The Key Factors to improve Thailand's Logistics System during the COVID-19 period

Teerasak Charoennapharat and Poti Chaopaisarn
Graduate Program in Industrial Engineering,
Department of Industrial Engineering, Faculty of Engineering,
Chiang Mai University, Chiang Mai 50200, Thailand
Teerasak_ch@cmu.ac.th
Excellent Center in Logistics and Supply Chain Management,
Faculty of Engineering, Chiang Mai University,
Chiang Mai 50200, Thailand
Poti@eng.CMU.ac.th

Abstract

COVID-19 has made precision logistics more critical than ever before and logistics management more complicated. Which must the help from the government, It relate to set the direction of policy priority for solving the logistics problems of Thailand during COVID-19. Therefore, this research aims to find factors that should be urgently improved and developed to increase the efficiency of the Thai logistics system. This study demonstrates to implement optimal investment priorities and enact appropriate regulations to improve Thailand's logistics system, which reducing resource waste and inefficient investments and promoting industrial development and international trade, by using the consistent fuzzy preference relations (CFPR) method to weigh the significant factors influencing Thailand's logistics system improvement.

Keywords
Logistics systems, Delphi Method, CFPR, COVID -19

1. Introduction

Logistics systems were essential for national competitiveness (Wong and Tang, 2018). As a result of rising globalization, several nations have focused more on improving their national logistics costs in order to improve their competitiveness and support their national development objectives (Havenga, 2018). The World Bank's Logistics Performance Index (LPI), Doing Business's Trading Across Borders Indicators, and the World Economic Forum's Global Competitiveness Index are only a few examples of global indicators connected to national-level logistics. Although these indicators give useful macro-level information for countries, they are insufficient for assessing domestic and internal logistics operations in particular countries (Banomyong et al., 2021).

Developing a national logistics system requires big data from providers and significant investment from the government to use investment capital effectively and rightly determine the policy. Prioritization of development is required. However, while choices have been made regarding the critical tasks that must be completed to strengthen the country's logistics system, a precise investment plan for rapid and effective improvement has yet to be developed. Furthermore, only a small amount of study has used quantitative analysis to identify the critical issues that must be addressed to enhance Thailand's logistics system (Banomyong et al., 2021; Garza-Reyes et al., 2018). Furthermore, the COVID-19 pandemic directly impacted logistics providers during the COVID-19 crisis. Logistics organizations, an essential element of value chains, assist businesses to get their products to customers by facilitating trade and commerce inside and across international boundaries. As a result, supply chain interruptions induced by the pandemic might influence the sector's competitiveness, economic development, and job creation. The COVID-19 epidemic has had a significant impact on logistics providers, exposing the vulnerability of operations in the provider sector and introducing new problems. Policymakers have had the difficult job of supporting health care and unemployment while staying within the constraints of economic and financial framework actions to avoid a complete economic shutdown. (Choi, 2020; W. Liu et al., 2020; Singh et al., 2021).

Furthermore, organizations have sought to resolve the shift in consumer and supplier paradigms while also preserving potential operational and economic difficulties (Mirza et al., 2020). Furthermore, suppliers have had difficulty managing the logistics supply chain across borders and enabling commerce and business (Aday and Aday, 2020). Therefore, this study aims to provide recommendations for the Thai government on how to prioritize policy and investments in order to improve the logistics system and reduce costs, expenditures, and ineffective investments while enabling logistic service providers and international trade development in the COVID-19 context. In addition, this research aims to give insights into the state of Thailand's logistics system for the benefit of logistics players in the nation, allowing them to adopt appropriate strategies in line with the government's overall goals in the COVID-19 scenario. Experts from the logistics service providers will analyze the essential aspects needed to enhance Thailand's logistics system in this research. In this situation, a suitable methodology was necessary to enable the extraction and assessment of both quantitative and qualitative aspects and contribute to the improvement of the country's logistics system. As a result, the CFPR technique will be used in this study, which is an effective and well-known tool for facilitating information extraction in decision-making processes. The CFPR may be used to assess the significance of essential elements relating to logistical improvement (Doan et al., 2021).

2. Literature Review

2.1 Logistics systems

There have been several logistics systems resolves, all of which have evolved through time. Materials, parts, and finished products, as well as their marketing channels, were purchased with care, and data was circulated, transported, and stored via logistics (Christopher, 1992). Indicated that logistics, which account for most of a company's costs, has had a substantial influence on economic activity. In addition, (Kuo and Chen, 2010) claim that businesses may have difficulty delivering finished items or developing efficient logistics methods. Assume the country where they conduct business lacks warehousing, transportation, telecommunications, and other relevant sectors. A country's competitiveness may be determined by its logistics infrastructure (Ekici et al., 2016) and it can attract a greater number of FDIs (Banomyong, 2010). Many academics have used various techniques to investigate the factors that impact a country's logistics system's capacity.

For example, (Ruijgrok, 2017) evaluated physical logistics structures (e.g., efficiency, warehousing, logistics costs, transportation systems, inventories in the national economy, distribution channels and patterns, and handling and packaging of materials) as well as organizational structures and strategies. A literature assessment of current research concerning the frequent causes of logistical difficulties and important factors in the development of national logistics systems will be accomplished in the following section. This section of the study will also address the critical need for more research on Thailand's logistics system. Following that, the major components and findings of the study will be explored in depth. This study findings and suggestions for further research will be given at the end. Otherwise, the author intended to highlight stakeholder values and business rules that ease the transportation of products inside the country's logistics system's current infrastructure. (Raut et al., 2019) They also identified critical criteria for improving logistics, includes human development, regulations, infrastructure, and integration

Many researchers have studied Thailand’s national logistics system. For example, (X. Liu, 2016) was analysis effect of logistics costs on economic development in Thailand, which revealed that the Thai economy faced the problem of low logistics efficiency. That showed an exceptionally high logistical cost compared to gross domestic product. (Rungskunroch et al., 2019), Evaluated the connectivity of modern transportation and logistics for sustainable development in Thailand for investigates the linkages of existing rail transport to current air transport and other modes of transport to support future needs.(Pengman, 2020), intended to investigate the capacities of Logistics Service Providers about cross-border operations between Thailand and Malaysia. This study aimed to develop an appropriate model for assessing logistics service providers' capabilities for cross-border processes between Thailand and Malaysia. This was accomplished via a review of the literature of online sources and data collection from a variety of international and domestic documents obtained through internet searches of online databases and statistical data from annual reports of national and international organizations. (Chotechoei, 2018), was educated on the variables influencing the effectiveness of logistics management among Thailand's small and medium-sized logistics service providers. According to the findings, quick response strategies, office information systems, relationship retention, transportation, relationship establishment, facility site selection, warehousing, and storage all positively affect the efficiency of small and medium LSV logistics management in Thailand.

The research also identified several issues that each part wanted to resolve and suggestions for critical logistical operations that would help Thailand's logistics systems improve. Until far, research articles on Thailand's logistics system have focused on only a few aspects of the system or on analyzing the system's overall status. A limited number of research have concentrated on defining the ideal prioritizing sectors to develop Thailand's logistics system or to facilitate industrial improvement, reduce ineffective investments and wasted resources, or immediately improving the position of Thailand's logistics system in the world logistics index. From research reviews of many criteria (both quantitative and qualitative) is used Multiple-criteria decision-making (MCDM) for help to decide, which had various methods used to resolve MCDM problems. The analytical hierarchy process (AHP), for example, is one of the most commonly used approaches for establishing priority amongst given qualities by comparing critical pair criteria (Wind and Saaty, 1980). This technique, however, has drawbacks, such as the length of the questionnaire. It has many questions (n (n - 1)/2) for evaluating the n criteria, which may cause respondents to become confused. (Macharis et al., 2004). (Saaty and Ozdemir, 2003) also pointed to inconsistency in AHP's implementation, as the expert judgment was often inconsistent, and their assessments were inaccurate. For this reason, the CFPR method developed by (Herrera-Viedma et al., 2004), a linear weighting technique, was used to solve the problem. Consistency, computational simplicity, and effective criteria are also included (Chao and Chen, 2009). As a result, the CFPR approach was utilized in this study to identify and analyze the essential variables needed to enhance Thailand's logistics system from an LSV standpoint.

2.2 COVID-19 economic impact

Since the emergence of COVID-19, one of the most difficult challenges has been estimating the projected harm to human health and the global economy, which is made more difficult because various regions of the world are affected differently. COVID-19 outbreaks forced governments to take steps to prevent the spread of the disease, which hampered economic operations and harmed logistics and transportation networks in the maritime, rail, aviation, and trucking industries (Choi, 2020; W. Liu et al., 2020). Furthermore, (Aloi et al., 2020) investigate the influence of COVID-19 on urban mobility, reporting a 76 percent decrease in total mobility, primarily due to a 93 percent decrease in public transportation users. Finally, trade restrictions, supply constraints, and a shortage of skilled personnel significantly impact supply chains and freight volume (Loske, 2020). In the situation of COVID-19, (Ivanov, 2020) modeled the effects of pandemic outbreaks on global supply networks. Decision-makers may utilize the findings of this report to forecast the immediate and long-term effects of epidemic breakouts on COVID-19 and design strategies to deal with the pandemic.

3. Methods

Through computational simplicity and consistency, the CFPR technique aided in assessing the path selection process by establishing priority for criteria (Chen and Chao, 2012). The CFPR method is also used to solve many decision-making problems in documents (S. Liu and Qian, 2019; Nguyen et al., 2015). Under uncertainty, decision-making in the selection of transportation routes was an MCDM problem with quantitative and qualitative variables. If there is no precise data, expert expertise will be required to solve the problem (Pham et al., 2018).

3.1 The Delphi Method

The RAND Corporation created the Delphi approach in the 1950s to forecast the influence of technology on combat. This approach was used to find the most trustworthy consensus from iterated "group replies" to consecutive surveys to deal with a complicated situation (Helmer, 1972). Therefore, this strategy is used in a wide range of disciplines to identify and prioritize challenges for management decision-making (Cheng et al., 2017). The Delphi method entails a group of experts with extensive expertise and knowledge on a particular issue responding to questions.

3.2 The CFPR Method

This research used the CFPR method developed by (Herrera-Viedma et al., 2004) to assess the importance of logistics criteria. The CFPR method defined a dual comparison preference matrix for the decision-making defined by the passive addition property. Moreover, to improve the problem of uncertain and inaccurate assessment, the linguistics scale was a powerful fuzzy theory-based approach using the linguistics scale (Akkaya et al., 2015). (Zadeh, 1996) presented the fuzzy set theory using fuzzy triangular numbers. Recently, (Mathew et al., 2020) proposed combining AHP and TOPSIS for advanced manufacturing system selection under spherical fuzzy sets. The following improvements were made to the key definitions and propositions: (1) the relative importance scale was reduced from 9 to 5 to make a simpler judgment Table 1, and pairwise comparisons reduced the intensities of importance from 17 to 9, resulting in a higher chance of responses; and (2) the assessment criteria for the CFPR method included both

quantitative and qualitative factors. In terms of quantitative aspects, this article obtained correct data and used questionnaires to acquire qualitative data.

Table 1. Linguistic terms for the criteria's importance weight

Relative Importance	Linguistic Terms
1	Equally important (EI)
2	Weakly more important (WI)
3	Strongly more important (SI)
4	Very strongly more important (VI)
5	Absolutely more important (AI)

3.2.1 Preference Relations

Decision-makers calculate a set of criteria and options to define preference relations; the value represents the preference rate of the two criteria or alternatives. Two preference relations were applied: (1) the multiplicative preference relation; and (2) the fuzzy preference relation.

1. Professionals express their preferences for a set of options X using a preference relation matrix in the multiplicative preference relation A, $A \subset X \times X$, $A = a_{ij}$, $\forall$ i, j $\in$ (Gani, 2017), in which a_{ij} indicates the ratio of the preference ratio of alternative x_i to x_j.

$$a_{ij} \in [\frac{1}{5}, 5]$$

As $a_{ij} = 1$ denotes an equivalence between x_i and x_j, and as $a_{ij} = 5$ denotes that xi is absolutely preferred to x_i, the preference relation R is proposed to be a multiplicative reciprocal:

$$a_{ij} * a_{ji} = 1 \quad \forall i, j \in \qquad (1)$$

2. In the fuzzy preference relation, the ratio of the preference intensity of alternative xi to that of xj is indicated by expert assessments of a set of alternatives, in which X indicates a positive preference relation matrix $P \subset X \times X$ with membership function $\mu p\ (x_i, x_j) = p_{ij}$. When $p_{ij} = \frac{1}{2}$, there is no difference between xi and x_j($x_i \sim x_j$), whereas $p_{ij} = 1$ indicates that xi is absolutely preferred to x_j; $p_{ij} = 0$ Indicates that xj is absolutely preferred to xi; and $p_{ij} > \frac{1}{2}$ indicates that xi is preferred to x_j($x_i > x_j$). Thus, P is an additive reciprocal:

$$p_{ij} + p_{ji} = 1 \quad \forall i, j \in \{1, \ldots, n\} \qquad (2)$$

3.2.2 Propositions in Consistent Fuzzy Preference Relations

The inconsistency issue would be resolved by creating pairwise comparison decision matrices based on the following three propositions:

1. Proposition 1. Suppose the existence of a set of alternatives $X = \{x_1, x_2, \ldots, x_n\}$ is associated with a multiplicative preference relation $A = (a_{ij})$, with $a_{ij} \in [\frac{1}{5}, 5]$. The corresponding reciprocal additive preference relation $P = p_{ij}$ with $p_{ij} \in [0, 1]$ to $A = a_{ij}$ is defined as follows:

$$p_{ij} = g(a_{ij}) = \frac{1}{2}(1 + \log_5 a_{ij}) \qquad (3)$$

where g is a transformation function, and log5 aij is utilized because aij is between 1/5 and 5.

2. Proposition 2. The reciprocal fuzzy preference relation is P = g (A), where $P = (p_{ij})$, and the following statements are equivalent:

$$p_{ij} + p_{jk} + p_{ki} = \frac{3}{2} \qquad \forall i, j, k \qquad (4)$$

$$p_{ij} + p_{jk} + p_{ki} = \frac{3}{2} \qquad \forall i < j < k \qquad (5)$$

3. Proposition 3. The reciprocal additive fuzzy preference relation is $P = (p_{ij})$, and the following statements are equivalent:

$$p_{ij} + p_{jk} + p_{ki} = \frac{3}{2} \qquad \forall i < j < k$$

$$p_{i(i+1)} + p_{(i+1)(i+2)} + \ldots + p_{j(i-1)} + p_{ji} = \frac{j-i+1}{2} \quad \forall i < j \qquad (6)$$

If the preference matrix has values that are not in the interval [0, 1] but in [-a, 1 + a], to preserve the reciprocity and additive transitivity, a linear transformation is required: f: [-a, 1 + a] → [0, 1]. The transformation function is then denoted as follows:

$$f(p_{ij}^k) = (p_{ij}^k + a) / (1+2a) \quad (7)$$

where a is the absolute value of the minimum negative value in the preference matrix.

3.2.3 Evaluating the Weights of Criteria

1. Integrate the evaluations of m experts by using the notations of the average value.

$$p_{ij} = (p_{ij}^1 + p_{ij}^2 + \cdots + p_{ij}^m) / m \quad (8)$$

p_{ij}^k is the transformed fuzzy preference value of expert k for evaluating the criteria i and j.

2. Normalizing the aggregated fuzzy preference relation matrices rij is employed to illustrate the normalized fuzzy preference value of each considered criteria:

$$r_{ij} = p_{ij} / \sum_{i=1}^{n} p_{ij} \quad (9)$$

3. Using w_i to indicate the average priority weight of considered criteria i, the priority of each criterion can be obtained:

$$w_i = \sum_{j=1}^{n} r_{ij} \quad (10)$$

where n is the number of the criteria considered.

3.3 The Survey Design

The research objectives were accomplished in two steps. The first phase used the Delphi method to establish a hierarchy of factors affecting Thailand's logistics system's effectiveness in the Covid-19 scenario. Following that, a second phase used the CFPR method to evaluate those factors. During the first Delphi phase, variables for debate were discovered in the literature. Experts, both shippers and logistics service providers (LSPs) acquainted with Thai logistics, served as experts to maximize the result's efficiency. We weighted the critical components of the experts' competence using a linguistics scale. The researcher then examined the impact of each factor on the effectiveness of Thailand's logistics system during the COVID-19 crisis.

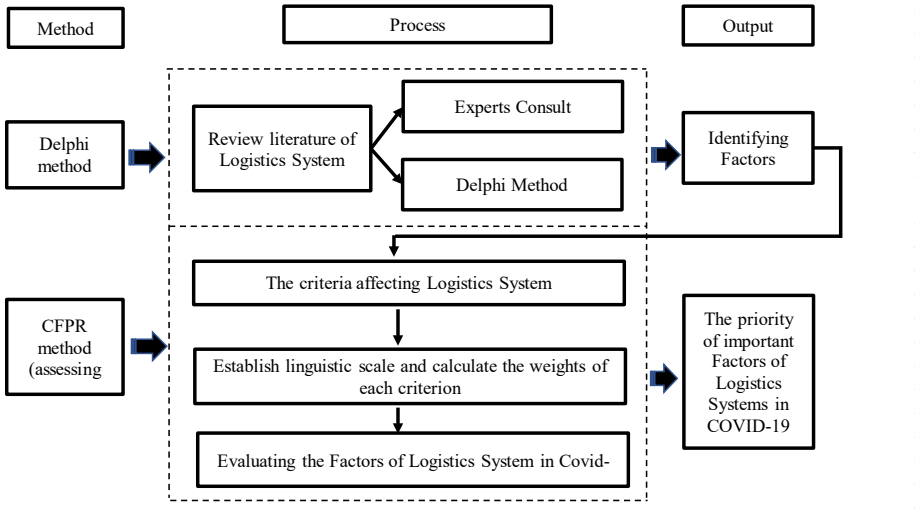

Figure 1. Research schematic diagram

4. Data Collection

Table 2. Factors influencing of national logistics systems.

No	Factors of national logistics systems		
	Factors	**Description**	**Reference**
A	Logistics Services Provider	• Transportation services (sea, rail, air, and rail), • Freight forwarding, • Warehouse services, and • Value-added activities	(Banomyong et al., 2015); (Dang and Yeo, 2018)
B	Logistics Infrastructure	• Transportation infrastructure (sea, air, road, railway, and handling equipment); (ICDs).	(Banomyong et al., 2015); (Rashidi and Cullinane, 2019)
C	Logistics Costs	• Transportation expenses, • customer service costs, • risk and damage costs, • administrative costs, • handling and packing costs, and • inventory-carrying costs, to name a few.	(Yu, 2015); (Rashidi and Cullinane, 2019)
D	Frameworks and Policy	• Customs clearance procedures and applicable rules, directives, and requirements • Environmental education, • Concerns of corruption (extra fees for customs officers)	(Banomyong et al., 2015); (Dang and Yeo, 2018)
E	Connections Between Logistics Components	• Connectivity in multimodal transport. • Connectivity in information	(Banomyong et al., 2015)
F	Logistics in Manufacturing and Trading	• Extensive expertise using the logistics systems of manufacturing and commercial businesses (not professional logistics service providers)	(Solakivi et al., 2018)
G	Technology	• Customs clearance; • Online status monitoring (E-Tracking/Tracing); • Warehouse management system (WMS); • Transportation management system (TMS); (ERP)	(Banomyong et al., 2015); (Dang and Yeo, 2018)
H	Communication and Inter Cooperation	• Educate state agencies and businesses about logistics; • Strengthen collaboration between local and foreign businesses.	(Solakivi et al., 2018)
I	Human resources	• The quality of the labor force; • The experience of senior level managers and directors; and • The educational standards for logistics.	(Grygorak, 2018)

4.1 The Survey Design

4.1.1 The Procedure's First Step: Identifying the priority factors for the improvement of Thailand's logistics system.

The poll lasted 40 days (from 22 May to 30 June 2020) and was done via email, phone, and face-to-face interviews. The experts responded to questions based on the literature review's determinants. By answering open-ended questions and participating in brainstorming sessions, they were asked to identify any missing factors and those overlapping. The questionnaire was administered in rounds to ascertain expert views. Following this phase, a hierarchy of factors was established, including the following: 1) logistics services; 2) logistics infrastructure; 3) logistics costs; 4) institutional frameworks and policy; 5) connections between logistics components; 6) logistics in manufacturing and commerce; 7) technology; 8) telecommunications and international cooperation; and 9) human resources. The findings are summarized in Table 2. Ten specialists were asked to participate in the study to determine the most critical variables affecting Thailand's logistics system in the covid-19 scenario. The ten experts were CEOs, managers, and general directors of different logistics firms with an average of at least ten years of experience working in Thailand's logistics industry. They were initially asked to prioritize the elements they believed were most critical for Thailand's logistics system development. At least six responders should vote on the criteria that have been selected. If a factor receives less than six votes, it will be removed. The findings are summarized in Table 3.

Table 3. Priority factors for the improvement of Thailand's logistics system

Factor	A	B	C	D	E	F	G	H	I
Vote	6	6	9	8	7	3	4	2	2

The following five priority factors from Delphi Method, which reported for 77% of the total vote, were selected for the improvement of Thailand's logistics system: A) logistics services; B) logistics infrastructure; C) logistics costs; D) institutional frameworks and policy; E) connections between logistics components.

4.1.2 Weighting Calculations and Evaluating the importance of logistics- factors in Covid-19

The result from Delphi Method was five factors. However, these were qualitative factors. That made it impossible for decision-makers to assign a numerical value to any of these variables. As a result, to alleviate the difficulty of comparing and evaluating the relative significance of the chosen variables, the CFPR technique was developed as described in Section 2 to aid decision-making in paring comparisons and enhance the particular constraints of these factors. Additionally, CFPR was utilized to minimize audit discrepancies and shorten the time and effort required for the judgment process. The CFPR surveyed twenty respondents, including CEOs, managers, and general directors of logistics firms with an average of ten years of experience in the logistics industry. Because logistics businesses are more familiar with Thailand's present state of logistics than other people, this research provided a logistics industry viewpoint. Twenty responses would be enough for an in-depth interview with a knowledgeable specialist (Wang and Yeo, 2016). As indicated in Table 1, the respondents expressed their opinion with the selected factors through scale-based linguistic variables [1, 5]

Table 4. Priority factors for the improvement of Thailand's logistics system

	Factor	Weight	Rank
A	Logistics Services Provider	0.191	3
B	Logistics Infrastructure	0.185	4
C	Logistics Costs	0.239	1
D	Frameworks and Policy	0.218	2
E	Connections Between Logistics Components	0.167	5

5. Results and Discussion

Five variables were critical for Thailand's logistics system improvement in the covid-19 scenario using the CFPR methodology calculating process. Twenty individuals were engaged in the data collecting procedure, which was used to determine the relative importance of the five chosen variables to ease the data analysis procedure. The information from the first responder was used as a baseline. Following data gathering, the researcher created pairwise comparison matrices. The findings are summarized in Table 4.

With an assessed weight of 0.239, C was identified as the most critical element affecting Thailand's logistics systems improvement. Indeed, logistics expenses are the primary metric used to evaluate the effectiveness of logistics operations. Logistics expenses include the cost of fuel and transportation for transporting products through several modes of transportation, including road, ocean, air, and train. Additionally, they have eliminated taxes, tariffs, and security, as well as packing, storage, and material handling. Logistics expenses accounted for roughly 13.5 percent of Thailand's GDP, with the highest proportion being in COVID-19. The shipping procedure is more complex, which results in more excellent logistics costs than usual. As a result, the Thai government's logistics expenses should be reduced in the long run for economic growth and Covid-19.

Respondents rated frameworks and policy (D) as the second most critical element in strengthening Thailand's logistics system. Effective frameworks were essential in establishing logistics systems, as a realistic institutional structure may help decrease delivery times and streamline product handling procedures. Institutional frameworks imply operational policies, directions, and choices, represented in the implementation of customs policies, directions, and decisions. However, in Thailand, these frameworks were nonetheless seen as restrictive, inconsistent, and confusing due to a lack of efficient communication between the government, policymakers, and the impacted business sector. While many institutional frameworks incorporate customs clearance originations such as automation, modernization, online submission of customs documents, single-door administrative policies, and clearance of imported or exported goods at ICDs or warehouses, several regulations need improvement. For example, global shipping companies must complete time-consuming and complicated procedures to produce necessary papers in order to avoid double taxation.

In covid-19, logistics services (A) were rated as the third most critical element in building and strengthening Thailand's logistics system. In addition to conventional services such as transportation (sea, air, railway, and rail transport), forwarding, storage, and customs, the quality and quantity of logistics services were critical components of income for logistics providers. These services may include freight-handling functions such as distribution, marking, packing, and consolidation. While all of the services mentioned above are necessary components of Thailand's logistics system, Thailand's LSPs face many constraints. Thailand's logistics businesses are uncompetitive globally and can only provide a restricted range of services inside the country. They often had unpredictable delivery times, and the quality of these services was usually subpar. As a result, in order to maximize Thailand's LSPs' performance, this issue must be adequately focused on. Additionally, they lack access to particular modes of travel, such as inland canals or domestic railroads, due to the government sector's lack of growth in the transportation sector.

Thailand's logistics infrastructure was rated as the fourth most critical element affecting the country's logistics system improvement. These are the primary determinants of a country's logistics system's international competitiveness, and they are essential in developing business strategies targeted at increasing a country's share of the worldwide market (Bensassi et al., 2015). Thailand's railway transportation system also confronts many challenges because most railway lines and stations were built 30–40 years ago and are now obsolete. Additionally, various of them absence container handling capabilities, resulting in inefficient service operation and delivery delays for the railway. Cross-provincial goods movement under the COVID-19 scenario will be simpler to handle and lower transportation costs if products can be delivered through railroads. However, an efficient connection between the railway station and the major road and cargo processing facilities renders rail transit ineffective.

Connections between logistics components (E) were rated as the fifth most essential factor because they included many weak spots in the cargo handling process. Thailand, for example, lacked ICDs and logistics hubs near seaports, roads, and industrial zones, which were often dispersed and made use of primitive equipment. Additionally, they lack modern technology that meets consumer requirements. However, most ICDs in Thailand were linked through highways and interior waterways, but seldom via railroads. In summary, all of the issues mentioned above raised the total cost of Thailand's logistics and demonstrated that many aspects of Thailand's logistical infrastructure were inefficient.

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6. Conclusion

This study pointed to enable the Thailand government to prioritize development for improving the logistics system that the impact of covid-19. This study worked with logistics service providers and exporters to draught suitable strategies for increasing efficiency and a list of common goals. According to a provider's and exporters perspective, this research assessed the consequence of five factors correlated to positions in the country's logistics system (e.g., logistics costs, logistics infrastructures, connections between logistics components, logistics services, frameworks, and policy). Experts have carefully selected these criteria to propose specific priorities for improving Thailand's logistics system in COVID-19. After using the CFPR method, the findings showed that logistics costs were most essential in enhancing a country's logistics system due to rising logistics costs during COVID-19, but the income has decreased. Therefore, costs reductions were necessary to balance costs appropriately with revenue.

Finally, these factors also reveal the disadvantages of the country’s logistics systems, which frameworks and policies were essential factors that the government will use to improve Thailand’s logistics systems during the COVID-19 situation. This study demonstrates to implementing optimal investment priorities and enacting appropriate regulations to improve the country's logistics system, reducing resource waste and inefficient investments, and promoting industrial development and international trade. Additionally, the research educates logistics stakeholders in Thailand on the state of the country's logistics system and the government's plan for achieving the country's objectives.

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Biographies

Teerasak Charoennapharat is a Ph.D. candidate for the Ph.D.'s Degree Program in Industrial Engineering, Department of Industrial Engineering, Faculty of Engineering at Chiang Mai University, Chiang Mai, Thailand. He holds a Bachelor Degree in Industrial Engineering, Faculty of Engineering from Chiang Mai University, Chiang Mai, Thailand, a Master of Business Administration Programme in International Logistics and Supply Chain Management from Mae Fah Lung University, Chiang rai, Thailand and a Ph.D. student in Industrial Engineering, Faculty of Engineering from Chiang Mai University, Chiang Mai, Thailand. He is now pursuing PhD with a focus on Logistics and Transportation Management.

Poti Chaopaisarn is an Assistant Professor and Researcher at Department of Industrial Engineering, Faculty of Engineering at Chiang Mai University, Chiang Mai, Thailand. Dr. Chaopaisarn holds a Bachelor in Business Administration in Marketing from Thammasat University, Bangkok, Thailand, a Master of Science Degree in International Transport, a Master of Philosophy Degree in Social Science Research Method and a Ph.D. in Logistics and Operations Management from Cardiff University, Wales, United Kingdom. He has published in journal and conferences and has conducted research projects domestically and internationally. He has over 7 years of business and industrial operation consultancy experience in Thailand. His research interests include logistics and supply chain management, operations management, simulation and modelling, multimodal transport system and business

improvement theory. He is a member of Excellence Centre in Logistics and Supply Chain Management, programmed chair of ICLT and MPM.

