

# The Role of Road Transport Infrastructure Investments on Logistics Performance: A Research Agenda

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## Abstract

**Purpose:** This research aims to highlight the impact of road transport infrastructure investments on logistics performance.

**Design/ methodology/ approach:** A systematic review of 20 published research on the role of road transport infrastructure investments was conducted with the purpose of identifying the impacts of road infrastructure on logistics performance, the methods used in the previous studies, the lessons learned from investing in road transportation infrastructure, and the previous researchers' recommendations for the further studies.

**Findings:** It was revealed that road transportation investments are essential for a country's development from logistics, economic, and social perspectives. Road transport investments play a vital role in the efficiency of a country's logistics performance and the economy as it facilitates connectivity and accessibility to all supply chain areas within a country. In addition, it reduces all the operational costs of road trips. Moreover, in previous research, almost all researchers used a single method to figure out these impacts and none of them used hybrid methods to get more accurate results.

**Research implications/ limitations:** The paper provides a comprehensive view on the impact of road transport infrastructure investments on logistics performance. In addition, it identifies new research gaps as not all the factors of road transportation that affect logistics performance have been fully tackled in previous research, upon which a research agenda was developed.

**Originality:** The paper introduces a comprehensive systematic literature review that highlights the relationship between road infrastructure investments and logistics performance to guide future research.

**Keywords:** Infrastructure investments, logistics performance, road transportation.

# Introduction

Transportation plays a vital role in providing access to different locations for businesses and individuals, for both freight and passengers (Yu et al, 2005). It connects all the supply chain entities together with the aim of converting resources to be useful goods to the ultimate consumer. So, its process should be effectively managed to minimize the total costs and provide customer satisfaction (Topolšek et al, 2018).

Transportation is considered the most important logistics activity among all the activities, as it occupies one third of the total expenses of an organization (Helmy et al, 2018). Explicitly, it has an influence on the final price of the product (Aleksandra, 2017). Consequently, developing transportation infrastructure is considered as a critical issue due to the increased dependence of the society on transportation networks (Satish et al, 2009).

Transport investments have a lot of influences such as reducing transport time and costs by reducing the total trip time, decreasing the operating costs such as fuel consumption, and enhancing access to locations within the network. These investments may also eliminate the barriers that hinder the economic growth of a country and increase the level of logistics performance efficiency. For example, it could reduce congestion and the risk of accidents (Filip & Popa, 2014). These contributions could be shown in the following figure:

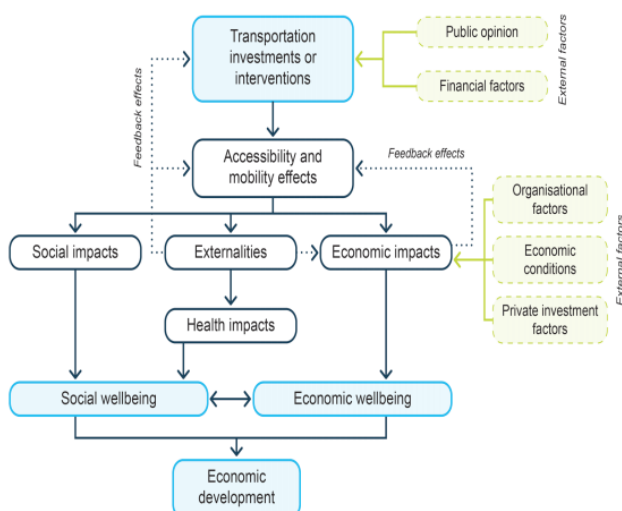


Fig 1: Transport investments impact - key connections  
Source: (Wood, 2016)

In the long run, transportation investments stimulate a country's economic development by contributing to a variety of interconnected economic processes that improve a country's overall productivity and accessibility, as transportation networks and services aid in the expansion of markets for individuals and businesses and improve their access to suppliers. Moreover, increased access and connectivity create increased opportunities for trade, competition, and specialization, which can lead to long-term productivity gains (Wood, 2016). In addition, a well-developed transportation network helps in economic growth by increasing place and time utility, and hence increasing globalization and international value-added chains (Filip & Popa, 2014).

There are several modes of transportation, such as rail, road, sea shipping, air, inland water transport, and pipelines. As a result of globalization and international and national trade, the demand for transport services has increased, and in recent years, this demand has shifted to mainly road transport because of its advantages, such as easy accessibility, flexibility of operations, and reliability. Thus, it's considered as one of the most influential factors for the economic development of a country (Jain & Dhiman, 2017). From a freight perspective, road transportation is used for transporting small shipments over short distances. Moreover, it is an essential mode of transport at the beginning and end of the multimodal transport chain. In addition, road transportation is the only mode that provides door-to-door service, which gives supply chain parties the freedom to locate wherever they choose. Therefore, investing in road transportation infrastructure is a critical issue (Engström, 2016).

Therefore, the construction of an effective transportation network has become an important mission for transport network planners and decision makers. (Zhang & Levinson, 2008). To develop a transportation network and a well-constructed infrastructure, it requires a lot of time, capital, and significant investments to do some improvements, which will help to satisfy demand at a required level of service. Therefore, an optimal

investment strategy is important to be developed by keeping in mind the present and future network parameters such as demand, capacity, and travel time (Satish et al, 2009).

Basically, transportation infrastructure investments include two types of investments, which are infrastructure expansion and infrastructure enhancement. First, infrastructure expansion includes the construction of additional highway segments, rail lines, or additional waterways, rail, or bus terminals using traditional technology. While infrastructure enhancement adds new services such as logistics centers, emergency stations, fuel stations, or new technology to enhance the efficiency of the existing highway system. Investors should study the needs of the country and invest in both (Eberts, 2017).

Obviously, a country's infrastructure is essential for its logistics performance. It facilitates the flow and storage of goods, services, and related information from the point of origin to the point of consumption to meet customer requirements (Mangan et al, 2016). To achieve logistics efficiency and effectiveness, it requires improving each mode of transport and integrating them between them to support demand management, supply management, manufacturing requirements, storage, distribution, and value-added services. These could be achieved by constructing a well-developed infrastructure to connect all the supply chain parties together in an efficient way to minimize total logistics costs (Arnold, 2012).

To evaluate the consequences of the development of transport infrastructure on the logistics performance of a country, different approaches are implemented. The first one is an assessment of transport infrastructure based on the calculation of the Global Competitiveness Index (GCI), by the World Economic Forum. The second one is the evaluation of logistics activities based on the evaluation of the Logistics Performance Index (LPI), which was developed by the World Bank in 2007. The Global Competitiveness Index (GCI) measures the level of competitiveness of an economy, which is defined as the set of institutions, policies, and factors that determine the level of productivity of an economy. Measurement of the level of transport infrastructure is one of the parts of the total evaluation of the GCI.

While the Logistics Performance Index (LPI) analyses the differences between countries in terms of customs procedures, logistics costs, and the quality of the infrastructure for overland and maritime transport, So, the LPI approach is considered more efficient. (Oksana & Irina, 2016).

As stated by the World Bank (2010), LPI is one of the most significant benchmarks in logistics management. Its goal is to assess how countries rank in the managerial and physical effectiveness of their logistics. The LPI is an index based on some measures of transport, information flow infrastructure, logistics management, and trade facilitation capabilities, which are calculated based on a world survey of international freight forwarders and express carriers. The LPI is based on seven factors of logistics performance, which are the efficiency of the clearance process by customs and other border agencies, the quality of transport and information technology infrastructure for logistics, the ease and affordability of arranging international shipments, the competence of the local logistics industry, the ability to track and trace international shipments, and timeliness of shipments in reaching their destination. (World Bank, 2010).

As mentioned before, the development of infrastructure is vital for ensuring connectivity between supply chain entities, and hence logistics performance becomes more efficient. Presently, the inland transportation connections are still not well developed due to a lack of investment and government spending, especially in road transportation. Although road transportation has a lot of significant impacts on a country's economic growth and logistics performance, it is still not fully developed in some countries. (Oksana & Irina, 2016).

Therefore, investing in road transportation infrastructure is a critical issue. It has various impacts on a country's economic development objectives, such as productivity, employment, business activities and the overall accessibility as it improves business's ability to provide goods and services, and people's ability to access education, employment and services and reduce transportation costs including travel time, vehicle operating costs, road and parking facility costs, accident and pollution damages that result in increasing

economic productivity and development. Moreover, this increases businesses' efficiency, reduces their costs of obtaining input materials and services, and expands their potential market. Moreover, this may increase economies of scale in production processes, which means higher productivity through lower costs per unit of output (Litman, 2010).

Moreover, a well-connected road network is fundamental for the efficiency of road transport. It can be defined as the density of connections in a road network. It should have several links and intersections to facilitate traffic flow as they provide alternative routes which help reduce the demand on any single street. A poorly connected network creates longer trips and concentrates traffic on a selected number of streets, which results in congestion and untimely implementation of road widening and major improvement projects (Litman, 2017). In addition, setting the performance measures of logistics and modeling supply chain within a country is another consideration that countries must define (Tipi & Sara, 2021). Thus, the efficiency of a well-connected transport system helps in reducing the overall time of the trip and hence, the long distances. Also, it will facilitate accessibility because there will be alternative routing opportunities, especially in emergency cases. Moreover, it will allow public transportation to operate more efficiently and hence, reduce total transport costs (Auttapone & Asif, 2017).

Accordingly, the importance of road transport infrastructure investments in a country is obvious. Based on the previous reviews, there are gaps that have not been investigated yet and are recommended for future research as no systematic review has been conducted before to identify, evaluate, and summarize the findings of all relevant individual studies in this field. Additionally, the role of road transport infrastructure investments on logistics performance has not been investigated comprehensively in a separate paper yet; it was investigated from the economic perspective or on a separate logistics activity. Therefore, this review highlights the role of road infrastructure investments in logistics performance comprehensively and their contribution to the economic status of a country by conducting a systematic review. Consequently, this

paper attempts to answer the following three research questions:

**RQ1:** What are the impacts of road transport infrastructure investments on logistics performance?

**RQ2:** What are the research methods used in the previous studies concerning road transport infrastructure investments to propose new methods for further research?

**RQ3:** What are the researchers' limitations and recommendations for further studies?

This paper is divided into four sections. The first emphasizes the importance of road transport infrastructure investments and the second addresses the research questions. The second section is a Systematic Literature Review (SLR), which aims to give answers to the research questions. Subsequent results and discussion highlighted the learned lessons form the basis for the third section, which is followed by a summary of the outcomes of the study and highlights of potential avenues for future research in the fourth section by providing a research agenda.

## Methods

To figure out solutions to the questions presented in the previous section, a systematic literature review method was used to reveal the history behind the topic, reflect on the attempts that have been made so far, and determine the potential areas for future studies.

According to (Knoll et al 2018), the following are the essential nine steps in conducting a systematic literature review:

1. Formulating a clear, designed research question clarifies the objectives and the study's inclusion and exclusion criteria.
2. Writing a systematic literature review protocol helps in highlighting which actions to be taken.
3. Literature research by using selected keywords; to identify relevant reports from databases and other resources.
4. Abstract screening.
5. Full text screening.
6. Data extraction from included studies; select the relevant sources that bring the desired outcome.
7. Data analysis.
8. Assess and evaluate the acquired data.
9. Systematic review report followed by publication.

First, the research questions that had been developed in the last section were followed by formulating a protocol for the systematic literature review. Then three research engines are used, which are the Web of Science, Research Direct, and SCOPUS to collect related articles such as peer reviewed journals and conferences proceedings. The strategy used is keyword filtration. The relevant keywords are "road infrastructure", "road transport", and "logistics performance". Once the articles with related keywords are collected, date restriction is used to refine the results from 2011 to 2021 only to depend on recent data. Then, the screening process of the selected articles started by initially, the title and abstract of each paper were read and then, the whole paper with focusing on its aim, methodology and findings to come up with the main research gaps and ideas for further research. 45 articles were retrieved and then were refined by the mentioned technique to be 20 articles, as shown in table 1 in the following

section. The aim of this research is to highlight the role of road transport infrastructure investments in a country's logistics performance and its economy, and to propose a research agenda on further research areas that guide researchers.

## Results & Discussion

Upon the mentioned methodology, the following table evaluates the selected papers to round up previous research in this area and identify the gaps in each paper to propose an agenda for future work and give answers to the research questions. After the filtration process of refining all the retrieved articles to be 20, the selected articles were analyzed based on the focus of the research, and the aim and the methodology used in each paper have been identified. Followed by recognizing the main findings and limitations of the research. Finally, the suggestions for further research have been observed.

Table 1: Systematic literature review on the role of road transport infrastructure

No	Author & year	Title of the paper	Keywords	source	Focus	Findings
1	Özgür Kabak, Şule Önsel Ekici, & Füsün Ülengin (2020)	Analyzing two-way interaction between the competitiveness and logistics performance of countries	Road infrastructure & Logistics performance	Transport Policy Journal	The paper's aim is to reveal the relationship between the competitiveness and logistics performance of a country using GCI and LPI.  A hybrid methodology is used, using Bayesian Net (BN) to analyze relationships between variables, structural Equation Model (SEM) to test hypotheses, and Partial Least Square Model (PLS) to do the analysis.	The results showed that countries should invest in CGI pillars to improve the logistics performance of their countries. Especially important is business sophistication and hence the infrastructure to reduce costs and promote trade.
2.	J. Allen, M. Browne, & T. Cherrett (2012)	Investigating relationships between road freight transport, facility location, logistics management and urban form	Road transport & Logistics performance	Journal of Transport Geography	The paper's aim is to investigate the relationships between road freight transport in urban areas, land use, facility location, and logistics management.  A descriptive analysis is used for 14 urban areas in the UK for their geographical areas, population sizes, economic composition.	The results showed that logistics performance and road freight transport operations are affected by geographical location, land use, and trade imbalances, and this in turn requires countries to invest in their road networks to be more connected.
3	Heri Amalindo, Anis Saggaff, & Joni Arliansyah (2019)	Infrastructure development of road network for regional development based on accessibility concept	Road transport & Road infrastructure	International Journal on Advanced Science Engineering, and Information Technology	The paper's aim is to study the importance of developing road networks in Pali, Indonesia to enhance accessibility and to support its economic growth and regional development.  An accessibility matrix model is used to propose scenarios for improvements.	The results of the model showed that developing transport infrastructure and national road networks could enhance the accessibility and the national economy of Pali.

No	Author & year	Title of the paper	Keywords	source	Focus	Findings
4	Till Becker, Moritz Emanuel Beber, Katja Windt, & Marc Thorsten Hu"tt (2012)	The impact of network connectivity on performance in production logistics networks	Road transport & Logistics performance	CIRP Journal of Manufacturing Science and Technology	<p>The paper aims to investigate the relationship between road network connectivity and logistics performance in production areas.</p> <p>Standard optimization approach and algorithmic models are used to figure out the relationship.</p>	The results showed that supporting roads with network connections such as services, devices, and sensors would allow companies to improve their logistics performance regarding waiting time and work in process by rearranging their material flow toward optimal connectivity.
5	Pablo Coto-Millán, Xose Luís Fernández, Miguel Ángel Pesquera, & Manuel Agüeros (2016)	Impact of logistics on technical efficiency of world production	Road	Networks and Spatial Economics Journal infrastructure & Logistics performance	<p>The paper aims to investigate the contribution of logistics management efficiency to domestic production efficiency.</p> <p>A descriptive analysis is used for 34 countries using the (LPI) and World Economic Indicators, and then analyze it using an instrumental variable model and cause and effect approach.</p>	The results showed that policymakers need to facilitate logistics services, especially transportation network activities, and develop infrastructure to encourage production and domestic capabilities, hence raising the LPI ranking of a country.
6	Wynand J. vdM. Steyn, Wilna Bean, David King, & Julius Komba (2011)	Evaluation of selected effects of pavement riding quality on logistics costs in South Africa	Road transport & Logistics performance	Transportation Research Record: Journal of the Transportation Research Board	<p>The paper aims to examine the impact of roads' infrastructure quality on logistics costs (transportation, storage, and inventory carrying costs) and their performance in South Africa.</p> <p>Surveys are conducted along with benefit-cost analysis with logistics service providers.</p>	The results indicate that improving roads' infrastructure and road maintenance would reduce vehicle operating costs, logistics costs, and increase the economic growth and logistics activities of a country.
7	Choy Peng Nga, Teik Hua Lawb, Fauzan Mohd Jakarnib, & S. Kulanthayanc (2018)	Relative improvements in road mobility as compared to improvements in road accessibility and urban growth: A panel data analysis	Road transport & Road infrastructure	Transportation Research Part A: Policy and Practice Journal	<p>The paper's aim is to determine how investments in different road types facilitate urban growth for a country.</p> <p>A linear regression analysis is used on a panel of 60 countries over the period of 1980–2010.</p>	The results showed that investments in road networks are critical for developing countries to increase their growth rate and trade. for developed countries to raise accessibility, connectivity, and employment rates. In both cases, it would increase their economic growth by increasing exports.
8	Guoqiang Shena, Long Zhouc, & Saniye Gizem Aydin (2020)	A multi-level spatial temporal model for freight movement: The case of manufactured goods flows on the U.S. highway networks	Road transport & Logistics performance	Journal of Transport Geography	<p>The paper's aim is to develop a conceptual framework for enhancing freight movement, transportation planning, and the economy.</p> <p>A multi-level spatial-temporal model is developed to examine the relationship between the five dimensions (time, mode, space, goods, and flows) by using the Standard Classification of Goods (SCTG) for freight movements.</p>	The results indicate that freight movement influences a country's economy, society, and quality of life. Hence, strategic planning for transportation is essential for such things as selecting a mode of transport, reducing time and cost, and routing strategies.

9	Rikard Engström (2016)	The roads' role in the freight transport system	Road transport & Road infrastructure	Transportation Research Procedia	<p>The paper's aim is to explain the role of road transport and to provide a model that shows solutions to road challenges. The model includes infrastructure, policies, social planning, and logistics.</p> <p>The methodology used is a qualitative approach by collecting empirical material in terms of existing case studies.</p>	The results showed that road infrastructure is not used optimally and could be enhanced by using technology. Also, trucks themselves should be managed regarding their size and loading tonnage because they are the main reason for congestion, safety problems, and emissions of air pollutants.
10	Rubel Das (2020)	Approach for measuring transportation network resiliency: A case study on Dhaka, Bangladesh	Road transport & Road infrastructure	Case Studies on Transport Policy	<p>The paper's aim is to apply an analytical approach to characterize the flexibility of the transport system to assist managers in decision making to strengthen their infrastructure system.</p> <p>The resilience index and shortest path models are used by taking Bangladesh as a case study.</p>	The results indicate that decision makers should first rebuild a connected network model and then focus on improving the functionality to reduce failure probabilities and consequences and reduce recovery time.
11	Abhijit Banerjee, Esther Duflo, & Nancy Qian (2020)	On the road: Access to transportation infrastructure and economic growth in China	Road transport & Road infrastructure	Journal of Development Economics	<p>The paper's aim is to examine the effect of transportation networks on regional economic outcomes in China.</p> <p>A descriptive analysis is used to develop a conceptual framework using a simple model.</p>	The results indicate that regions closer to historical transportation networks have higher levels of GDP. Also, good transportation infrastructure reduces trade costs and promotes market integration, reduces price volatility, and reallocates resources.
12	Villarreal Bernardo, Garza-Reyes Jose Arturo, Kumar Vikas, & Lim Ming K. (2016)	Improving road transport operations through lean thinking: A case study	Road transport & Logistics performance	International Journal of Logistics Research and Applications: A Leading Journal of Supply Chain Management	<p>The paper's aim is to improve the road transport operations of an organization by applying to a leading Mexican brewing organization as a case study.</p> <p>The methodology used is developing a feasibility study and analyzing it by using waste management analysis and lean tools.</p>	The results indicate that waste in transportation is waiting time, unnecessary movement, incorrect processing and routing, inadequate loading capacity, and damage. Hence, lean thinking is an effective and suitable method to target the improvement of road transport operations.
13	Michał Kowalski, & Szymon Wisniewski (2019)	Transport accessibility and mobility: a forecast of changes in the face of planned development of the network of expressways and motorways in Poland	Road transport & Road Infrastructure	European Spatial Research and Policy Journal	<p>The paper's aim is to determine the effects of infrastructure investments on transport accessibility, traffic flows, and mobility in Poland.</p> <p>An analysis of the current and planned road network from reliable data sources through linear programming is used.</p>	The results showed that infrastructure investments reduce travel time between Poland by connecting its regional centers, also, increase freight transportation, and the social and the economic dimensions.
14	Ahmed Abu El-Maaty, Ahmed Yousry Akal, & Saad A. El-Hamrawy (2018)	The iron triangle of projects management: quality, schedule, and cost of road infrastructure projects in Egypt	Road infrastructure & road transport	Towards Sustainable Cities in Asia and the Middle East, Sustainable Civil Infrastructures, Egypt	<p>The paper's aim is to judge Egyptian road projects' performance and determine whether they suffer from the Iron Triangle (quality, time, and cost) or not.</p> <p>A quantitative method is used by conducting a survey with experts in Egypt on 56 new roads.</p>	The results showed that road development contributed to Egyptian GDP. The quality level percentage ranges from 60% to 80%, with an average of 71.76%. Also, all the surveyed projects suffered from time overruns and cost

						escalation, with an average percentage of 73.80% and 46.30%, respectively.
15	Bartłomiej Rokicki, Eduardo A. Haddad, Jonathan M. Horridge, & Marcin Stępniaik (2020)	Accessibility in the regional CGE framework: The effects of major transport infrastructure investments in Poland	Road transport & Road infrastructure	Transportation Journal	<p>The paper's aim is to measure the effects of transport infrastructure investments in Poland through investment spending and accessibility improvements.</p> <p>A regional dynamic Computable general equilibrium (CGE) is applied between 2005 and 2015 to measure the effects of transport infrastructure investments in Polish regions.</p>	The results indicate that infrastructure investment impacts are very small at national level that do not exceed 1% in the case of real GDP regarding employment and income and it does not influence accessibility.
16	Andréa Leda Ramos de Oliveira, Monique Filassi, Bruna Fernanda, Ribeiro Lopes, & Karina Braga Marsola (2021)	Logistical transportation routes optimization for Brazilian soybean: An application of the origin-destination matrix	Road transport & Logistics performance	Ciência Rural	<p>The paper's aim is to investigate the effect of transportation routes (North-South Railroad) in Brazil on logistics costs.</p> <p>A linear programming method is used to propose scenarios to get the best solutions.</p>	The results indicate that investing in new transportation routes would reduce logistics costs and increase a country's competitiveness through transporting more goods.
17	Zbigniew Bentyn (2016)	Logistics performance development of the countries on the northern corridor of the new silk road	Road transport & Logistics performance	European Transport Journal	<p>The paper's aim is to present the changes in transportation and logistics in five selected countries when investing in new roads.</p> <p>Descriptive analysis is used by considering the logistics performance Index (LPI) as a tool.</p>	The results showed that expanding infrastructure and an increase in logistics competence brought noticeable improvements in the logistics performance of a country.
18	Ivan Marović, Ivica Androjić, Nikša Jajac, & Tomáš Hanák (2018)	Urban road infrastructure maintenance planning with application of neural networks	Road transport & Road infrastructure	Complexity Journal	<p>The paper's aim is to design and develop a model to achieve a successful prediction of road deterioration in urban areas.</p> <p>A qualitative method is used by collecting reliable data to make a model.</p>	The results showed that road maintenance depends on many factors, such as comparing design load to operating load and asphalt layer quality. So, rules can be managed to balance this issue to enhance the infrastructure level of a country.
19	Eric Kroes, Paul Koster, & Stefanie Peer (2018)	A practical method to estimate the benefits of improved road network reliability: An application to departing air passengers	Road transport & Road infrastructure	Transportation Journal	<p>The paper's aim is to estimate the benefits of improved reliability of road networks to and from airports in Amsterdam.</p> <p>A qualitative method is used by collecting reliable information about local travel time and cost to develop a mathematical model.</p>	The results showed that improvements in network reliability are substantial. It reduces time and costs, even if it is a small amount, but in the long run, all infrastructure improvements will add value to a country.
20	Imad El-Anis (2021)	Transport infrastructure and regional integration in the Middle East	Road infrastructure & road transport	The Muslim World Journal	<p>The paper aim is to investigate the relationship between transport infrastructure and economic integration and how it promotes regional trade.</p>	The results indicate that there's a direct relationship between transport infrastructure in all modes of transport and economic growth, but the barriers to those countries' having a well-constructed infrastructure are political instability and huge financial gaps.



The review illustrated the role of road transport infrastructure in several areas, such as logistics performance and the economy. Hence, the lessons learned could be as follows:

- Almost all the authors agreed that all road transport infrastructure investments such as constructing new roads, developing the existing roads, and constructing new national road networks contributed to the economic growth of a country, logistics performance, and productivity.
- Besides, road transport infrastructure investments contribute to increased transportation efficiency and lower transportation costs by improving journey time reliability, reducing congestion, increasing the efficiency of freight supply chains, and making better use of existing transportation capacity.
- Also, investing in road infrastructure provides better accessibility to markets and all supply chain entities, which increases the employment level within a country.
- Moreover, constructing efficient road transport networks facilitates freight transportation as it gives more route alternatives, and as a result, the logistics performance of a country will increase, in addition to its LPI ranking concerning infrastructure, logistics competence and timeliness indicators.
- Finally, there are some indirect contributions, such as a reduction in deaths and serious injuries from road crashes, and a reduction in environmental effects and hence, the sustainability level will be enhanced.

Concerning the conducted review of the previous research, almost all researchers used the methodology of case studies and descriptive analysis for selected countries to measure their logistics performance by using LPI and GCI as a tool. Some researchers used algorithmic models such as the accessibility matrix model, standard optimization model, and benefit cost analysis model. Additionally, other researchers used qualitative surveys to select countries and feasibility studies, and they used the structural equation model as a tool of analysis. This reveals that researchers used a variety of methods in this field. However, it is observed that no relevant article was found using hybrid methods

to get more accurate results. Therefore, future research could focus on using a mixed type of methodology with the aim of getting more reliable results in this field.

## Conclusion and Future Research Agenda

To summarize, transportation infrastructure investments are essential for the development of any country, from both social and economic perspectives. It bridges the gap between producers and consumers. Especially in road transportation, new investments facilitate the movement of passengers and freight. Thus, it reduces trip times, costs, creates new job opportunities, facilitates the connection between regions, enhances a country's economy, and helps in reaching efficient supply chain and logistics costs, such as reducing total costs and satisfying all parties. This research first started with a narrative literature review to identify the importance of transportation and transport infrastructure investments with the aim of establishing research questions. Then, a systematic literature review method was used to highlight the lessons learned from previous studies and the previously used methods. Upon which, a further research agenda could be proposed as follows:

- Almost all the researchers in previous studies from 2011 to 2021 recommend additional research to analyze the quality of road transport in specific countries using descriptive analysis of the Global Competitiveness Index and Logistics Performance Index for selected consecutive years to find out the gap according to the tool's indicators and suggest solutions to improve a country's road transport infrastructure efficiency.
- From 2011 to 2016, researchers recommended to highlight the extra costs that logistics providers pay because of bad road infrastructure and inadequate quality concerning vehicle types and their effect on the percentage of the GDP of a selected country by using a lean approach and waste minimizing techniques.
- Researchers in 2012 recommended investigating road network properties that might hinder the logistics performance of a country that might hinder its efficiency besides network connectivity,

- such as network accessibility, network safety, and network design, using simulation models.
- In 2018, researchers agreed that it is important to assess the effects of growth in high mobility and accessibility roads and their interaction effects on urban growth of a country.
  - Researchers recommended considering first the distribution of traffic density within a selected network in a country for individual destinations to implement effective investments in road transport infrastructure.
  - Researchers recommend developing a model for sub-countries focusing on road dimensions such as speed limits, congestion, and multi-or inter-modality to be able to propose scenarios that might help in increasing the freight movement transportation and logistics performance of a selected area.
  - Other researchers in 2020 recommend further research to investigate the impact of improving transportation infrastructure on social returns and a country's economy, such as employment level, road sustainability and environmental level.
  - In 2021, researchers mentioned important barriers that hinder countries from investing in their road infrastructure networks such as political instability and financial barriers. Hence, it is recommended that to investigate the impacts of these two barriers and propose solutions to overcome them.
  - Moreover, as indicated in the last section, future research could focus on using a mixed type of methodology with the aim of getting more reliable results in this field.
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