TẠP CHÍ KHOA HỌC CÔNG NGHỆ HÀNG HẢI
JOURNAL OF MARINE SCIENCE AND TECHNOLOGY
ISSN: 1859-316X

ASSESSING THE NEXUS BETWEEN THE QUALITY OF PORT INFRASTRUCTURE AND ECONOMIC GROWTH: THE MEDIATING INFLUENCE OF THE GLOBAL COMPETITIVENESS INDEX IN THE CONTEXT OF 7 ASEAN COUNTRIES

ĐÁNH GIÁ MỐI QUAN HỆ GIỮA CHẤT LƯỢNG CƠ SỞ HẠ TẦNG CẢNG VÀ TĂNG TRƯỞNG KINH TẾ: TÁC ĐỘNG TRUNG GIAN CỦA CHỈ SỐ CẠNH TRANH TOÀN CẦU TRONG BỐI CẢNH 7 QUỐC GIA ASEAN

DUONG THI THUY QUYNH*, LE THI NGOC THO, LE THI THAO VAN

Faculty of International Business - University of Economic - University of Da Nang

**Email liên hệ: quynhdtt@due.edu.vn*

Abstract

This paper focuses on the impact of Port Infrastructure Quality on the national economy. In addition, the paper also examines the mediating role of Global Competitiveness in the relationship between Port Infrastructure Quality and the national economy. The scope of the paper includes seven ASEAN countries that are strategically located and play an important role in the global supply chain. The results demonstrate the significant positive impact of Port Infrastructure on the national economy. These results provide a deeper understanding of the role of Port Infrastructure Quality and provide solutions and recommendations for the Government and industry stakeholders to focus on improving the quality of port infrastructure to improve competitiveness and economic efficiency, thereby promoting the economic performance of ASEAN countries.

Keywords: *ASEAN, global competitiveness, National Economy, quality of Port Infrastructure.*

Tóm tắt

Bài viết này tập trung nghiên cứu về tác động của Chất lượng cơ sở hạ tầng cảng đến nền kinh tế quốc gia. Ngoài ra, bài nghiên cứu cũng xem xét vai trò trung gian của Năng lực cạnh tranh toàn cầu trong mối quan hệ giữa Chất lượng cơ sở hạ tầng cảng và nền kinh tế quốc gia. Phạm vi của bài nghiên cứu bao gồm bảy quốc gia ASEAN có vị trí chiến lược và đóng vai trò quan trọng trong chuỗi cung ứng toàn cầu. Kết quả chứng minh tác động tích cực đáng kể của Cơ sở hạ tầng cảng đối với nền kinh tế quốc gia. Những kết quả này cung cấp sự hiểu biết sâu sắc hơn về vai trò của Chất lượng cơ sở hạ tầng cảng và đưa ra các giải pháp và khuyến nghị cho Chính phủ và các bên liên quan trong ngành để tập trung nâng cao chất lượng cơ sở hạ tầng cảng biển nhằm cải thiện năng lực cạnh tranh và hiệu quả kinh tế, từ đó thúc đẩy hiệu quả kinh tế của các quốc gia ASEAN.

Từ khóa: *ASEAN, năng lực cạnh tranh toàn cầu, Nền kinh tế quốc gia, chất lượng cơ sở hạ tầng cảng.*

1. Introduction

The logistics sector plays a crucial role in global economic activities and international trade, with infrastructure being a key determinant of economic efficiency. High - income countries demonstrate 48% higher efficiency in infrastructure than low-income nations, underscoring the significance of infrastructure investment (Martí et al., 2014) [1]. Previous studies have highlighted the positive impacts of transportation infrastructure on economic efficiency and trade stimulation (Deng, 2013; Lan et al., 2017; Saidi et al., 2018). Infrastructure investment is fundamental for a nation's prosperity, influencing business productivity, GDP, and international competitiveness. Given the pivotal role of infrastructure in trade and economic development, investments in infrastructure are expected to enhance economic growth [2], [3], [4]. In Vietnam, efficient port infrastructure has been linked to economic gains (Nguyen et al., 2021) [5].

Besides, ASEAN plays a crucial role in the global economy as one of the fastest - growing regions and a key driver of economic growth in the Asia-Pacific. With its strategic geographic location bridging East Asia, South Asia, and Australia, and a coastline accounting for 11% of the world's total, ASEAN is home to numerous seaports along major international shipping routes. These ports serve as vital hubs for regional and global trade. By leveraging its strategic

position and developed port infrastructure, ASEAN has become a significant trading partner worldwide. The quality of port infrastructure has an increasing importance for the economic goals of the ASEAN countries now due to the current stage of deepening economic integration in the region. Therefore, this study identifies the direct and indirect effects of Port Infrastructure Quality on economic performance through the Global Competitiveness Index of ASEAN countries. Thus assisting the Government and stakeholders to gain an overview and emphasizing the significance of Port Infrastructure Quality. The study also proposes practical recommendations for the Government and relevant stakeholders to improve the quality of port infrastructure through the application of technology or encouraging investment in automation, etc., based on these results to enhance competitive advantage, international trade and economic development.

2. Literature Review

2.1. Definitions

Quality of Port Infrastructure (QPI) - This index is also different from LPI because it relates with the efficiency and quality of country level maritime infrastructure. The QPI uses a 1-to-7 scale (1 for low, 7 for high) to indicate the quality of ports and port-related services. As a reporting indicator about the adaptability and efficiency of national ports.

National Economy is one of the few development scale and prosperity of the national people's economy. A country's economy is often measured through GDP per capita, and adjusted for Purchasing Power Parity (PPP). Of which, GDP is the main factor in assessing the development of a country. According to the World Bank (World Bank), GDP reflects the economic scale of a country by measuring the total value of goods and services produced in that country. Therefore, we use GDP per capita, adjust according to the equivalent purchasing power, as the only index to represent the national economy.

2.2. Hypothesis Development

The Global Competitiveness Index (GCI) is a comprehensive assessment of a country's competitiveness at a given point in time. In the logistics industry, a country's competitiveness will be greatly affected by the quality of its port infrastructure. Therefore, investment by the State or relevant parties in building modern, efficient ports and using advanced cargo handling technology will help increase loading and unloading speed, enhance cargo security and facilitate the handling of larger ships [6]. This will help promote larger trade volumes, lower transportation costs and faster movement of goods (Notteboom & Rodrigue, 2005).

In addition, countries will have the opportunity to increase global access and expand markets when improving the quality of port infrastructure [7], [8]. Countries with efficient port infrastructure create more trust and provide faster cargo transportation services. This helps promote international trade, attract foreign direct investment (FDI) and contribute to the overall economic competitiveness of a country in the global arena (Lakshmanan, 2011; Selviaridis et al., 2008). Modern technologies and equipment will help improve the quality of a country's ports and logistics, creating higher reliability, fewer errors, better tracking and tracing of shipments to meet timely deliveries, contributing to the country's competitive advantage (Song & Panayides, 2008) [9]. Countries with well-developed port infrastructure are more attractive for import and export activities and attract international investment, so they often have high rankings in the GCI (Schwab, 2018) [10]. Limao and Venables (2001) and Lakshmanan (2011) also pointed out that in promoting import and export activities, the quality of port infrastructure and transportation costs are very important. Moreover, these two factors also emphasize the importance of QPI in shaping the economic trajectory of the country [7], [11].

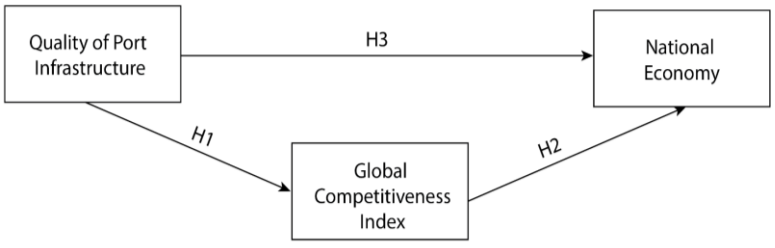

Figure 1. Proposed research model

TẠP CHÍ ISSN: 1859-316X
KHOA HỌC CÔNG NGHỆ HÀNG HẢI
JOURNAL OF MARINE SCIENCE AND TECHNOLOGY

Given these findings, the authors propose the following hypotheses:

H1: The Quality of Port Infrastructure has a positive effect on the Global Competitiveness Index.

H2: The Global Competitiveness Index has a positive impact on the National Economy.

H3: The Quality of Port Infrastructure has a positive impact on the National Economy.

H4: The Quality of Port Infrastructure has a positive impact on the National Economy through the Global Competitiveness Index.

3. Research Methodology

3.1. Data collection

Panel data is collected from the World Bank, The Global Economy, and The Global Economic Forum. The data is retrieved from secondary data of 7 partner countries of ASEAN including Singapore, Malaysia, Thailand, Vietnam, Indonesia, Cambodia and Philippines. Brunei, Myanmar and Laos are not included because of the unavailability of data. Due to data limitations, the authors collect data from 2008 to 2018. The Global Economy Forum's Quality of Port Infrastructure (QPI) data is available only until 2019, and the Global Competitiveness Index (GCI) switched to a new scale in 2018, complicating data collection. Thus, the 2008-2018 period was chosen for convenience and comprehensiveness.

3.2. Research equation

A method for determining the minimum sample size in PLS-SEM has been proposed. As our model does not have a formative measurement structure, the minimum sample size should be equal to 10 times the number of paths pointing towards a construct with the most incoming paths. From the model, it can be observed that the variable "National Economy" has the most arrows pointing towards it (2 arrows), thus the minimum sample size required is 2*10=20 samples. Therefore, our study proceeds to collect data for 11 years (2008-2018) from 7 ASEAN countries, resulting in a sample size of 11*7=77, meeting the minimum sample size requirement for meaningful PLS SEM analysis. After data collection, we decide to use PLS SEM analysis. This study employs Smart PLS 4.0 to conduct Structural Equation Modeling (SEM) analysis, R-square, and f-square calculations. Additionally, Bootstrapping is utilized to assess the significance of path coefficients.

4. Results and Discussion

P-value < 0.05, the indirect effect is statistically significant. The results show that GCI is not a mediator in the relationship between QPI and GDP per capita, nor does it mediate the relationship between QPI and GDP per capita, with p-values of 0.942 and 0.915, respectively, both greater than 0.05. This suggests that these indirect effects are not significant.

The sum of all specific indirect effects will be equivalent to the total indirect effect. In this context, the total indirect effects stemming from QPI to both GCI and GDP per capita exhibit a p-value of 0.000 < 0.05. Hence, it can be inferred that there is indeed an indirect association from QPI to GCI and from QPI to GDP per capita.

R square values of 0.75, 0.50, or 0.25 in PLS path models as substantial, moderate, and weak respectively (Henseler et al., 2009) [12]. Within the study, two variables GCI, and GDP per capita - are influenced by other variables. GCI is impacted by QPI. GDP per capita, on the other hand, is influenced by QPI and GCI. The adjusted R-squared value for GCI is 0.599, indicating that the independent variable QPI collectively explains 59.9% of the variance in GCI. Similarly, the adjusted R-squared value for GDP per capita is 0.718, demonstrating that the variables QPI and GCI collectively account for 71.8% of the variance in GDP per capita.

Cohen's f-square index is used to assess the impact of independent variables on dependent variables. In the analysis, when considering the Global Competitiveness Index (GCI) as the dependent variable, the Quality of Port Infrastructure (QPI) shows no significant impact, with an f-square value of 0.015. However, when GDP per capita is used as the dependent variable, QPI demonstrates a moderate impact, with an f-square value of 0.180, while GCI has no significant impact, with an f-square value of 0.000.

H1: The Quality of Port Infrastructure has a positive effect on the Global Competitiveness Index (QPI → GCI) Not supported

H2: The Quality of Port Infrastructure has a positive impact on the National Economy (QPI → GDP) Supported

H3: The Global Competitiveness Index has a positive impact on the National Economy (GCI → GDP) Not supported.

H4: The Quality of Port Infrastructure has a positive impact on the National Economy through the Global Competitive Index (QPI → GCI →GDP) Not supported.

Table 1. Summary of regression results

Variable	Original Sample (O)	Sample mean (M)	Standard deviation (STDEV)	T Statistics ($\|O/STDEV\|$)	p values
QPI ->GCI	0.006	0.004	0.063	0.098	0.000
GCI -> GDPper	0.009	0.008	0.088	0.107	0.915
QPI -> GDPper	0.388	0.395	0.078	4.944	0.000
QPI -> GCI -> GDPper	0.001	0.003	0.019	0.073	0.942
R - square					
				R - square	**R - square Adjusted**
GCI				0.610	0.599
GDPper				0.729	0.718
F - square					
			GCI	**GDPper**	**QPI**
GCI				0.000	
GDPper					
QPI			0.015	0.180	

Quality of Port Infrastructure and National Economy: The outcome of this study showed that the Quality of port infrastructure in seven ASEAN countries has a positive influence on the national economy which is measured by GDP/capita. The findings are consistent with the previous studies of Munim et al., (2018) and Yeo et al., (2020). This result highlights the critical role that well-functioning ports play in facilitating international trade and fostering economic development [13, 14]. In ASEAN, where intra-regional trade is substantial, high - quality port infrastructure facilitates the movement of goods, enhances trade flows, and promotes economic integration among member states. Efficient ports lower transaction costs, reduce shipping times, and improve supply chain reliability, thereby stimulating economic activity and contributing to higher GDP per capita levels. Across the ASEAN region, countries with well-developed port facilities, such as Singapore and Malaysia, have demonstrated higher levels of GDP per capita compared to those with less advanced infrastructure.

High Infrastructure Quality, Global Energy Competitiveness Index and National Economy: The study found that high infrastructure quality and national economy do not work together through the Global Energy Competitiveness Index (GCI). The study found that port infrastructure quality and national economy do not have a relationship or influence with each other through the Global Competitiveness Index (GCI). While port infrastructure has a strong and important impact on trade activities, its impact on economic competitiveness index is complex and depends on many factors such as institutions, technology and legal framework (Rodrigue, 2016) [15]. A typical example, Singapore is a country with a high GCI and this does not have a direct correlation with high GDP in this country. Therefore, GCI is only useful for assessing capacity, competitiveness, and it does not directly affect economic development. Thereby, the authors found that countries should focus on developing appropriate economic strategies, diversifying business types, promoting innovation to develop the economy in the most sustainable way.

5. Conclusion

This study provides a broader overview of economic development activities in countries with maritime systems and seaports. The research explores the relationships among the quality of port infrastructure, the Global Competitiveness Index and national economic development. Based on the analysis results, we have refuted the hypothesis that the quality of port infrastructure positively impacts the Global Competitiveness Index and that the Global Competitiveness Index positively impacts the national economy. Research also shows that in the relationship between the quality of the port infrastructure and The

TẠP CHÍ ISSN: 1859-316X
KHOA HỌC CÔNG NGHỆ HÀNG HẢI
JOURNAL OF MARINE SCIENCE AND TECHNOLOGY

National Economy, GCI does not play an intermediary. The above results provide valuable insights into these factors of 7 ASEAN countries in the context of logistics development in particular and economic development in general.

Improving the quality of logistics contributes to GDP growth and sustainable economic development. Therefore, investors and stakeholders need to have a plan to promote infrastructure development, promote efficiency and optimize logistics activities, etc. In particular, promoting investment in the quality of port infrastructure is one of the important measures to improve the quality and speed up the process of handling and transporting goods in import and export. It is possible to expand and upgrade the quality of ports or open new seaports combined with the application of automation and technology in port operation and management, which is very necessary for the logistics industry in particular and economic development in general. In addition, in order to support the seaport to operate as optimally as possible, investing in road and railway systems is also very important. It helps improve the transportation system connecting ports with important economic centers, thereby helping to shorten delivery times and cut costs. Singapore is one of the typical examples for ASEAN countries to learn from and apply in practice. Singapore has the largest seaport system in the world and continuously transports international goods. The port here has applied many advanced and modern technologies in the operation and management of seaports, helping to increase the efficiency and capacity of the port significantly. In addition, the Government can also implement the Public-Private Partnership (PPP) model to attract more investment capital from the private sector to strongly invest in port infrastructure. The State can also promote support policies and encourage the application of technology in port management. These applications not only improve port efficiency and performance but also help enhance the competitiveness of ASEAN countries. The nations of ASEAN may then work together to grow and gain from the high-quality infrastructure development, supporting the region's economic growth and global integration. Finally, expanding and maintaining regional cooperation is also an important factor. This is demonstrated through the free trade agreements established and signed by ASEAN countries, promoting exchange, business and trade activities between countries. In the study of Yeo et al. (2020), the importance of international trade is also emphasized - it acts as an intermediary. When better infrastructure and logistics will promote the development of a country, it will increase the quantity of goods, the volume of trade between countries.

REFERENCES

[1] Puertas, R., Martí, L., & García, L. (2014), *Logistics performance and export competitiveness: European experience.,* Empirica, Vol.41(3), pp.467-480.

[2] Deng. (2013), *Impacts of transport infrastructure on productivity and economic growth: Recent advances and research challenges,* Transport Reviews, Vol.33(6), pp.686-699.

[3] Lan, S., Yang, C., & Huang, G. Q. (2017), *Data analysis for metropolitan economic and logistics development*, Advanced Engineering Informatics, Vol.32, pp.66-76.

[4] Saidi, S., Shahbaz, M., & Akhtar, P. (2018), *The long-run relationships between transport energy consumption, transport infrastructure, and economic growth in MENA countries*, Transportation Research Part A: Policy and Practice, Vol.111, pp.78-95.

[5] Nguyen, C. D. T., Luong, B. T., & Hoang, H. L. T. (2021), *The impact of logistics and infrastructure on economic growth: Empirical evidence from Vietnam*, The Journal of Asian Finance, Economics and Business, Vol.8, pp.21-28.

[6] Notteboom*, T. E., & Rodrigue, J. P. (2007), *Port regionalization: towards a new phase in port development*, Maritime Policy & Management, Vol.32, pp.297-313.

[7] T. R. Lakshmanan (2011), *The broader economic consequences of transport infrastructure investments. Journal of transport geography*, Journal of transport geography, Vol.19, pp.1-12.

[8] Selviaridis, K., Spring, M., Profillidis, V., & Botzoris, G., *Benefits, risks, selection criteria and success factors for third-party logistics services*, Maritime Economics & Logistics, Vol.10(4), pp.380-392.

[9] Song, Panayides (2008), *Global supply chain and port/terminal: integration and competitiveness*, Maritime Policy & Management, Vol.35, pp.73-87.

[10] K. Schwab (2018), The Global Competitiveness Report 2018, World Economic Forum.

[11] Limao, N., & Venables, A. J. (2001), *Infrastructure, geographical disadvantage,*

transport costs, and trade., The World Bank Economic Review, Vol.15, pp.451-479.

[12] Henseler, J., Ringle, C., & Sinkovics, R. (2009), *The Use of Partial Least Squares Path Modeling in International Marketing*, Advance in International Marketing, Vol.20, pp.277-319.

[13] Munim, Z. H., & Schramm, H. J., *The impacts of port infrastructure and logistics performance on economic growth: the mediating role of seaborne trade*, Journal of Shipping and Trade, Vol.3, pp.1-19.

[14] Yeo, A. D., Deng, A., & Nadiedjoa, T. Y. (2020), *The effect of infrastructure and logistics performance on economic performance: The mediation role of international trade*, Foreign Trade Review, Vol.55(4), pp.450-465.

[15] J.-P. Rodrigue (2016), *The Role of Transport and Communication Infrastructure in Realising Development*, The Palgrave Handbook of International Development, Vol.33, pp.595-614.

Received: 15 August 2024
Revised: 30 August 2024
Accepted: 17 October 2024