The Guideline for Improving Efficiency of Rail Freight Transport Between China – Laos - Thailand Under Belt and Road Initiative: A Case Study of Thailand and Laos Rail Freight Transport

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Abstract

The objectives of this research were to study 1) the levels of transport public policy, logistics infrastructure, connectivity of transport, cross-border regulation, and rail freight efficiency 2) the influence of Transport Public Policy, Logistics Infrastructure, Connectivity of Transport, and Cross-border regulation effect on the efficiency of rail freight transport and 3) to provide suggestions for improving railway freight efficiency between Thailand and Laos under the "One Belt, One Road" initiative. This study used quantitative research methods. The sample size consisted of 308 individuals, including importers, exporters, customs brokers, and freight forwarders, obtained from Taro Yamane's sample size calculation. They were selected by proportional stratified sampling. Data were collected via the use of a questionnaire and analyzed with descriptive analysis and multiple regression model.

The research results show that: 1) transport public policy was a high level, the cross-border regulations, transportation connectivity, logistics infrastructure, and efficiency of rail freight transport including punctuality, cost saving, and convenience were the highest level 2) logistics infrastructure, connectivity of transport and cross-border regulations affect the efficiency of rail freight transportation. 3) The suggestions for improving the efficiency of rail freight transport found that the transport public policy of Thailand and Laos must have a clear goal and cooperation for further rail transport development together. cross-border regulations, transportation connectivity, and logistics infrastructure are important for government agencies to manage for the most efficiency of rail freight transport, punctuality, cost saving, convenience, and competition. The results of this research study are information for

government agencies and the private sector in both of Thailand and Laos. The related agencies can use the research results to be a suggestion for planning a strategy and setting an administrative policy for the efficiency of rail freight transport.

Keywords: Rail Freight Efficiency, Belt and Road Initiative, Public Transportation Policies, Transportation Connectivity, Logistics Infrastructure

Introduction

The Belt and Road Initiative (BRI) has emerged as a significant global development strategy aimed at promoting economic integration and connectivity among participating countries. Under the framework of the BRI, the development of rail freight transport between China, Laos, and Thailand has gained substantial attention due to its potential to enhance trade and regional cooperation. This research focuses on examining the factors that influence the efficiency of rail freight transport in this specific context, with Thailand and Laos being the case study countries. (Accadachanon, 2022)

Rail freight transport plays a vital role in facilitating the movement of goods between countries, offering advantages such as high capacity, energy efficiency, and reduced environmental impact compared to other modes of transportation. The strategic location of China, Laos, and Thailand, coupled with the BRI's emphasis on infrastructure development, has led to significant investments in rail connectivity projects in the region. The completion of the China-Laos-Thailand railway is anticipated to strengthen trade links, stimulate economic growth, and promote regional integration. (Luo Shengrong and Zhao Juan, 2021)

Despite the strategic position of the China-Laos-Thailand Railway in the regional economy, freight efficiency still faces some challenges and uncertainties, (Senate, 2023) specifically:

1. The railway only connects Laos: Currently, the China-Laos-Thailand railway project only covers Laos, resulting in fragmentation and inconvenience in regional cargo transportation.

2. Lack of railway bridge connections between Laos and Thailand: Currently, there is a lack of railway bridge connections between Laos and Thailand, which limits the connectivity of the entire railway network and affects the smoothness of cross-border cargo transportation.

3. High rail transshipment costs at Thanaleng dry port in Laos: The high rail transshipment costs may affect the economy and efficiency of cargo transportation and require further research and solutions.

However, to ensure the success of rail freight transport between China, Laos, and Thailand, it is crucial to identify and understand the factors that impact its efficiency. Various factors can influence the efficiency of rail freight transport, including infrastructure quality, logistics management, policy and regulatory frameworks, customs procedures, and intermodal connectivity. By examining these factors in the specific context of the China-Laos-Thailand railway, this research aims to contribute to a deeper understanding of the challenges and opportunities associated with enhancing the efficiency of rail freight transport under the BRI.

While previous studies have explored the efficiency of rail freight transport in different regions, there is a need for research specifically focused on the China-Laos-Thailand corridor. This case study approach allows for a comprehensive analysis of the unique characteristics, challenges, and potential solutions related to rail freight transport efficiency in the context of these two countries. By investigating the factors affecting efficiency, this research aims to provide valuable insights and policy recommendations that can aid policymakers, transportation planners, and stakeholders in optimizing rail freight operations and enhancing the overall effectiveness of the Belt and Road Initiative.

In conclusion, the efficient operation of rail freight transport between China, Laos, and Thailand is crucial for realizing the economic potential of the Belt and Road Initiative. This research seeks to contribute to the existing knowledge by identifying and analyzing the factors influencing efficiency in this specific context. The subsequent sections of this paper will delve into a comprehensive examination of these factors and their implications, providing valuable insights for policymakers and practitioners involved in the development and management of rail freight transport under the BRI.

Research Objectives

1. To study the level of Transport Public Policy, Logistics Infrastructure, Connectivity of Transport, Cross-border regulation, and the efficiency of rail freight transport.

2. To study the influence of Transport Public Policy, Logistics Infrastructure, Connectivity of Transport, and Cross-border regulation effect on the efficiency of rail freight transport.

3. To provide suggestions for improving the efficiency of rail freight transport between Thailand and Laos under the Belt and Road Initiative Project

Methodology

This research defines the area as Thailand and Laos according to a case study of Thailand and Laos rail freight transport under the Belt and Road Initiative project. The population used in this research are importers and exporters, customs brokers, and freight forwarders who ship the cargo, and do customs formality, between Thailand and Laos from the Import and Export Transport Association, Thai Authorized Customs Brokers Association, and Thai International Freight Forwarders Association, total population are 1,341 persons. The sample group used in this research is the executives of companies, totaling 308 people, obtained from Taro Yamane's sample size calculation. A proportional stratified random sampling was used for samples from 3 associations.

Quantitative research tools use the questionnaire, then take it to find the accuracy value by finding the IOC index of consistency with a value of not less than 0.50 - 1.00. The researcher took the questionnaire and tested it with a group other than the sample of 30 people to test the reliability of the tool. The questionnaire uses Cronbach's Alpha Coefficient method and the reliability of the questionnaire of this study was 0.965. The researcher prepared a complete questionnaire and collected a total of 308 sets. Quantitative data analysis uses descriptive statistics to analyze the data and multiple regression analysis to analyze the influence of the studied variables.

Results

General information, it was found that the majority of the sample were males, 200 people, accounting for 64.94 percent, followed by females, 108 people or 35.06 percent. The majority of the sample was 31 - 40 years old, 99 people (32.14%), followed by those under 30 years of age, 41-50 years of age, 93 people (30.19%). The majority of the sample had a bachelor's degree, 176 people (57.14 %), a master's degree, 76 people (24.68 %). Job positions transportation companies, the majority of the sampling group had job positions in transportation companies as managers or supervisors, 197 people (63.96%), followed by business owners, 111 people (36.04%). It was found that most of the sample groups were in agencies of the Thai Authorized Customs Brokers Association, 226 people (73.38%), followed

by the International Freight Forwarders Association, 58 people (18.83%) based on a proportional stratified random sampling method.

1) In the overall level of opinions regarding the independent variables, it was found that the cross-border regulations ($\overline{X}$ =4.27), followed by transportation connectivity ($\overline{X}$ = 4.25) and logistics infrastructure ($\overline{X}$ =4.25) were the highest level and transport public policy ($\overline{X}$ =4.11) was at a high level. For the dependent variable, the overall efficiency of rail freight transport was at the highest level ($\overline{X}$ =4.36) and when considering each aspect, it was found that the most opinion was punctuality ($\overline{X}$ =4.39), followed by convenience ($\overline{X}$ = 4.37) and cost saving ($\overline{X}$ =4.32) respectively.

2) Results of multiple regression analysis, it was found that logistics infrastructure, connectivity of transport, and cross-border regulations affect the efficiency of rail freight transportation. Transport public policy does not affect the efficiency of rail freight transportation overall. Transport Public Policy, Logistics Infrastructure, Connectivity of Transport, and Cross-border regulation can predict overall rail freight transport efficiency at 0.07.

For testing the suitability of this regression line, there is an F statistic value of 154.15 and considering an R2 value of 0.67, which can explain the variation in the overall efficiency of rail freight transport, 67 percent, and considering an Adjusted R2 value of 0.67, shows that the independent variables together discussed the results of the overall efficiency of rail freight transport at 67 percent. In addition, the standard error of estimation was considered at the Std. The error of the Estimate value of 0.28, and when considering each component, it was found that

1. Public policy on transportation Affects the efficiency of overall rail freight transport with no statistical significance (β=0.07, $p > 0.05$). The results of this analysis show that the hypothesis

2. Logistics infrastructure Affects the efficiency of overall rail freight transport with statistical significance at the 0.05 level (β=0.12, $p < 0.05$). The results of this analysis show that accepting the hypothesis

3. Connectivity of Transport Affects the overall efficiency of rail freight transport with statistical significance at the 0.05 level (β=0.35, $p < 0.05$). The results of this analysis show that accepting the hypothesis

4. Cross-border regulations Affect the overall efficiency of rail freight transport with statistical significance at the 0.05 level (β=0.39, p <0.05). The results of this analysis show that accepting the hypothesis

The prediction equation can be written in raw score form as follows.

Overall rail freight transport efficiency = 0.77 + 0.05(Transport Public policy) + 0.11(logistics infrastructure) + 0.32(transport connectivity) + 0.37 (cross-border regulation).

The prediction equation can be written in standard score form as follows.

Overall rail freight transport efficiency = 0.07(Transport Public policy) + 0.12(logistics infrastructure) + 0.35(transport connectivity) + 0.39(cross-border regulations)

Summarizes the results of testing the research hypotheses.

Independent Variable	Dependent variable Efficiency of rail freight transport			
	Punctuality	Cost Savings	Convenience	overview
Transport Public policy	✗	✗	✓	✗
Logistics infrastructure	✗	✓	✓	✓
Connectivity of Transport	✓	✓	✓	✓
Cross-border regulation	✓	✓	✓	✓

✓ accept the hypothesis

✗ reject the hypothesis

Picture 1: The results of testing the research hypotheses.

3) The suggestions for improving the efficiency of rail freight transport between Thailand and Laos under the Belt and Road Initiative Project.

1. Policy Alignment: Given the positive perceptions of stakeholders toward Transport Public Policy, it is recommended to continue fostering a policy environment that supports and encourages the development of rail freight transport. This can include regular policy reviews and updates to ensure alignment with the evolving needs of the industry and cross-border operations. Collaboration among countries involved in cross-border transportation, such as Thailand and Laos, can also be strengthened to promote policy harmonization and facilitate seamless operations.

2. Focus on improving logistics infrastructure: Since logistics infrastructure was found to have a significant impact on the overall efficiency of rail freight transport, it would be beneficial to prioritize investments and improvements in this area. Thailand and Laos

must urgently cooperate and make a final decision to build a new bridge for linking the China-Laos-Thailand speed train for more efficient goods delivery between the 3 countries. This may involve upgrading rail networks, enhancing intermodal connections, and optimizing storage and handling facilities.

3. Connectivity Enhancement: Efficient Connectivity of Transport is crucial for addressing cross-border transport challenges. It is suggested to focus on collaborative efforts to enhance transport connectivity between Thailand and Laos, and regions. This can include initiatives to improve intermodal linkages, information-sharing systems, and coordination mechanisms to ensure seamless connectivity among different modes of transport and across borders.

4. Review and streamline cross-border regulations: The analysis revealed that cross-border regulations significantly influence rail freight transport efficiency. It would be advisable to assess and streamline these regulations to reduce barriers and facilitate smoother cross-border operations. This may involve harmonizing standards, simplifying customs procedures, and establishing efficient regulatory frameworks.

5. The efficiency of rail freight transport involving punctuality, cost saving, and convenience of transport are the highest demand for the importer and exporter. It found that the transport public policy of Thailand and Laos must have a clear goal and cooperation for further rail transport development between Thailand and Laos. cross-border regulations, transportation connectivity, and logistics infrastructure are important for government agencies to manage for most efficiency of rail freight transport and be competitive.

Overall, by focusing on improving logistics infrastructure, enhancing transport connectivity, streamlining cross-border regulations, and monitoring public policy, stakeholders can work towards optimizing the efficiency of rail freight transport and potentially achieve even better results. By implementing these recommendations, policymakers, transportation planners, and stakeholders can work towards optimizing rail freight operations and maximizing the benefits of the Belt and Road Initiative in the China-Laos-Thailand corridor.

Discussion

The research findings provide valuable insights into the influence of various factors on the efficiency of rail freight transport. The study focused on Transport Public Policy, Logistics Infrastructure, Connectivity of Transport, and Cross-border regulation and their impact on rail freight transport efficiency.

1) Transport public policy is at a high level of opinion. Transport public policy is important to the significant efficiency of rail freight transport. It can be seen that the public policy framework creates an environment conducive to the success of the China-Laos-Thailand Railway, transport policies of Thai and Laos must effectively address the needs and challenges of cross-border trade and logistics, Transport public policies of Thai and Laos adequately support the development and growth of the railway transportation sector were the items with the most comments corresponds to Thai Senate Transportation Committee (2022), that Thailand continues to develop and seeks a more prosperous nation moving forward, and it has identified several official policy initiatives. Douangk, (2018), stated that transport public policy is important for logistic infrastructure, connectivity of transport for both countries, and efficiency of rail freight transport

2) Logistics Infrastructure was at the highest opinion level. Logistics Infrastructure is important to the significant efficiency of rail freight transport. Ongoing developments in logistics infrastructure at the Thai–Laos border increase the efficiency of rail freight transport, Logistics infrastructure is an important strategy to facilitate seamless connectivity with other transportation modes, Investments in logistics infrastructure connecting the Thai-Laos rail way have positively impacted the efficiency of rail freight operations that correspond to Phritsaya et al. (2023) found that the logistics infrastructure supporting the tourism industry in Borikhamsay Province had the highest average level, followed by the level of convenient transportation facilities to tourist sites and accommodation, and Reddy (2023) stated that increasing infrastructure investment will promote the development of India's industry and logistics sector.

3) Transportation connectivity was at the highest opinion level. Transportation connectivity is important to the significant efficiency of rail freight transport. Efficient connectivity effectively addresses bottlenecks for cross-border transport and collaborative efforts in enhancing transport connectivity between Thai – and Laos under the Belt and Road Initiative increase the efficiency of rail freight transport corresponds mentioned that in the road transport system, damage to agricultural products is inevitable and accounts for a significant proportion. , according to Tao Qing (2017), after the completion and operation of the China-Laos Railway, road-rail combined transport will become an important operation mode for this logistics corridor.

4) Cross-border regulations were at the highest opinion level**.** Cross-border regulations are important to the significant efficiency of rail freight transport. Harmonizing cross-border regulations between Thailand and Laos reduces barriers to rail freight transport, Regulations need to be updated and adapted to evolving challenges in cross-border logistics and the coordination between Thai and Laos on cross-border regulation increases rail freight efficiency corresponds to Wang, (2022) emphasized that the safety work of the Mohan-Boten section in Laos should be equally important as the domestic Yu-Mo section.

5) The efficiency of rail freight transportation and punctuality is at the highest opinion level. Punctuality is important to the significant efficiency of rail freight transport. Transporting goods by rail system between Thailand-Laos-China reduces transportation time compared to road transport, Real-time monitoring systems contribute to maintaining punctuality in railway operations, Efficient transport connections affect time efficiency in delivering goods, Punctuality is a key priority in the overall planning and execution of rail freight services and Transporting goods by rail requires consistent punctuality corresponds to Nat Niwatanon (2018, cited in Sarochinee Suktrakul, 2022) states that the objective of managing the transportation business is as important as ensuring safe transportation, which is timely delivery to the destination.

6) Cost saving was at the highest level. Cost saving is important to the significant efficiency of rail freight transport. Most comment on the efficiency of rail freight transport for cost saving are businesses perceive railway freight as a viable option for crossborder cargo transportation in terms of cost savings and investments in the railway network lead to long-term cost efficiencies for stakeholders. This corresponds to Ren Xiaowei (2022) which stated that cost control refers to the control of production according to production requirements during production activities.

7) Convenience was at the highest level. Convenience is important to the significant efficiency of rail freight transport. it was found that the item with the most opinions was Stakeholders find the railway system to be a convenient and practical choice for freight transportation, followed by Customs formality facilitated for transshipment of cargo between Thai-Laos, The convenience of using the China-Laos-Thailand Railway is a key consideration for cargo transport to China, The transshipment yard at Thanalaeng is convenient for connectivity of transport and Efforts to enhance convenience such as simplified

documentation processes are noticeable. This corresponds to Anderson et al. (2013) studies measuring and valuing convenience and service Quality.

Discussion for the results of the hypothesis testing.

Results of multiple regression analysis, logistics infrastructure, connectivity of transport, and cross-border regulations affecting the efficiency of rail freight transportation, transport public policy does not affect the efficiency of rail freight transportation. For rail freight transport operation, logistics infrastructure, connectivity of transport, and cross-border regulations directly affect the efficiency of rail freight transportation corresponds to Prasathai (2023) who pointed out that important elements of becoming a logistics hub consist of infrastructure aspects and service operations aspects. The level of infrastructure determines the driving force of service operations and the quality of management preparedness, while also influencing the level of service operations. In the same opinion, Tao Qing (2017) stated that after the completion and operation of the China-Laos Railway, road-rail combined transport will become an important operation mode for this logistics corridor. Efforts need to be made to build a multimodal transport system through coordinated planning, production, information, and operational collaboration. Yao Xin (2017) pointed out that to improve the efficiency of railway logistics transportation, it is necessary to optimize transport routes rationally. railway logistics enterprises should take the initiative to take on the responsibility of coordinating with road logistics and sharing information with road logistics companies through co-building logistics systems and other means. This way, when the train arrives at the station, the corresponding trucks can load the goods promptly, greatly improving the efficiency and transportation effectiveness of the entire railway logistics system Nopparada Khamchuenwong (2020) stated that Cross-border freight transport is an important component of international trade. It opens up the opportunity to access the markets of other countries for trade and investment. Issues in laws, regulations, and regional agreements related to cross-border goods have a direct impact on entrepreneurs, causing costs and time for transporting goods to increase. And there are a lot of products stuck at customs checkpoints. Therefore, if the laws related to cross-border transport of goods are improved to be consistent with the principles of border crossing of goods according to international principles or regional agreements, standardize and unify regional agreements including developing trade facilities and transporting goods to be more efficient. It will help encourage more trade and investment between ASEAN countries. It is also an opportunity to develop and increase trade

opportunities, and investment of Thailand and neighboring countries in the ASEAN group as well. For the transport public policy which does not directly affect to efficiency of rail freight transport, it must be managed by government agencies or the concerned private sector, then affects to efficiency of rail freight transport.

Conclusion

The research findings shed light on the importance of Transport Public Policy, Logistics Infrastructure, Connectivity of transport, and Cross-border regulation in enhancing the efficiency of rail freight transport. The positive opinions expressed by stakeholders demonstrate the recognition of these factors as critical for improving rail freight operations. The study highlights the need for supportive public policies, investments in logistics infrastructure, seamless connectivity, and harmonized cross-border regulations to promote efficient and cost-effective rail freight transport. These findings can inform policymakers, transportation authorities, and industry stakeholders in their decision-making processes to optimize rail freight operations and foster economic growth. Further research and collaboration among relevant stakeholders can build upon these findings to continually improve the efficiency and effectiveness of rail freight transport systems.

Suggestions

1. Guidelines for developing land and rail freight transport links at the border checkpoints of Thailand-Laos, Malaysia, Cambodia, and Myanmar.

2. Guidelines for increasing the volume of rail freight transport between Thailand, Laos, and China.

References

Accadachanon, W. (2022). *Research on the problems and countermeasures of China-Thailand railway construction cooperation*. (MA thesis) Hubei University.

Danthamrongkul. W. (2019). *Administration*. Bangkok: Third Wave Education.

Douangk, V. H. (2018). *Research on the Development of Economic and Trade Relations between Laos and China*. PhD Thesis of Shandong University.

Khamchuenwong, N. (2020). *Cross-border transportation of goods.* Retrieve on November 20, 2023, from https://researchcafe.tsri.or.th/the-impacts-of-goods-in-transit-regulatory-reform-and-trade-facilitation-improvement-on-thai-trade-and-investment/

Lin Zhongyi. (2024). *Research on the impact of the opening of the China-Laos Railway on the economic development of Nong Khai Province in Thailand: Thailand's perspective*. (MA thesis). Guangxi University for Nationalities.

Luo Shengrong & Zhao Juan. (2021). Railway cooperation between China and Southeast Asian countries is on the rise. *World Knowledg, 03*, 68-69.

Mihaiu, D. M., Opreana, A. & Cristescu, M. P. (2010). Efficiency, effectiveness, and performance of the public sector. *Romanian Journal of Economic Forecasting, 4,* 132-147.

Phritsaya, P., Panida, N., Chonlapasorn, S., & Rachanon, T. (2023). *The Logistics Infrastructure to Support Tourism in Phatthalung Province.* Retrieved on November 25, 2023, from https://so04.tcithaijo.org/index.php/jsd/article/download/259769/177015

Prasathai, C. (2023). *Infrastructure Readiness to Be a Center for Health Logistics Service Providers*. Retrieved on November 25, 2023, from https://researchcafe.tsri.or.th/infrastructure/

Reddy, S. (2023). *Growing Infrastructure Investments to Boost Indian Industrial & Logistics Sector.* Retrieved on November 25, 2023, from https://th.savills.co.th/blog/article/202672/india-aritcles/growing-infrastructure-investments-to-boost-indian-industrial-and-logistics-sector.aspx

Senate. (2023). *Guidelines for developing rail transport connectivity between Thailand, Lao PDR, and China*. Retrieved on November, 20, 2023, from https://www.senate.go.th/view/386/รายละเอียดข่าว/ActivitiesCommittee/20/TH-TH

Senate Transportation Committee. (2022). *Guidelines for developing rail transport links between Thailand, Lao PDR, and China*. Retrieved on November, 25, 2023, from https://anyflip.com/kshdj/jldr/basic

Tao, Q. (2017). Discussion on the Logistics Development of the China-Laos Railway International Intermodal Transport Channel under the "Belt and Road" Initiative. Railway Freight, 10.

Wang, G. (2022). Research on High-Quality Operation and Development Strategies of China-Laos Railway. *Railway Transport and Economy, 44*(11), 6–11.

Yao, X. (2017). A Brief Analysis of Factors Influencing Railway Logistics Transport Efficiency. *Modern Economic Information, 01*.