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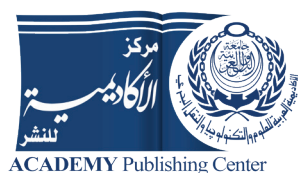
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  4. Provide executives and teachers with reports of current developments in the field of business logistics.
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## Cross border cooperation for innovative resource efficiency services in the Mediterranean

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The Mediterranean basin is expected to become a climate change hot spot in the future as the region will experience increasing temperatures and declining precipitation leading to water shortages, loss of biodiversity and risks to food production (Med ECC Network, 2019; Tuel, 2020). In this respect, the need for innovation is urgent in the field of resource efficiency services (RE), which is becoming progressively a new economic paradigm that is expected to drive development in the EU and internationally.

However, despite the fact that in the Southern Mediterranean countries there is a growing need for RE services (consulting, engineering and operations) to deal with the pressure on the environment, the RE supply persists at low levels (Volles, 2020; Euromesco Policy Study, 2021). This is essentially due to the lack of a proper innovation process that would be able to identify the needs, structure the creative solutions and commercialize them.

Indeed, competitiveness, innovation and research present consistently low values in the Southern Mediterranean countries (in Lebanon, Egypt and Jordan R&D/GDP is between 0.2 and 0.71%) (UNESCO Institute for Statistics (UIS), 2021; Beirut Research and Innovation Center, 2016). When innovation is not available locally it becomes necessary to activate an external source. However, while the EU countries have access to an internal market of half a billion of consumers with dynamics and advanced technology, the SMEs from MED countries face a higher degree of isolation. Linking both economic systems in the field of RE might

be an opportunity to match a growing demand and need with a dynamic supply.

MAIA-TAQA project (Mobilizing new Areas of Investment And Together Aiming to increase Quality of life for All) funded by the ENI Cross Border Cooperation Med Programme, will contribute to fill-the-gap by developing the right North-South Mediterranean networks and promoting in the MED markets: innovative RE services supplied by local SMEs; new institutional regulation and systems that support innovation (i.e. voucher); long-lasting commercial framework and reinforcement of local capacities.

As we are entering the 3rd and final year of MAIA-TAQA project implementation, the scene has been set, despite the big difficulties caused by Covid-19 pandemic and local political and economic crisis in Lebanon. Four innovative pilot projects are being constructed in Alexandria, Beirut, Aqaba and Amman and operation is expected till February 2022: A solar microgrid for a local wholesale market and a wastewater treatment plant, a solar cooling system and a building integrated photovoltaic system for three tertiary sector buildings, respectively.

Apart from project partners, several stakeholders actively participated in pilots definition and development, including Ministries, RTOs and regional, local and regulatory authorities. In parallel, a 60-hour training course per pilot area was created that covers vertical technology and resource relevant topics as well as horizontal topics like legal frameworks and finance

opportunities. An innovation ecosystem is being set up that will be animated throughout MAIA-TAQA's final year through the establishment of three innovation one stop shops to act as incubator nodes in Alexandria, Aqaba and Beirut. Their operation will be piloted through the function of a voucher system. Company missions of local SMEs to EU enterprises and b2b events will further empower EU - South MED business networks.

As mentioned before, innovation is a necessary element to develop the new business in the field of RE and sustainability. The peripherality of the MED area has further contributed to a lack of opportunities in this regard. Cross Border Cooperation can help to establish connections and create networks among, from one side, a more developed business environment (EU) where, innovation and research are more popular and

already introduced as a normal practice, towards, on the other side, an environment in which the innovation linkage needs to be developed.

In this context, international logistics will play an increasingly important role in the development and animation of the Euro-Mediterranean innovation and business ecosystem, as transport of goods and people can be a catalyst or a barrier to further development. For example, a researcher in Lebanon may be hosted at an EU industry manufacturing PV panels or a Spanish SME may collaborate with a research institute in Egypt for developing a novel wastewater treatment method. In MAIA-TAQA pilot in Aqaba, a Jordanian company collaborates with a Greek one for installing a solar cooling system at the local Chamber of Commerce, while the equipment is manufactured in Germany and other countries and raw materials may come from China.

*\*MAIA-TAQA project is funded by the EU under the ENI CBC Med Programme. The contents of this article are the sole responsibility of MAIA-TAQA consortium and can under no circumstances be regarded as reflecting the position of the European Union or the Programme management structures.*

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## Biography

*Dr. Perakis acquired his PhD in chemical engineering from the National Technical University of Athens in 2007. Since then he has worked for 2 years for a private Greek company in the study and development of renewable energy investment projects and afterwards in the Development Programs Division of CRES as a project manager and energy expert. He has more than 10 years of experience in managing projects supporting the development of renewable energy technologies funded by the EU and other international organizations. His geographical focus, besides Greece and other EU countries, includes South East Europe and the Mediterranean basin.*

# 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:

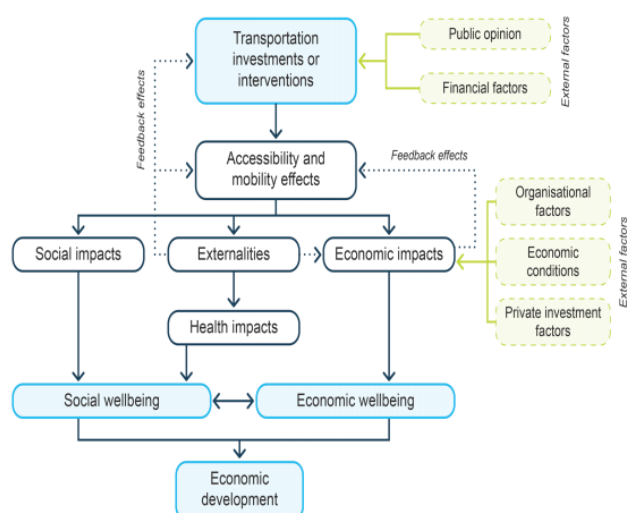


Fig 1: Transport investments impact - key connections

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 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, & Füsun Ülengin (2020)	Analyzing two-way interaction between the competitiveness and logistics performance of countries	Road infrastructure & Logistics performance	Transport Policy Journal	<p>The paper's aim is to reveal the relationship between the competitiveness and logistics performance of a country using GCI and LPI.</p> <p>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.</p>	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	<p>The paper's aim is to investigate the relationships between road freight transport in urban areas, land use, facility location, and logistics management.</p> <p>A descriptive analysis is used for 14 urban areas in the UK for their geographical areas, population sizes, economic composition.</p>	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	<p>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.</p> <p>An accessibility matrix model is used to propose scenarios for improvements.</p>	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 Stępnia (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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# An analysis of Blockchain in Supply Chain Management: System Perspective in Current and Future Research

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## Abstract

**Purpose:** This study aims to review the current academic research on blockchain, especially in the fields of business and economics. Based on a systematic review of literature retrieved from the Web of Science service, the researchers explore the top-cited articles, the most productive countries, and the most common keywords.

**Methodology:** This research conducts a clustering analysis and identifies the following five research themes: "economic benefit," "blockchain technology," "initial coin offerings," "fine tech revolution," and "sharing economy."

**Findings:** It showed that the most common subject area is Computer Science, following research by Engineering, Telecommunications, and Business and Economics. With regard to Business and Economics, several key nodes have been identified in the literature, such as the top-cited articles, most productive countries.

**Keywords:** Blockchain, Cite Space, Systematic Literature Review, Supply Chain.

## Introduction

The concepts of blockchain were first proposed by research in 2008 by someone using the pseudonym Satoshi Nakamoto, who described how cryptology and an open distributed ledger could be combined into a digital currency application (Nakamoto, 2008). Initially, the extremely high volatility of bit coin and the attitudes of many countries towards its complexity somewhat restrained its development. Nevertheless, the advantages of the blockchain, which is an underlying technology of bit coins, have attracted increasing attention. Some of the advantages of blockchain include its distributed ledger, decentralization, information

transparency, tamper-proof construction, and openness. The evolution of the blockchain has been a progressive process. Blockchain is currently delimited to Blockchains 1.0, 2.0, and 3.0, based on their implementations. The current research provides more details about the three generations of blockchain in the Appendix. The application of blockchain technology has extended from digital currency to finance, and it has even gradually extended to healthcare, supply chain management, market monitoring, smart energy, and copyright protection (Engelhardt, 2017; Hyvärinen, et al., 2017; O'Dair & Beaven, 2017; Kim & Laskowski,

2018; Radanović & Likić, 2018; Savelyev, 2018).

Blockchain technology has been studied in a wide variety of academic disciplines. For example, some researchers have studied the underlying technology of blockchain, such as distributed storage, peer-to-peer networking, cryptography, smart contracts, and consensus algorithms (Christidis & Devetsikiotis, 2016; Kraft, 2016; Cruz, et al., 2018). Meanwhile, legal researchers are concerned with regulations and laws.

As the old saying goes: "scholars in different disciplines have many different analytical perspectives and speak many different languages." This paper focuses on analyzing and combining papers in the fields of business and economics. The research aims to identify the key nodes (e.g., the most influential articles and journals) in the related research and to find the main research themes of blockchain in our discipline. In addition, the research attempts to offer some recommendations for future research and provide some suggestions for businesses that aim to implement blockchain in practice.

This study conducts a systematic and objective review based on data statistics and analysis. The research first describes the overall number and discipline distribution of blockchain-related papers. A total of 756 journal articles were retrieved. Subsequently, the research refined the subject area to business and economics, and managed to add 119 articles to our additional analysis. The research then explored the influential countries, journals, articles, and most common keywords. On the basis of a scientific literature analysis tool, the research was able to identify five research themes on blockchain. The researchers believe that this data-based literature review will be able to present the status of this research more objectively.

The remainder of this paper is organized as follows. In the next section, the research provides an overview of the existing articles in all disciplines. The research comprehensively describes the number of papers related to blockchain and discipline distribution of the literature. The research then conducts a further analysis in the subject field of business and economics, where the research analyzes the countries, publications, and highly cited papers, etc. The research also demonstrates

the main research themes of this paper, based on Cite Space. These are the recommendations for promising research directions and practical applications. In the last section, the research discusses the conclusions and limitations.

## Overview of the Current Research

This paper first conducts a study of the research of Science Core Collection (WOS), including four online databases: Science Citation Index Expanded (SCI-EXPANDED), Social Sciences Citation Index (SSCI), Arts & Humanities Citation Index (A&HCI), and Emerging Sources Citation Index (ESCI). This research chooses the WOS because the papers in these databases can typically reflect scholarly attention towards blockchain. When searching the term "blockchain" as a topic, the research found a total of 925 records in these databases.

After filtering out the less representative record types, the research reduced these papers to 756 articles that the research then used for further analysis. The research extracted the complete bibliographic record of the articles identified by the search from WOS, including information on the title, author, keywords, abstract, journal, year, and other publication information. This research was then exported to CiteSpace for subsequent analysis. CiteSpace is a scientific literature analysis tool that enables us to visualize trends and patterns in the scientific literature (Chen, 2004). In this paper, CiteSpace was used to visually represent complex structures for statistical analysis and for conducting cluster analysis. Table 1 displays the number of academic papers published per year.

The research listed the number of all the publications in WOS, the number of articles in all the disciplines, and the number of articles in business and economics topics. It should be noted that the research retrieved the literature on March 25, 2019. Therefore, the number of articles in 2019 relatively small. The number of papers has continued to grow in recent years, which indicates that there is a growing interest in blockchain.

All of the extracted papers were published in WOS

after 2015, seven years after blockchain and bitcoin were first described by Nakamoto. In these first seven years, many research papers were published online or indexed by other databases, however, they were not discussed here. The research selected only WOS, which are representative of high-level literature databases. This is the most common way to conduct a literature review (İpek, 2019).

Table I: Number of Academic Papers on Blockchain

	WOS-All	WOS-Articles	WOS- Business & Economics
<b>Before 2015</b>	0	0	<b>0</b>
<b>2015</b>	4	1	<b>0</b>
<b>2016</b>	40	28	<b>5</b>
<b>2017</b>	200	158	<b>45</b>
<b>2018</b>	553	453	<b>61</b>
<b>#2019</b>	138	116	<b>8</b>
<b>Total</b>	<b>925</b>	<b>756</b>	<b>119</b>

In the 756 articles that the research managed to retrieve, the three most common keywords besides blockchain are bitcoin, smart contract, and cryptocurrency, with the frequency of 113 times, 72 times, and 61 times, respectively. This shows that the majority of the literature mentions the core technology of blockchain and its most widely known application bitcoin,

In WOS, each article is assigned to one or more subject categories. Therefore, the research utilized CiteSpace to visualize what research areas are included in current research on blockchain. Figure 1 shows a network of these subject categories. The most common category is Computer Science, which includes the largest circle, following research by Engineering and Telecommunications. Business and Economics is also a common subject area for blockchain. Consequently, the research will conduct further analysis in this field.

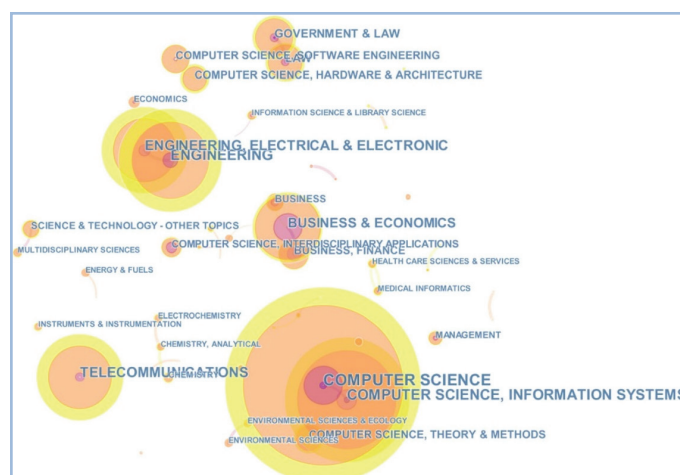


Fig. 1: Disciplines in blockchain

## Articles in Business and Economics

Given that the main objective of our research was to investigate the research of blockchain in the areas of economics and management, the research conducted an in-depth analysis on the papers in this field. The study refined the research area to Business and Economics. Finally, the research retrieved 119 articles from WOS. In this section, the research analyzed their published journals, research topics, and citations, etc., to depict more comprehensively the research status of blockchain in the fields of business and economics.

There are several review papers on the blockchain. Each of these papers contains a summary of multiple research topics, rather than a single topic. The research did not include either these literature reviews or articles; nonetheless, it also played an important role in the study of blockchain. For instance, Wang, et al. (2019) investigated the influence of blockchain on supply chain practices and policies. Zhao, et al. (2016) suggested that blockchain would be widely adopted in finance and would lead to many business innovations and research opportunities.

## Countries

The United States, the United Kingdom, and Germany are the top three countries by the number of papers published on blockchain; specific data were shown

in Table II. The United States has issued more papers than the other countries and it has produced more than one-third of the total articles. As for data collection, China contributed 11 papers, ranking fourth. A total of 119 papers came from 17 countries and regions. In contrast, the paper searched "big data" and "financial technology" in the same way, and found 286 papers on big data came from 24 countries, while 779 papers on fintech came from 43 countries. This shows that blockchain is still an emerging area of research, and it needs more countries and scholars to contribute to this research discipline.

Table II: Main Research Countries

Country	No. of Papers	%/119
USA	41	34.454%
ENGLAND	14	11.765%
GERMANY	12	10.084%
PEOPLES R CHINA	11	9.244%
CANADA	8	6.723%
FRANCE	8	6.723%

## Journals

The research counted the journals published in these papers, and found that 44 journals published related papers. Table III lists the top 11 journals to have published blockchain research. The first is "Strategic Change: Briefings in Entrepreneurial Finance," followed by "Financial Innovation" and "Asia Pacific Journal of Innovation and Entrepreneurship." The research included/covered the majority of papers published in the journal "Strategic Change" in 2017, with the exception of one published in 2018 and another one in 2019.

Table III: Top 11 Journals Publishing Blockchain Research

Source Title	No. of Papers
Strategic Change- Briefings in Entrepreneurial Finance	12
Financial Innovation	6
Asia Pacific Journal of Innovation and Entrepreneurship	5
Journal of Risk and Financial Management	4
Mit Sloan Management Review	4
Quality- Access to Success	4
Technological Forecasting and Social Change	4
Technology Innovation Management Review	4
Business Horizons	3
Intelligent Systems in Accounting Finance & Management	3
Journal of Risk Finance	3

## Cited References

Table IV presents the top six cited publications, which were cited by the research no less than five times. The list consists of three papers and three journal articles. Some of these publications introduce blockchain from a technical perspective, while others present it from an application perspective. A paper by Swan (2015) illustrated the application scenarios of blockchain technology. In this paper, the author demonstrates that blockchain is essentially a public ledger with the potential of being a decentralized digital repository of all assets—not only tangible assets, but also intangible assets such as votes, software, health data, and ideas.

The paper of Tapscott and Tapscott (2016) explained why blockchain technology would fundamentally change the world. Yermack (2017) demonstrated that blockchain would have a substantial impact and would present many challenges to corporate governance. Böhme et al. (2015) introduced bitcoin, the first and most famous application of blockchain. Narayanan et al. (2016) also focused on bitcoin and explained how bitcoin worked on a technical level. Iansiti and Lakhani (2017) argued that it would take years to truly

transform the blockchain since it was a fundamental rather than disruptive technology, which would not drive implementation, and thus companies would need other incentives to adopt blockchain.

Table IV: Cited References

Title	Author & Year	Type	Citations
<b>Blockchain: Blueprint for a New Economy</b>	(Swan, 2015)	paper	21
<b>Blockchain revolution: how the technology behind Bitcoin is changing money, business, and the world</b>	(Tapscott and Tapscott, 2016)	paper	17
<b>Bitcoin: Economics, Technology, and Governance</b>	(Böhme <i>et al.</i> , 2015)	article	7
<b>Corporate Governance and Blockchains</b>	(Yermack, 2017)	article	5
<b>Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction</b>	(Narayanan <i>et al.</i> , 2016)	paper	5
<b>The Truth about Blockchain</b>	(Iansiti and Lakhani, 2017)	article	5

## Most Influential Articles

The research cited these 119 papers 314 times in total, and 270 times without self-citations. The number of articles cited was 221, of which 197 were non-self-citations. The most influential articles with more than 10 citations were listed in Table V. The most popular article in our dataset was Iansiti & Lakhani (2017), with 49 citations in WOS. This suggests that this article has had a strong influence on blockchain research. This paper postulated that there is still some distance to the real application of blockchain. The other articles described how blockchain affects and works in various areas, such as financial services, organizational management, and health care. Since blockchain is an emerging technology, it is particularly necessary to investigate how to combine blockchains with various industries and fields.

By comparing the journals in Tables IV and V, the research found out that some journals appeared in both of the lists, such as Financial Innovation. In other words, the research papers on blockchain are the papers that come up the most in these journals, and the journal papers are highly recognized by other scholars.

Table V: Most Cited Articles

Title	Author & Year	Journal	Citations in WOS(a)
<b>The Truth about Blockchain</b>	(Iansiti and Lakhani, 2017)	Harvard Business Review	49
<b>Blockchain-based sharing services: What blockchain technology can contribute to smart cities</b>	(Sun, Yan and Zhang, 2016)	Financial Innovation	19
<b>Citizen utilities: The emerging pothe research paradigm</b>	(Green and Newman, 2017)	Energy Policy	18
<b>Blockchain and Its Coming Impact on Financial Services</b>	(Fanning and Centers, 2016)	Journal of Corporate Accounting and Finance	15
<b>Toward Blockchain-Based Accounting and Assurance</b>	(Dai and Vasarhelyi, 2017)	Journal of Information Systems	12
<b>How Blockchain Will Change Organizations</b>	(Tapscott and Tapscott, 2017)	Mit Sloan Management Review	11
<b>Hitching Healthcare to the Chain: An Introduction to Blockchain Technology in the Healthcare Sector</b>	(Engelhardt, 2017)	Technology Innovation Management Review	10
a Data last updated on 2019-04-08			

Meanwhile, although journals such as Harvard Business Review have only published a few papers related to blockchain, they were highly cited. Consequently, the journals in both of these lists were found to be of great importance.

## Research Themes

Addressing research themes is crucial to understanding a research field and exploring future research directions. This paper investigated the research topic based on keywords. The keywords are representative and provide a brief description of the article's content. First, the research analyzed the most common keywords used by the papers. The research found that the top five most frequently used keywords are "blockchain," "bitcoin," "cryptocurrency," "fintech," and "smart contract." Although the potential of blockchain applications goes beyond digital currencies, bitcoin and other cryptocurrencies are widely discussed in these articles as important blockchain application scenarios in the finance industry. Smart contracts were found to allow firms to set up automated transactions in blockchains,



thus playing a fundamentally supporting role in blockchain applications. Similar to the literature across all subject areas, studies in business and economics also frequently used bitcoin, cryptocurrency, and smart contract as their keywords. The difference found was that many researchers have combined blockchain with finance, considering it as an important financial technology.

After analyzing the frequency of keywords, the research conducted an analysis of the keyword clustering in order to identify the research themes. As shown in Figure 2, the research identified five clusters through the log-likelihood ratio (LLR) algorithm in Citespace, namely; cluster #0 "economic benefit," cluster #1 "blockchain technology," cluster #2 "initial coin offerings," cluster #3 "fintech revolution," and cluster #4 "sharing economy."

Several researchers have studied the economic benefits of blockchain. They suggested the application of blockchain technology to streamline transactions and settlement processes can effectively reduce the costs associated with manual operations. For instance, in the health care sector, blockchain can play an important role in centralizing research data, avoiding prescription drug fraud, and reducing administrative overheads (Engelhardt, 2017). In the music industry, blockchain could improve the accuracy and availability of copyright data and significantly improve the transparency of the value chain (O'Dair and Beaven, 2017). Swan (2017) demonstrated the economic value of blockchain through four typical applications, including digital asset registries, leapfrog technology, long-tail personalized economic services, payment channels, and peer banking services.

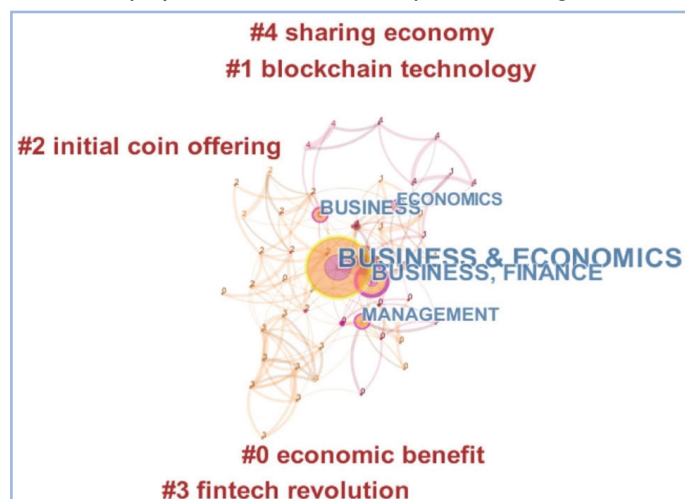


Fig. 2: Disciplines and topics

The representative paper on the "blockchain technology" cluster was published by Iansiti and Lakhani (2017), who analyzed the inherent features of blockchain and pointed out that further research was needed in order to extensively apply blockchain. Other researchers have investigated the characteristics of blockchain technology from multiple perspectives. For example, Xu (2016) explored the types of fraud and malicious activities that blockchain technology can prevent and identified attacks to which blockchain remains vulnerable. Meanwhile, Aune et al. (2017) proposed a crypto-graphic approach to solve information leakage problems on the blockchain.

Initial coin offering (ICO) is also a research topic of great concern to scholars. Many researchers have analyzed the determinants of the success of initial coin offerings (Adhami, et al., 2018; Ante, et al., 2018). For example, Fisch (2019) assessed the determinants of the amount raised in ICOs and discussed the role of the technological capabilities of signaling ventures in ICOs. Deng, et al. (2018) argued that the outright ban on ICOs may hinder revolutionary technological development and provide some regulatory reform suggestions regarding the current ICO ban in China.

Many researchers have explored blockchain support for various industries. The fintech revolution brought by the blockchain has received extensive attention Yang and Li (2018). Researchers agreed that this nascent technology may transform traditional trading methods and practice in financial industry (Chen et al., 2017; Ashta and Biot-Paquerot, 2018; Kim and Sarin, 2018). For instance, Gomber et al. (2018) discussed transformations in four areas of financial services: operations management, payments, lending, and deposit services. Dierksmeier and Seele (2018) addressed the impact of blockchain technology on the nature of financial transactions from a business ethics perspective.

Another cluster corresponds to the sharing economy. Few researchers have focused on this field and they have discussed the supporting role that blockchain plays in the sharing economy. Pazaitis, et al. (2017) described a conceptual economic model of blockchain-based decentralized cooperation that may better support the

dynamics of social sharing. Sun, et al. (2016) discussed the contribution of emerging blockchain technologies to the three major factors of the sharing economy (i.e., human, technology, and organization). They also analyzed how blockchain-based sharing services contribute to smart cities.

## Discussion

In this section, the research discusses the following issues: (1) What are the future research directions for blockchain? (2) How can businesses benefit from blockchain? The researchers hope that the research discussions will be able to provide guidance for future academic development and social practice.

### What Will be the Future Research Directions for Blockchain?

In view of the five themes mentioned in this paper, the research provides some recommendations for future research in this section.

The economic benefits of blockchain have been extensively studied in previous research. For individual businesses, it is important to understand the effects of blockchain applications on the organizational structure, mode of operation, and management model of the business. For the market as a whole, it is important to determine whether blockchain can resolve the market failures caused by information asymmetry, and whether it can increase market efficiency.

For researchers in blockchain technology, this paper suggested that the research should pay more attention to privacy protection and security issues. Despite the fact that all of the blockchain transactions are anonymous and encrypted, there is still a risk of the data being hacked. In the security sector, there is a view that absolute security can never be guaranteed wherever there is a physical contact. Consequently, the question of how to share transaction data while also protecting personal data privacy are particularly vital issues for both academic and social practice.

Initial coin offering and cryptocurrency markets have grown rapidly, which raises many interesting questions, such as how to manage digital currencies. Although the

majority of the previous research has focused on the determinants of the success of initial coin offerings, the research believed that future research will discuss how to regulate cryptocurrency and the ICO market. The success of blockchain technology in digital currency applications prior to 2015 attracted the attention of many traditional financial institutions. As blockchain has continued to reinvent itself, it is now more than capable of fulfilling the needs of the finance industry. The research believed that blockchain is able to achieve large-scale applications in many areas of finance, such as banking, capital markets, internet finance, and related fields. The deep integration of blockchain technology and fintech will continue to be a promising research direction.

The sharing economy is often defined as a peer-to-peer activity of sharing goods and services among individuals. In the future, sharing among enterprises may become an important part of the new sharing economy. Therefore, building the interconnection of blockchain may become a distinct trend. These interconnections will facilitate the linkages supply chain management, and payments in commercial operations. It will also allow for instantaneous information exchange and data coordination among enterprises and industries.

### How Can Businesses Benefit from Blockchain?

Businesses can benefit from blockchain in a variety of ways to gain an advantage over their competitors. They can streamline their core business, reduce transaction costs, and make intellectual property ownership and payments more transparent and auto-mated (Felin & Lakhani, 2018). Many researchers have discussed the application of blockchain in business.

### Accounting Settlement and Crowdfunding

Bitcoin or another virtual currency supported by blockchain technology can help businesses solve funding-related problems. For instance, cryptocurrencies support companies who want to implement non-cash payments and accounting settlement. The automation of electronic transaction management accounting improves the level of control of monetary business execution, both

internally and externally (Zadorozhnyi, et al., 2018). In addition, blockchain technology represents an emerging source of venture capital crowdfunding (O'Dair & Owen, 2019). Investors or founders of enterprises can obtain alternative entrepreneurial finance through sales tokens or initial coin offerings. Companies can handle financial-related issues more flexibly by holding, transferring, and issuing digital currencies that are based on blockchain technology.

## Data Storage and Sharing

As the most valuable resource, data plays a vital role in every enterprise. Blockchain provides a reliable storage and efficient use of data (Novikov et al., 2018). As a decentralized and secure ledger, blockchain can be used to manage digital asset for many types of business (Dutra, et al., 2018). Decentralized data storage means the data is not given to a centralized agency, but it is given to people around the world because no one can manipulate with the data on the blockchain. Businesses can use blockchain to store data, improve the transparency and security of the data, and prevent the data from being tampered with. At the same time, blockchain also supports data sharing. For instance, all the key parties in the accounting profession leverage an accountancy blockchain to aggregate and share instances of practitioner misconduct across the country on a nearly real-time basis (Sheldon, 2018).

## Supply Chain Management

Blockchain technology has the potential to significantly change supply chain management (SCM) (Treiblmaier, 2018). Recent adoptions of the Internet of Things and block-chain technologies support better supply-chain provenance (Kim & Laskowski, 2018). When the product goes from the manufacturer to the customer, important data are recorded in the blockchain. Companies can trace products and raw materials to effectively monitor product quality.

## Smart Trading

Businesses can build smart contracts on blockchain, which are widely used to implement business collaborations in

general and inter-organizational business processes in particular. Enterprises can automate transactions based on smart contracts on blockchains without manual confirmation. For instance, businesses can file taxes automatically under smart contracts (Vishnevsky and Chekina, 2018).

## Findings and Conclusion

This paper reviewed 756 articles related to blockchain on the research of Science Core Collection. It showed that the most common subject area is Computer Science, following research by Engineering, Telecommunications, and Business and Economics. With regard to Business and Economics, several key nodes have been identified in the literature, such as the top-cited articles, most productive countries, and most common keywords. After a cluster analysis of the keywords, the research identified the five most popular research themes: "economic benefit," "blockchain technology," "initial coin offerings," "fintech revolution," and "sharing economy."

As an important emerging technology, blockchain will play a role in many fields. Therefore, the research postulated that the issues related to commercial applications of blockchain are critical for both academic and social practice. The research proposed several promising research directions. The first important research direction is understanding the mechanisms through which blockchain influences corporate and market efficiency. The second potential research direction is privacy protection and security issues. The third relates to how to manage digital currencies and how to regulate the cryptocurrency market.

The fourth potential research direction is how to deeply integrate blockchain technology and fintech. The final topic is cross-chain technology—if each industry has its own blockchain system, then researchers as well as developers must discover new methods for data exchange. This is the key to achieving the Internet of Value. Therefore, cross-chain technology will become an increasingly significant topic with the passage of time.

Businesses can substantially benefit from blockchain

technology. Therefore, the research suggested that the application of blockchain be considered when businesses have the following requirements: accounting settlement and crowdfunding, data storage and sharing, supply chain management, and smart trading.

The study has some limitations. First, this paper only analyzed the literature in the research of Science Core Collection databases (WOS), which may lead to the incompleteness of the relevant literature. Second, the research literature was filtered based on the subject category in WOS. In this process, the research may have omitted some relevant researches. Third, our recommendations have subjective limitations. The researchers hope to initiate more research and discussions to address these points in the future.

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# Egypt's Participation in the Global Value Chain: A Proposed Road Map

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## Abstract

**Purpose:** This research aims to identify the current status of Egypt's participation in the global value chain (Strengths, Weaknesses, Opportunities, and Threats) while highlighting the main requirements and obstacles that face such participation.

**Methodology:** The paper investigates the current status of Egypt's participation in the global value chain, adopted the qualitative approach through conducting semi-structured interviews with all relevant parties from the governmental and private sectors in addition to experts in the field. Also, a focus group was conducted with relevant parties to analyze the current status of Egypt's participation in the global value chain and to identify the obstacles it faces. These qualitative data were analyzed using narrative data analysis methods.

**Findings:** From the semi-structured interviews and the focus group, it was concluded that Egypt has many weaknesses and challenges that limit its participation in the global value chain. Accordingly, all sectors must work on linking the domestic value chain with regional and global value chains.

**Research limitations:** This research only used structured interviews and focus groups as research instruments. Nevertheless, more research methods, such as surveys with significant stakeholders, could be used in future research to increase its value and relevance.

**Practical implications:** The paper provides a road map proposal to increase Egypt's participation in the global value chain, with a review of the role of different sectors to link the domestic value chain with regional and global value chains.

**Originality/value:** This paper proposed a road map to enhance the participation of Egypt in global value chains. Also, the paper suggested detailed action plans for different involved sectors, such as trade and investment, export and logistics, the international and multimodal transport sector, and the scientific research sector.

**Keywords:** Covid 19, Egypt, Global Value Chain, GVCs, International trade, Logistics, Participation in Global Value Chain.

**Article classification:** Original research.

## Introduction

The coronavirus outbreak has been a major test for humanity, as its coping mechanisms will have a significant impact on the global economy in the next few years, as well as the significant macroeconomic shift still facing the world today (Global Trade Review, 2020). The world trading system has been heavily influenced by major changes in trade over the past decade, these changes have also created obstacles that may change the entire global trade road map, especially as the capacity and volume of international trade and foreign investment have expanded in conjunction with the technological advances created by the Fourth Industrial Revolution (European Bank, 2020).

Egypt is slowly recovering now after turbulent years marked by social unrest and political instability, which caused a significant slowdown in the country's development in the previous period. Although the economy gradually started to grow, many of the social issues that led to the revolution have not yet been addressed, in addition to the isolation imposed by the Covid 19 pandemic. In this light, it has become important to increase the participation of Egyptian investments in the international trade map and to engage in the global value chain. However, Egypt faces many challenges that prevent increased participation in global value chains, so it is important to adopt positive changes to increase involvement in the global value chain (Information and Decision Support Center, 2020).

The paper starts with an introduction and theoretical background. Section two reviews the concept and evolution of global value chains and analyzes their impact on many economic variables, with a review of the most important successful experiences in this regard. The study then analyzes the current economic situation at the international level, especially during the COVID-19 pandemic, and its impact on global value chains, focusing on Egypt's current situation and its participation in global value chains. In section three, research methodology is illustrated, by conducting a semi-structured interview and focus group to analyze the most important opportunities and challenges facing

Egypt to enter the global value chain. Section four illustrates the results of the semi-structured interview and focus group. The paper concludes in section five by presenting the research findings and providing a road map proposal to increase Egypt's participation in the global value chain, with a review of the role of different sectors to link the domestic value chain with regional and global value chains.

## The Theoretical Framework of the Study

### *Global Value Chains Concept*

Global value chains (GVCs) can be defined as "the range of activities through which companies and workers undertake to get the product to the end-user and beyond (Jerome & Ajakaiye, 2019; Tipi et al., 2021). The concept of value chains can be traced back to the 1870s, as a result of changes in national development strategies from the import-substitution industry (ISI) to the export promotion industry (Osabuohien et al., 2015).

According to World Bank (2020), increasing participation in global value chains is one of the top priorities of many economic development strategies around the world. This is because rapid technological developments in the world over the past three decades have led to significant growth in global value chains, which now account for 50% of global trade volume. Countries that innovate and produce advanced goods and services, such as the United States, Japan, and the European Union, have the largest share in global value chains. Egypt belongs to the category of countries with a medium contribution to global value chains through raw materials and primary commodities.

## **Successful International Experiences to Activate Participation in Global Value Chains**

The analysis of the examples of other countries in increasing participation in global value chains can provide important insights and best practices to support Egypt's aim to increase such international participation.

For example, the Brazilian aviation industry is an interesting case for the participation of a developing country in global value chains, as the participation of countries in global value chains is concentrated only at an early stage of the industrialization process. Still, the aviation industry in Brazil, a high-tech sector, is an illustrative case of the participation of Brazilian companies in the entire production cycle, from design to sales and after-sales services. Manufacturers of all products in this industry receive inputs from around the world and export intermediate products and services to foreign companies.

R&D is mostly carried out by domestic institutes, such as the Aeronautics Institute of Technology, or in partnership with foreign companies. These institutes are also responsible for building capacity in services related to maintenance and repair of aircraft of all sizes, engines, components, on-board systems, design services, engineering, and industrial services (Al-Najjar, 2019).

**Tunisia** is also a good example of an Arab country working to activate its participation in global value chains, as the European Bank (2020) states that Tunisia's strategy for integration into global value chains was based on two pillars. First, the country took a step to liberalize trade, signing more than 60 trade agreements with the European Union, Turkey, COMESA, the Agadir Group, the Arab world, and with the entire African continent through the recent ratification of the African Continental Free Trade Agreement (AFCFTA).

Tariffs were simplified and decreased between 2006 and 2016, with the average tariff applied to manufactured goods dropping from 20% to 10%. Second, Tunisia promoted an attractive system for firms operating in exports in free trade zones, through which

export-oriented firms enjoyed a wide range of financial incentives and were also eligible for tax exemptions and investment grants in regional development zones. In 2016, a new investment law was implemented, which targeted foreign investors by effectively reducing red tape, liberalizing foreign equity rules, granting land, and promoting free capital movement. These strategies have had a significant impact on the growth of Tunisian exports and increased the share of companies operating in the offshore system from 0.6% in 1996 to 4% of the total private sector companies in 2016.

Currently, foreign companies represent 34% of employment in the private sector and 78% of merchandise exports (excluding energy). Globally, Tunisia's integration into the global value chain has stagnated in recent years, while the most significant trade integration has occurred in the 2000s. In this light, the country's integration into the GVCs has declined since 2011. Nevertheless, Tunisia still enjoys strong GVC integration, as the economy has strong backlinks in GVCs (European Bank, 2020).

From this analysis, this paper extracts some of the requirements necessary for successful participation in global value chains, such as the application of trade liberalization on a large scale and the need to have clear competitive advantages so that the country can obtain advanced or appropriate ratings in the competitiveness indicators determined by the Global Competitiveness Report.

Therefore, it can be stated that advantages of successful participation in global value chains include the following:

high quality of health and education, achieving political stability to reduce the risks of uncertainty when participating in global value chains, the efficiency of education and training, the efficiency of labor and business markets, the efficiency of commodity markets, efficiency of financial markets, technological and innovative modernization, commitment of companies to technological modernization and international quality standards, use of intermediate materials, high quality and conforming to international standards, the ability to perform the required tasks, activities and operations

with the highest quality and lowest price, in addition to the ability to enter and communicate with global markets according to modern systems (Global Competitiveness Report, 2018).

### ***Analysis of the International Situation in light of the COVID-19 Pandemic and Its Impact on Global Value Chains***

According to the World Economic Forum, globalization could deteriorate on the trade front. According to World Bank data, after decades of continuous growth, the volume of global trade declined due to the global financial crisis in 2009, and global trade volume has never returned to its previous growth trajectory since then (measured as a percentage of global GDP). In the wake of the effects of the pandemic, many experts expect that the pandemic and the trade war between China and the United States may push companies to move towards more local production and purchasing methods (self-sufficiency models), which may lead to a sustainable decline in global trade (Richter, 2020).

Adapting to employing the value chain proves to be difficult. Uncertainty is currently the biggest obstacle for companies, as it will hinder their ability to plan and forecast demand, allocate financial and human resources to specific projects and keep costs low (Laker, 2020). In response to this crisis, most companies have adopted the hedging approach through insurance and warehousing, seeking alternative supply solutions and better monitoring and understanding of the supply chain, in preparation for supply chain reorganization.

According to a survey made by Allianz (2020) of several companies, four out of ten companies announced that they had already started replacing suppliers from abroad. A percent of 32% of survey respondents also emphasized the focus on environmental, social, and corporate governance of suppliers to mitigate supply chain disruptions.

This will have its impact on global trade, as supply chain decisions will be driven by many possibilities associated with traditional issues that enhance or weaken competitiveness in the global supply chain,

such as production costs, quality, transportation issues, investment costs, and the demand for protection.

For policymakers, this means that governments have a role to play in enhancing the resilience of the domestic supply chain. The responses of companies are divided according to different political and economic measures, which confirms that the future will hold many possible scenarios for international production. For example, in the UK, supply chain concerns related to Brexit are self-evident, with companies concerned about cost competitiveness. In France, the focus is on labor market flexibility and investment in research and development to assert the country's position in global value chains, while in Italy companies are concerned about domestic tax incentives to boost attractiveness (Allianz, 2020).

### ***The Current Status of Egypt's Participation in Global Value Chains***

According to Information and Decision Support Center (2020), Egypt's participation in global value chains is increasing, and participation in 2018 was estimated at around \$11 million. Egypt ranks eighth in the Arab ports' waiting time index, with an average of 34.6 hours. This rank is considered among the efforts and opportunities for improvement by enhancing the competitiveness of the port. Improvements will also be achieved through digital transformation to simplify administrative procedures and customs clearance and increase the efficiency of port workers.

Egypt also ranks third in Africa in the Logistics Performance Index. Also, Egypt aims to increase the port's handling capacity from 120 million tons to 370 million tons by 2030. This is achieved through the establishment of the Red Sea Port Authority's utility station, the development of Port Said Port, and the development of port infrastructure. Egypt ranks first in Africa in the Shipping Lines Index and second in the Arab world, reaching 66.7 points in 2019. The high value of this indicator reflects the ease of access to the global shipping system for future trends, global value chains (Information and Decision Support Center, 2020).

Despite the remarkable improvement in international



indicators related to Egypt's participation in the global value chain, obstacles are facing Egypt to expand participation. The World Bank (2019) ranks Doing Business in Egypt fairly low in the category of cross-border trade (114 out of 190 countries). As nearly half of all active trading firms view customs and trade regulations as a major or serious obstacle to their business operations as illustrated in Figure 1:

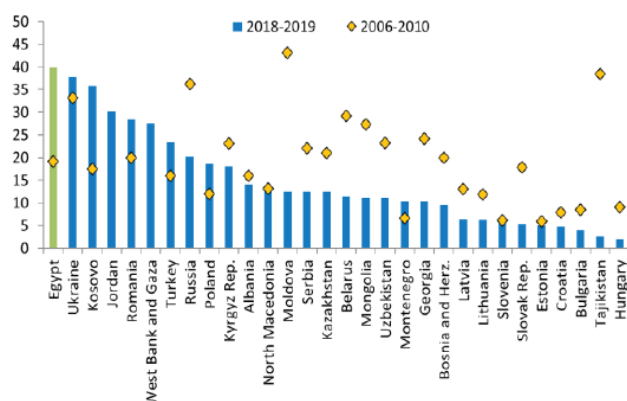


Fig. 1: Firms reporting customs and trade regulations as a major or serious obstacle (as a percentage of total firms active in trade)  
Sources: European Bank (2020)

European Bank (2020) states that trading companies face very high costs and lengthy customs procedures. Thus, only 10% of Egyptian companies are active in both export and import. The different complex regulatory frameworks and the resulting division of economic systems between exporting firms and firms operating in the large domestic market create a complex environment and lead to different levels of productivity between firms. This is reinforced by unfair competition, the extensive presence of state-owned enterprises and institutions operating in the informal sector, which represent a significant proportion of the economy.

Moreover, the scarcity of qualified labor due to lack of vocational training schools, skills mismatch, lack of compatibility with international standards, and poor-quality controls reduce opportunities for firms to enter new value chains, move up along existing value chains and benefit from access to the vast preferential markets available for Egyptian products (European Bank, 2020). In an attempt to compare Egypt's position in global value chains with other Arab countries in the region, an indicator is calculated by Giovannetti and Vannelli (2020) that

combines the quantitative and qualitative perspectives of the measures of participation in global value chains. Quantitative participation is assessed by the revealed comparative advantage (RCA) that a country holds in the products of global value chains, while qualitative participation is measured by using the PRODY index, as a proxy for value-added, and thus obtain an index in the country's global value chains (The Participation Index - PI). The study of Giovannetti and Vannelli (2020) is not comparing Egypt with Libya and Algeria, since Libya and Algeria specialize in primary activities, as well as they suffer from serious social and political challenges of recent years which leads to a decrease in their revealed comparative advantage (RCA). Therefore, this paper compares Egypt with Tunisia and Morocco as shown in Table. I:

Table I: The Participation of Egypt, Morocco, and Tunisia in Global Value Chains

GVC		Morocco	Tunisia	Egypt	PI mean
Automotive	Number of RCAs	10	15	3	9.21%
	PI	10.36%	15.09%	2.19%	
Aerospace	Number of RCAs	2	3	0	5.18%
	PI	5.71%	9.82%	0.00%	
Shipbuilding	Number of RCAs	7	13	26	10.07%
	PI	5.90%	9.57%	14.73%	
Electronics	Number of RCAs	24	58	18	9.90%
	PI	7.27%	17.97%	4.45%	
Total	Number of RCAs	40	86	46	9.58%
	PI	7.10%	15.25%	6.39%	

Source: Giovannetti and Vannelli (2020)

According to Giovannetti and Vannelli (2020), Egypt's participation in the global value chains represent a total PI of 6.39%. The country's highest major index is in the global shipbuilding value chains, which are also the highest in the region, reflecting the country's important historical traditions in this sector. However, apart from this series, the results are very disappointing. The shipbuilding value chain is followed by the electronics sector, with a very small PI of 4.45%, then the automotive sector at 2.19%, and finally the aerospace industry, with no product in the chain where Egypt has Zero RCA in the aerospace industry.

However, despite the low PI, country integration is expected to increase over the next few years, given the

large FDI inflows, especially in the electronics sector. In short, the challenges faced by Egypt's improvement in global value chains. First, an increase in PI or Egypt's participation in the shipbuilding value chain would allow the country to position itself as a leader in this sector, but at the same time would not encourage a significant improvement in the EXPY for Egypt. Second, investing to improve participation in the automotive and electronics chains would enable a significant increase in EXPY for the country as the country currently has very low PI values in these sectors.

In light of the outputs of the previous analyzes, a research methodology was formulated that aims to analyze the deepest strengths, weaknesses, opportunities, and threats facing strengthening Egypt's participation in the global value chain, and to determine the readiness of companies operating in Egypt to engage in the global value chain to draw conclusions and recommendations and develop a road map to enhance the participation of Egypt in the global value chain. The next part of the study reviews the details of the research methodology that were followed.

## Research Methodology

The study aims to answer the main question of the research problem: What is the proposed framework for increasing Egypt's participation in the global value chain? This is done by designing the research methodology to answer the following sub-research questions:

**Q1:** What is the current status of Egypt's participation in the global value chain?

**Q2:** How ready are local companies to participate in global value chains?

**Q3:** What are the obstacles that may arise while expanding Egyptian participation in global value chains?

**Q4:** What are the main obstacles and challenges that

local firms face in expanding participation in global value chains?

**Q5:** What are the strategic and technical measures to support Egyptian participation in global value chains?

**Q6:** How can the ecosystem support local companies to participate in global value chains?

To answer the previous research questions, the study adopted **the qualitative approach**, and relied, in addition to secondary data from previous studies and international reports, reviewed in the previous part, on compiling primary data from relevant parties through two research stages: **First, semi-structured interviews** were conducted with all relevant parties from the governmental and private sectors in addition to experts in the field to find out the current status of Egypt's participation in the global value chain.

**Second: A focus group** was formed with the relevant parties to analyze the main obstacles and challenges facing the expansion of Egyptian participation in global value chains and to put forward the most important strategic and technical measures proposed to support Egyptian participation in global value chains, to draw conclusions and recommendations and to set a road map to enhance the participation of Egypt in global value chains. The semi-structured interviews and a focused group were analyzed using **narrative data analysis methods**. Figure 2 summarizes the framework for the research methodology of the study and its relationship to the research questions, while the results of the analysis of the primary data and answering the research questions are reviewed in the next part.

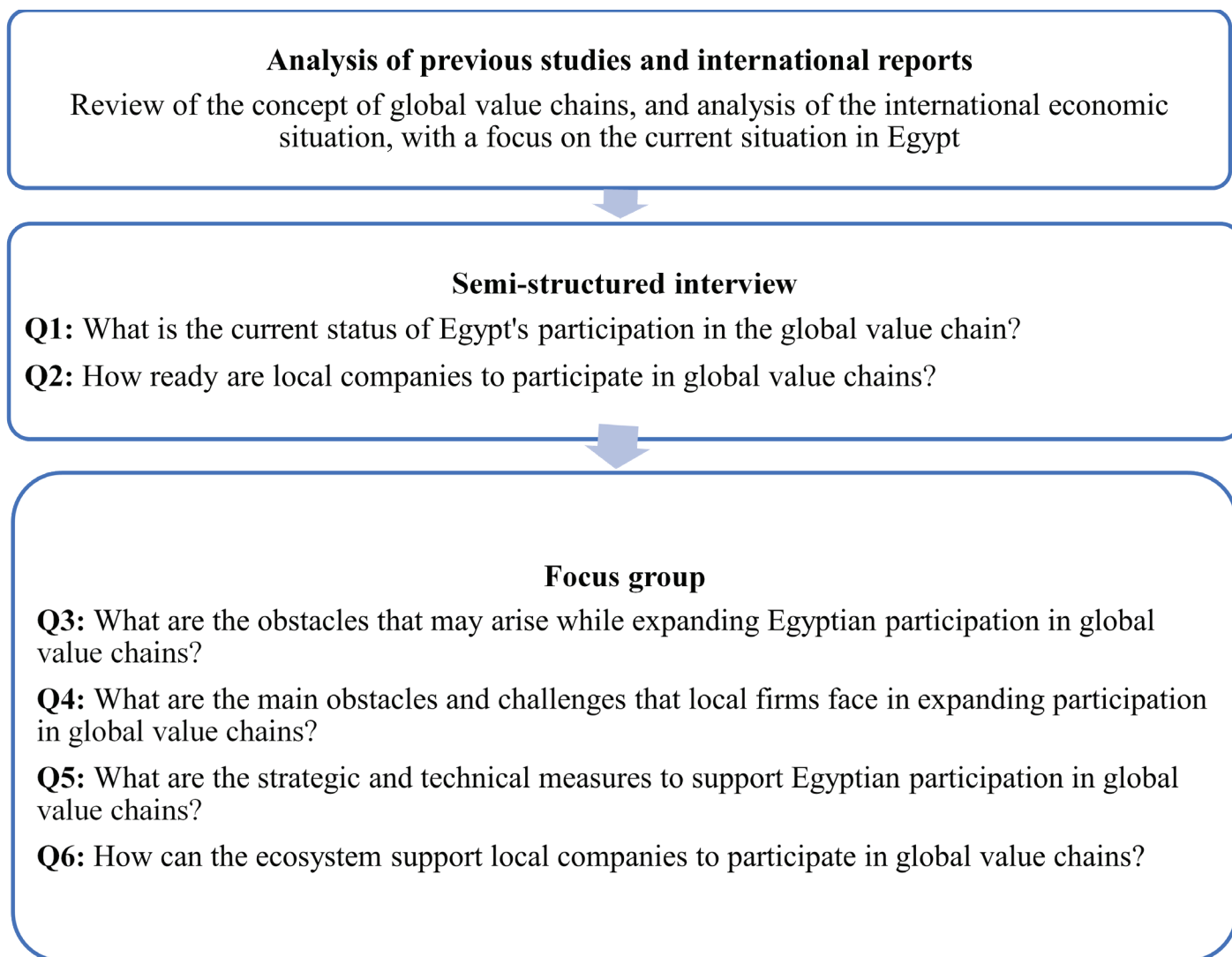


Fig. 2: The research methodology of the study and its relationship to research questions  
Source: The researchers

## Analysis of the Results

This section deals with an analysis of the primary data collected through several interviews, and focus groups with various relevant authorities from the public and private sectors and experts in the field to draw conclusions and recommendations to draw a road map to enhance the participation of Egypt and companies operating in Egypt in the global value chain.

### *Current Status of Egypt's Participation in the Global Value Chain*

To get acquainted with the current status of Egypt's participation in the global value chain and to identify the obstacles it faces, by analyzing the strengths,

weaknesses, opportunities, and threats facing Egypt to engage in the global value chain, five semi-structured interviews were conducted with representatives of the government and private sectors in the field of industry in addition to experts in the field (a representative of industrial companies, a representative of distribution companies, a representative of export and import companies, a representative of the Ministry of Supply and Internal Trade, and a consultant in the field of logistics and supply chains), where the interviews were recorded and transcribed to ensure accuracy by analyzing the answers. Table II summarizes the most important points made by the participants in the interviews regarding the current status of Egypt's participation in the global value chain and the obstacles it faces:

**Table II: The Current Status of Egypt's Participation in the Global Value Chain (Strengths, Weaknesses, Opportunities, and Threats)**

<b>Strength points</b>	<ul style="list-style-type: none"> <li>• Egypt's distinguished strategic geographical location in addition to the Suez Canal, which connects the East to the West.</li> <li>• Egypt has a comparative advantage in the field of agriculture, where the climate is moderate.</li> <li>• Egypt ranks first in the world for citrus exporting countries.</li> <li>• Availability of human wealth and cheap labor.</li> <li>• Multiple development projects such as new cities, national roads and infrastructure projects, and the development of slums and others.</li> <li>• Bilateral trade agreements that could serve many sectors and industries in Egypt if they were activated.</li> </ul>
<b>Weakness points</b>	<ul style="list-style-type: none"> <li>• Absence of a regulatory body to protect exports and market policies.</li> <li>• Absence of supervisory and regulatory bodies to protect markets and prevent export without a license.</li> <li>• Lack of a platform that works on marketing investment opportunities.</li> <li>• Lack of sufficient knowledge of the logistics officials in the Egyptian exporting companies regarding the regulations in force in the importing countries.</li> <li>• Lack of special studies to qualify the logistic officials for export operations.</li> <li>• Absence of an incentive structure that guarantees the continuity and development of emerging industries.</li> <li>• Existence of a complex legislative framework which increases the difficulty of entering new investments at the time when investment opportunities are available</li> <li>• High customs tariffs and taxes that directly affect the manufacturing industries that import components of their production from abroad in addition to affecting the logistics industry.</li> <li>• Bureaucracy and the difficulty of government procedures related to export.</li> <li>• Drivers' lack of commitment to regulations and laws and the absence of any supervision over drivers and their companies.</li> <li>• Lack of clarity on the policy of support for factories, companies, and exporters.</li> </ul>
<b>Opportunities</b>	<ul style="list-style-type: none"> <li>• Increasing the flow of foreign direct investments to Egypt.</li> <li>• Increasing and stabilizing the rate of economic growth.</li> <li>• Increasing the share of international trade exchange.</li> <li>• Developing value-added trade.</li> <li>• Improving economic efficiency and increasing development at many levels.</li> <li>• Providing advanced technology, developing the companies' capabilities, and meeting international standards.</li> <li>• Raising the capacity of the local product as a result of compliance with international controls and standards, which leads to facilitating the entry of the Egyptian product to international markets.</li> <li>• Creating better job opportunities.</li> <li>• Shifting from export of primary commodities to basic manufacturing.</li> <li>• Development of complementary industries that serve the sectors of manufacturing, transport, logistics, and agriculture.</li> </ul>
<b>Threats</b>	<ul style="list-style-type: none"> <li>• Some practices in bilateral agreements, such as imposing unjustified expenses by importing countries or obligating the exporter to document many documents.</li> <li>• Changes in political relations between countries of the world and the resulting change in commercial relations.</li> <li>• Egypt's lack of scientific research and development.</li> <li>• The unplanned and random entry of some manufacturers to the promising sectors.</li> <li>• Difficulty in complying with some of the new standards that are emerging in industries and services.</li> </ul>

Source: The researchers

It can be observed that the main obstacles which will be further discussed in the following section include: the absence of a regulatory authority to protect exports and market policies, and the absence of supervisory

and regulatory bodies to protect markets and prevent exports without a license. Other impediments mention the insufficient knowledge of the logistics officials in the Egyptian exporting companies about the regulations in force in the exporting countries and how to obtain documents to facilitate customs clearance of the importing customer, including the required controls and certificates in addition to the current legislative framework. All these hurdles make it more difficult for new investments to enter at a time when investment opportunities are available, as well as the cause rises increases in customs tariffs and taxes that directly affect the manufacturing industries that import components for their products from abroad.

### **Key Challenges for Egypt to Enter and Expand Participation in Global Value Chains**

To analyze the challenges and the most important procedures for entering and expanding participation in global value chains, to draw conclusions and recommendations in light of the above, and to develop a road map to enhance the participation of Egypt and companies operating in Egypt in the global value chain, a focus group was formed with relevant parties. The participants included six stakeholders from different sectors: retail, distribution, staging of goods, import and export, government sector, and an expert in the field of transport and logistics.

By asking the participants about the most important obstacles that Egypt and companies can face while expanding Egyptian participation in global value chains, the participants explained that participation in global value chains brings with it more trade integration and dependence on multiple countries, and the trade deficit is likely to increase in the early stages of participation in global value chains. The share of intermediate goods in international trade in global value chains is also increasing, which makes it difficult to control them, which may expose Egypt to shocks in its import accounts.

In addition, competition in global value chains is not absolute competition, but competition between major economic and commercial entities, that is, between mega monopolies. Within the framework of global value

chains, achieving independence in a country's trade policy is difficult, as is it difficult to adopt protectionist policies.

In addition, there are many obstacles that companies may face to participate in global value chains, such as lack of familiarity with the laws of the countries to which products are exported, and the imposition of additional fees from certain countries on cars and containers exported from Egypt.

In addition to obstacles in various modes of transport, land transport suffers from the age of the transport fleet and transport disruption resulting from the breakdown of transport vehicles during the delivery of goods to the ports and the resulting delays in shipping dates, with the insufficient land transport fleet to transport containers, in addition to the unjustified increase in transport prices that negatively affect the competitiveness of Egyptian products and the lack of special containers required for shipping goods in some cases (High Cab or Open Top).

In air transport, as a result of the backlog of transport requests, airlines will raise fares. In addition to the obstacles to maritime transport, especially the length of the sailing period, as the Egyptian ports are not entered with the original mother ship, but the shipment is carried out by feeders to European ports, where container terminals are transferred to other ships, which leads to a long sailing period. In addition to the inability of Egyptian ports to adapt to the continuous increase in the movement of exports at the same time when there is import movement.

To confront these numerous obstacles, the participants in the study proposed several strategic and technical measures to support Egyptian participation in global value chains. Such suggestions included working to strengthen regional value-added chains and linking them directly to global chains, which contributes to increasing productivity and increasing the competitiveness of industry, especially those with advanced manufacturing technologies.

Other suggestions were selecting sectors that are candidates to enter regional and international value chains

according to certain criteria, or sectors that achieve added value, import substitution, support for small and medium-sized enterprises, job creation, environmental protection, and energy efficiency.

Attention is directed towards developing business incubators to increase geographical coverage, enable entrepreneurs and investors to set up projects and take advantage of low-interest rates on loans, and work to keep pace with global demand trends by seeking to seize opportunities in global markets and researching the markets to which exports are directed. In this framework, it is proposed to build databases that include wide interactive platforms to bring together the various actors and ensure effective cooperation among them in various sectors with the relevant government agencies to engage in all work related to attracting and marketing investment opportunities. On the other hand, the huge momentum of online business interactions in Egypt should be taken advantage of.

It is also necessary to monitor and follow up existing companies, communicate with investors, and provide them with investment information through the investment cooperation committees of the facility locally and abroad. The business community must also be informed of the new role of the Investor Services Center, the investment map and incentives, the regular preparation of regional conferences in various regions of Egypt, the promotion of large projects, and the help of foreign investors in the search for Egyptian partners. In addition to working on developing the transportation system as a whole, the road network currently in Egypt represents a shift for Egypt, but it needs to be linked to ports and airports more efficiently to achieve total connectivity within Egypt.

The ecosystem can support companies to participate in global value chains, through the localization strategy to ensure the sustainability of local supply, provided that this covers all sectors. Also, the logistical strategy can make Egypt a hub for international companies, whether shipping, manufacturing, or trading companies, by establishing logistical centers for value-added, warehousing, and re-export activities, which ensures having a huge commercial stock to meet local and



international demand when needed. It also suggests launching a national initiative with a clear state orientation to provide facilities for individuals and companies that include positive social, economic, and environmental considerations when supplying, as this will help avoid social, economic, and environmental risks and help improve the social and environmental performance of the business. In addition to the application of modern customs technological solutions to facilitate the movement of trade.

A complementary framework must be developed among all parties in which the government plays a role in ensuring the sustainability of supply chains by imposing an appropriate legal framework that protects the public interest and supports responsible business practices and regular monitoring of business performance. Besides, the availability of flexible financial and monetary policies with global changes in addition to clarity.

The state's vision, which is reflected in the legislation and policies of the regulatory framework for the business sector, while the private sector works, as is a key partner in achieving development goals and addressing sustainability issues. This, in addition to the emergence of the role of banks in financing and investment in a more dynamic manner, as well as relying on training institutions and raising efficiency through training programs and platforms.

By reviewing the results from the previous analyzes, it becomes clear that the most important challenges facing Egypt's entry into the global value chain lie in:

- The potential increase in the trade deficit in the early stages of Egypt's participation in global value chains, in addition to the fact that it is difficult to adopt policies to protect or achieve independence in the country's trade policy;
- The absence of a regulatory body to protect exports and markets and prevent exports without a license;
- The lack of scientific research and development with the difficulty of complying with some of the new standards that are emerging on industries and services, in addition to the unplanned and random

entry of some manufacturers into promising sectors;

- Changes in political relations between countries of the world, and the resulting change in trade relations;
- The lack of a platform that markets investment opportunities in Egypt and directs investments to the required fields;
- The current legislative framework, which increases the difficulty of entering new investments at the time when investment opportunities are available;
- The high customs tariffs and taxes that directly affect the manufacturing industries that import components of their products from abroad;
- Some importing countries impose unjustified expenses or oblige the exporter to document many documents;
- Qualifying the logistic officials involved in export operations, in addition to the necessity of having knowledge of the logistic officials in the Egyptian exporting companies regarding the regulations in force in the countries of origin and how to obtain documents to facilitate customs clearance for the importing customer;
- Challenges in various modes of transport, especially the old fleet of land transport, with an insufficient transport fleet, in addition to the unjustified increase in transport prices that negatively affect the competitiveness of Egyptian products, the lack of special containers for some cases that require shipping goods (High Cab or Open Top), and the length of the sailing period;
- Companies are still in the early stages of integration into the global supply chain in terms of readiness for digital and modern applications since they are still using a traditional approach.

### ***A Proposal for a Roadmap to Increase Egypt's Participation in the Global Value Chain***

Within the framework of the previous analyzes and in light of the successful experiences that were reviewed in addition to the proposals submitted by the participants in the study, the authors propose to adopt a strategy to link the local value chain with the regional and global,

consisting in:

- Exploiting the existing infrastructure in Egypt, which is represented in the previously planned logistical areas (such as the Suez Canal axis, and the area adjacent to the East Al-Tariqa port), as well as a highly efficient network of roads, so this system can be developed within a comprehensive investment plan and link it with Central and West African countries to take advantage of opportunities to establish future export channels with Europe, the United States, and South America.
- Establishing a vertical development policy, "Vertical Integration", to direct local investments and institutions to replace imported intermediate materials that are included in the final goods to be exported with locally produced equivalents and providing these businesses with incentives as a kind of export incentive.
- Applying the sharing economy model.

This approach is based on considering the company's resources as an ecosystem, not a closed structure, where small and medium enterprises can use the mechanisms of the sharing economy to save money in the short term in light of the current crisis. They can also follow these mechanisms as a strategic approach in the long term as well by creating relationships with individuals and other institutions that can be beneficial to both parties through the flexibility of the staffing mechanism, outsourcing, and maximizing income from underutilized assets.

The proposed framework includes four main axes:

1. A governance model for supervising the activities of those economies participating in their various sectors to address any problems arising from these activities and to enhance consumer confidence.
2. Achieving conformity in legal regulations between participating markets, with the development of frameworks for determining legal liability that ensure consumer protection.
3. That modern labor policies include the concept of "part-time/part-time employment", for citizens or expatriates.
4. That the tax policies related to these activities be clear and announced by the concerned authorities

and commensurate with the reality of the establishments' activity.

Implementing Supply Chain Integration mechanisms, will lead to reducing supply chain costs, reducing time in supply operations, quality control, and reducing the costs of several operations – the most important of which are storage and distribution, quality assurance, and high competitiveness of products – in addition to improving the accuracy of demand forecasts by all partners. From this point of view, it is necessary to create incentive mechanisms to implement this approach, through the establishment of a body that can initially organize these processes to ensure the smoothness, credibility, and effectiveness of this approach, its marketing, and the protection of the rights of all parties working in it.

To activate the strategy of linking the local value chain with the regional and global, action plans are required for the different sectors as follows:

### **The Trade and Investment Sector**

- Exploiting the current economic war between the major countries to replace their imports, which have been customs duties imposed on them, with Egyptian products, as well as inviting companies that were affected to manufacture in Egyptian factories with a local component.
- Working to reconsider Egypt's trade policy and bilateral trade agreements, while maximizing the role of commercial representation to maximize the benefit of investment opportunities.
- Establishing a legislative system conducive to investment, as the crisis of the industrial sector and other investment sectors in Egypt does not lie in the lack of investment opportunities, but in the difficulty of obtaining land, licenses and financing, as well as the complexity of the legislative system and judicial disputes.
- Quickly solving investors' problems and, most importantly, preventing their recurrence, and ensuring that the decisions of the dispute settlement committees are implemented on the ground.
- Equality between private sector projects and

economic projects for all state agencies time concerning the price of land, utilities, and licenses, as failure to implement this will deter foreign investors who fear unfair competition with similar state projects.

- Developing standard designs for projects in commercial and industrial areas (building area, and height), provided that all licenses are issued once the land is allocated according to the standard design, and normal procedures are followed for projects that want other designs.
- Making a unified map of the attached lands available through all the state authorities for each activity (industrial, commercial, agricultural, tourism, and service) with spaces, prices, standard contract, allocation procedures and time for starting the project before withdrawing the land, provided that the allocation includes all approvals and licenses.
- Promoting investment for the 1000 major global Fortune 100 companies that have not invested in the region by putting in place a package of attractive incentives designed specifically for each company and traveling to present it to the head of each company, provided that it is conditioned on the percentage of a local component (which Malaysia, Turkey, and Morocco did).
- Promoting the sectoral industrial zones Cluster, including major companies, Anchor, surrounded by small and medium-sized feeding projects, by expanding the establishment of nurseries containing small workshops for young people with facilities next to major industries, so that these areas will turn into integrated industrial complexes (Clustering), as happened in the experiences of the leather industry and the furniture industry, with the necessity of Supporting it through technical assistance and promoting its products to global markets. In addition to increasing credit facilities for these projects to fill the financing gap that most small and micro companies suffer from.
- Launching the Egyptian Instant License, which can be approved online within a few minutes to conduct business activities through a single digital portal, which is an important step towards business and investment in Egypt. Having as the license category expanded, it will provide greater

flexibility for companies because the licensing system It will allow order completion easily, efficiently and quickly, and can be accessed by anyone. In addition, the approval will be issued online immediately and holders of licenses in most areas can start their activities immediately (Khalifa, 2019).

- Reducing interest rates on borrowing, as the matter has exacerbated the increase in bank interest rates on industrial and investment projects in Egypt.

## The Export Sector

The export sector will seek to launch the initiative to improve the efficiency of the export environment, which aims to understand the needs of exporters and spread the culture of export among them. It also focuses on solving the challenges they face and supporting them with support services and qualified human competencies to raise their level of satisfaction with the export environment, through:

- Supporting exports logistically and renting warehouses in free zones in the target markets, while accelerating the network of external logistics centers, to open new markets and help increase the flexibility of the supply of exported goods.
- Developing the export capabilities of the Egyptian establishments by launching a project to develop the training certificate program service for the practice of exporting, whereby building better local cadres by providing enhanced capacity building programs by international experts and making accredited training mandatory.
- Launching the consultancy services project for exporters by providing technical advice and market studies to exporters and formulating plans and policies to assist in innovation and localization of technology to improve competitiveness, whether by improving productivity or by improving product quality.
- Tax exemptions to stimulate investment, such as exempting distinguished exporters from indirect tax, exempting imports involved in manufacturing

exports from indirect tax, or tax exemptions for local producers who supply production inputs to exporting industries.

- Streamlining all export procedures at all levels and expediting the payment of export subsidy arrears due to exporters from the 2017/2018 fiscal year until 30/06/2019 to provide exporters with liquidity to meet business management requirements and pay obligations to workers and multiple entities such as insurance, electricity, suppliers, etc.
- Enhancing the orientation of Egyptian exports towards the African market, which represents only about 5% of the total Egyptian exports, taking into account the competition faced by Egyptian exports in those markets by some exporting countries through regular preparation for regional conferences in various regions of Egypt, promoting large projects and assisting foreign investors in searching for Egyptian partners.

## The Logistics Sector

The logistics sector can activate the logistical strategy to make Egypt a hub for international companies, whether shipping, manufacturing, or trading companies, by establishing logistical centers for value-added, warehousing and re-export activities, which ensures having a huge commercial stock to meet local and international demand when needed. It requires preparing an integrated map for the establishment of logistic centers and commodity exchanges for commodity markets that depend on good management of the supply chain, including storage, transportation, and distribution to achieve cost reduction and liquidity in the movement of goods flow to and from the logistic centers. This can be done through:

- Making an inventory of all the existing markets (wholesale, retail, and market) determining their area and locations, evaluating their productive and administrative efficiency, and comparing the number of markets to the population density of each governorate to determine the current situation, represented by the number of markets to the population, while determining the optimal

ratio to be reached.

- Identifying the conditions and influencing factors of the different modes of transport, storage levels, and distribution networks, and understanding the relationships between these variables to determine the locations and specifications of the logistics centers in the governorates.
- Preparing an electronic trading system to link producers, retail markets, wholesale markets, and logistics centers so that the electronic trading system performs inference processes for the dynamics of distribution by performing quantitative modeling applications for Supply Chain Modeling.
- Activating a system of financial inclusion by agreeing with some banks to facilitate the opening of a bank account for all producers and merchants dealing within the system so that opening the account includes the issuance of an electronic payment card and a contract to accept electronic payments and the provision of simple-interest financing, provided that the affiliate agrees with the conditions of the bank.

Moreover, it is proposed to establish logistic centers at three functional levels, including the work that is required to establish a mechanism for the flow of goods and information both financial and logistical:

1. The international centers are located within the boundaries of both Greater Cairo and Alexandria, which are the main urban centers in Egypt. They also contain the vast majority of Egypt's population, both in the present and in the future. Transport facilities tend to be of great importance in terms of air transport, dry ports, logistics, rail, and international/domestic transport services.
2. Regional centers that serve the collection of materials at the city or county level and that must be served by a variety of different modes of transportation.
3. Gate centers, which are centers with multiple purposes and work as both international and regional centers functionally aiming that the international centers work to facilitate the international movement of goods. The main

objective of these operations is to practice export and import operations and these centers are characterized by being connected by a series of transport corridors that supports multimodal transport operations in road, rail, and inland waterway systems.

### **The International Transport and Multimodal Transport Sector**

Reliance on the site only will not last as evidenced today by the transfer of Egypt's share, as having the pivotal ports to neighboring countries such as Saudi Arabia and Greece because of the emergence of new competitive hub ports, such as Saudi Arabia and Turkey, and the position of the port of Djibouti as an entrance to Central Africa instead of the Egyptian ports. The international transport sector must be developed and increase its competitiveness with the acceleration of multimodal transport mechanisms to reach Central Africa through:

- Preparing an annual comparative study of the costs of maritime transport services compared to neighboring countries.
- Preparing an annual comparative study of the time of maritime transport services compared to neighboring countries.
- Expediting the multimodal transport mechanisms to reach Central Africa, especially the Oweinat road to Chad, Alexandria, and Cape Town.
- Granting a discount on transit fees in the Suez Canal appropriate to the volume of transit and re-shipment in Egyptian ports.
- Focusing on increasing Egypt's share of the Belt and Road Initiative and available funding.
- Transparency and avoiding sudden decisions, especially concerning prices, as the whole world fixes prices for the whole year and new prices are announced for the next year after studying the comparative prices of competitors.
- It is permissible to negotiate directly with international companies from the perspective of the macroeconomic interest and not the return on the port.
- Promoting RoRo lines with all neighboring countries.
- The use of global risk management mechanisms

(ACCUDA) at customs, making white lists, and not charging the carrier with inspection costs, especially X-ray detection.

- Expediting the activation of the TIR agreement with the promotion and granting of all incentives to international land transport companies to modernize the land transport fleet in conjunction with the revival of the affiliated driver training centers to create a new generation of international drivers.
- Promoting the transfer of floating towers and cranes from the ports of Europe, whose volume of dealings to Egypt has decreased to activate the river transport.

### **The Scientific Research Sector**

Establishment of a (Research and Development Fund) to support the research and development activities of companies in Egypt. The Research and Development Fund grants to companies wishing to develop their activities to support research and development for:

- Innovation and technology localization by focusing on the development of scientific research to improve competitiveness, whether by improving productivity or by improving product quality.
- Contributing to providing more serious and effective technology to access global supply chains, thus reducing production costs and increasing export opportunities.

## **Conclusions**

Integration into global and regional value chains represents an important opportunity for most countries, among others, to foster industrialization and linkages between the primary sector and the rest of the economy, and to reduce heavy dependence on a small number of commodities and products. A significant portion of economic integration is the expansion of inter- and intra-regional trade, thereby achieving higher GDP growth rates, and improved resource allocation and distribution. Therefore, this paper aimed to provide a roadmap proposal to increase Egypt's participation in the global value chain, with a review of the role of different sectors



to link the domestic value chain with regional and global value chains.

The study found that Egypt faces many challenges that prevent its entry into the global value chain, such as the possible increase in the trade deficit in the early stages of Egypt's participation in global value chains, the absence of a regulatory body to protect exports and markets and prevent exports without a license, the lack of scientific research and development, the unplanned and random entry of some manufacturers to promising sectors, and the various challenges. As for transportation, just as companies are still in the early stages of being integrated into the global supply chain in terms of readiness for digital and modern applications, companies are still using a traditional approach. Therefore, action plans are required for the different sectors (the trade and investment sector, the export sector, the logistics sector, the international transport sector and multimodal transport, and the scientific research sector) to enhance the participation of Egypt in global value chains.

This paper advanced an original proposal for a roadmap to increase Egypt's participation in the global value chain, comprised of four main axes: A governance model for supervising the activities of the stakeholders of this domain to enhance consumer confidence, achieve conformity in legal regulations between participating markets, and apply modern labor policies for citizens and expatriates, as well as clear and adequate tax policies. Also, the paper presents detailed action plans for different connected sectors, such as the trade and investment sector, the export sector, the logistics one, the international transport and multimodal transport sector, and the scientific research sector.

## Future Work and Limitations

As part of the above, this study focused on investigating the current status of Egypt and providing a roadmap proposal to increase Egypt's participation in the global value chain, so it is proposed that future studies can use the same methodology used in this paper to tackle the obstacles facing other countries to propose a roadmap to increase the participation of these countries

in global supply chains. This paper did not address the implementation mechanism, and in this regard, future studies can complement this paper in listing the implementation mechanism and testing the extent of the success of the proposed roadmap to increase Egypt's participation in global supply chains.

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