 8 % per annum with growing integration and globalization (U.S. Department of Transportation, 2018; Bureau of Transportation Statistics, 2009: Rodrigu et al., 2016). This expansion has stimulated the growth of transport assets such as marine, air and land border crossings to link domestic US origin and destinations to foreign markets.

2.4 Impact of Logistics Operations on Economic Growth

Moreover, within the context of development, a typical society desires to improve the welfare of its citizens through the necessary socio-political and economic conditions (Rodrigu et al., 2016). These improved conditions lead to the quantitative and qualitative appreciation of human capital in terms of income and education. On the physical front, however, capital appreciates in terms of infrastructural elements known as social amenities. Transportation is a socio-economic element of physical capital that facilitates the mobility and equitable distribution of the elements of human capital. Not only does transportation benefit the mobility of human capital, but it also facilitates the equitable distribution of wealth across a given geopolitical region primarily in the form of the mobile factors of production – labour, capital and entrepreneurship (World Economic Forum, 2018). It also becomes particularly important to properly examine how road networks (also located on *land* as a factor of production) fill the vacuum of quays and docks that are for obvious reasons not available in hinterland regions. We may therefore infer that regions close to the seaport have low economic distance (J. P. Rodrigue et al., 2016) concerning goods brought in through international waterways. As a result, regions further inland have initially limited access to these goods and therefore require extensive logistics operations. Logistic operations in this regard form the bedrock for levelling the developmental platform across different zones within a political entity such as a State or Country (Soobramanien et al., 2017). In this regard, logistic operations (or the lack thereof) and the road networks they are built are synonymous to the arterial network in the body of a living organism that links and supplies essential nutrients for well-being throughout the body. Still based on this analogy, it is also important to note that any part of the body shut out of this network is in serious peril and may end up threatening the health of the entire body. This is the case with road networks in Northern-eastern Nigeria where poor security has severely undermined the supply chain of goods and services both locally and across the bordering regions (especially in the areas around the Chad basin) (Purokayo, 2016).

However, being a valid point of interest for researchers and policymakers, the relationship between the transportation infrastructure and economic development has been subject to several ventures – academic and otherwise, that have sought to understand and optimize them (Baghebo & Atima, 2013). This pursuit has led to several approaches as shown in Table 1.

Table 1: Some models for evaluating the economic impact of transportation and their adopters

Model	Adopted by:
Regression Model	Takyi *et al.,* 2013
Probit Model	Peter *et al.,* 2015
Solow's Economic Growth Theory	Agbigbe, 2016
Frischmann's Transport Infrastructure Theory	Agbigbe, 2016
Multivariate Outcome Functions	Berg, 2016
Cost-Benefit Analysis	Wang *et al.,* 2016
Cobb-Douglas Production Function Model	Tuong *et al.,* 2019
Spatial Correspondence Model	Proponent: Eberts
Granger Causality test	Ogunleye *et al.,* 2018

The above array of tools shows that the determination of the relationship between transportation infrastructure and the logistic industry is primarily a quantitative problem, or at least, it is mostly modelled as such. As a result, it forms a significant branch in econometric research. However, in all the cases considered above, the respective results show a very strong correlation between the state and extensiveness of road/transportation infrastructures, logistic operations and subsequently the economic development of a given geopolitical entity.

National policies and programmes are key players in determining the extent to which the link between logistics and road transportation can be explored. An emerging aspect of policymaking concerning transportation and the subsequent effect on logistics is environmental consciousness in legislation. Issues such as Global Warming and pollution, though still in their infancy, are shaping up to be front liners in determining how roads will be built and even what mode of transportation is used for transporting which product.

As a case study, China and some European nations have started incentivizing legislations to encourage the purchase of electric vehicles in the form of subsidies, subventions, and privileges. This will affect how roads are built in the long run to embrace auxiliary infrastructures such as online charging lines and charging stations. This trend will ultimately redirect the manner and modality of fleet acquisition in logistic firms, as most vehicles in this category are diesel-powered, with diesel being considered one of the major culprits in environmental pollution, not to mention that it is a fossil fuel. Ultimately, technology-driven by policies and legislation will be a major player in the determination of the structure of transportation and logistics outfits across the world.

3.0 Conclusions

In summary, we have seen how transportation infrastructure in any given geopolitical entity serves as the backbone of extensive economic activities. They facilitate multilevel transportation of people and goods through divers' logistic outlets in search of economic opportunities and a higher standard of living. Different conditions of roads affect logistic operations to different extents, ranging from delayed journeys to complete inaccessibility. It is therefore established that viable and an ever-expanding network of roads in quantity, quality, and functionality (achieved through technology) are needed to facilitate the smooth running of logistic operations within a given geopolitical entity.

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