PROMOTION OF WATER LOGISTICS SYSTEMS AMONG ENTREPRENEURS FROM BANGKOK PORT TO LAEM CHABANG PORT, CHONBURI PROVINCE

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ABSTRACT
The objectives of this study were: 1) to examine the level of water logistics system promotion among entrepreneurs transporting goods from Bangkok Port to Laem Chabang Port in Chonburi Province; and 2) to investigate the factors influencing the promotion of water logistics systems among entrepreneurs along this route. A questionnaire was employed to collect data from 400 entrepreneurs engaged in cargo transportation from Bangkok Port to Laem Chabang Port. The data were analyzed using frequency, percentage, mean, standard deviation, and multiple regression analysis. The results revealed that 1) the overall and dimensional levels of water logistics system promotion among entrepreneurs from Bangkok Port to Laem Chabang Port were high, particularly in terms of energy conservation, cost reduction, air pollution reduction, and mitigation of land traffic congestion, respectively; and 2) the factors of entrepreneurs' characteristics, entrepreneurs' needs, the role of the government sector, and the service processes of officials had significant effects on the promotion of water logistics systems among entrepreneurs operating along this route.
Keywords: Promotion of Logistics Systems, Bangkok Port, Laem Chabang Port

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INTRODUCTION

The logistics business is a system for managing the movement of goods, information, and resources from the point of origin to the point of consumption. It involves the integration of information, transportation, inventory management, raw material management, and packaging. Logistics is thus a process within the supply chain that adds value by optimizing time and place utility. The logistics process encompasses various transportation activities, including inbound logistics, which brings production factors to manufacturing plants and delivers finished products to distribution centers, followed by outbound logistics, which transports goods to the market through retail outlets before reaching consumers (Office of the National Economic and Social Development Council, 2017). Currently, the intensifying business competition due to increasing trade liberalization has compelled businesses to enhance operational capabilities across all possible dimensions (Worapot Meethom, 2017). Moreover, goods transportation is a critical management component and an economic activity that supports national economic development (Kamnai Apipratyasakul, 2017). Consistent with Piyanuch Sathapongphakdi (2019), transportation is a key activity within logistics and the supply chain. Modern business operations rely on transportation to deliver products and services to customers, utilizing various modes such as road, water, rail, and air transport. Among these, road transport accounts for the largest share, representing 79.3% of the country's total transportation volume (Office of the National Economic and Social Development Council, 2019). This is due to the characteristics of road transport by trucks, which enable door-to-door delivery from the sender or origin to the final recipient. Road transport also serves as a feeder linking other transportation modes—such as rail, water, and air—which cannot provide complete origin-to-destination service, thereby establishing road transport as the primary mode with a high contribution to the national transportation sector. This is reflected in the consistently higher costs of road transportation compared to other modes.

Similarly, freight transportation is a service-oriented business that plays a crucial role in distributing goods to both domestic and international markets. Transportation service providers are responsible for moving goods at each stage of the supply chain, from raw materials and primary products to intermediate and finished goods. The condition of the transportation business is therefore dependent on the volume of goods, which fluctuates with the national economic situation. Although road transportation offers the advantage of convenience, allowing for direct delivery without the need for transshipment as required in other modes of transport—thus reducing damage and loss during handling or vehicle transfer—it has the disadvantage of higher costs compared to other modes (except air transport). This is due to a high proportion of variable costs, including: 1) fuel and lubricants, which account for up to 49% of total costs, and 2) driver wages, representing 32% of total costs, which have been continuously rising due to labor shortages. Consequently, the government has accelerated the development of the national logistics system, particularly rail and water transport, through projects such as double-track railways, high-speed rail, and the expansion of deep-sea ports at Laem Chabang and Map Ta Phut, aiming to reduce costs and improve overall freight transportation efficiency (Department of Energy Business, 2019).

Currently, waterway transportation is considered an important logistics business system for the movement of goods. The route from Bangkok Port to Laem Chabang Port in Chonburi Province is a crucial transport corridor that requires significant promotion. Bangkok Port, located along the Chao Phraya River in the Khlong Toei area, serves as a central hub for the distribution of various goods and provides access to millions of consumers. It facilitates connections with Laem Chabang Port and other domestic ports via road, water, and rail transport. Bangkok Port is integrated into international trade networks as well as logistics networks across Thailand, offering direct transport services and comprehensive container services. It can accommodate various cargo ships and coastal vessels under international service standards. Laem Chabang

Port has been promoted by the government to serve as Thailand's main deep-sea port. As such, it represents a significant and strategic part of Thailand's trade. It is also ranked among the top 20 ports worldwide, with a capacity to handle approximately 11,000,000 TEUs per year. Furthermore, Laem Chabang functions as a central hub for logistics and supply chain connectivity, distributing goods to industrial factories in Thailand's eastern region. The port is under the supervision of the Port Authority of Thailand, with Global Terminal Operators (GTOs) acting as international terminal operators. Laem Chabang Port can accommodate a wide variety of cargo vessels, including specially large ships (SX Class), and has the capacity to distribute goods to Bangkok and nationwide destinations through multiple transport modes, including rail, road, and water. The port also provides facilities for logistics operations and other commercial businesses (Port Authority of Thailand, 2023).

In light of the aforementioned issues, the researcher is interested in studying "The Promotion of Water Logistics Systems among Entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province," which constitutes a key water transportation route within Thailand's logistics system. The study focuses on factors such as the role of government, entrepreneurs' characteristics, entrepreneurs' needs, and the service processes of officials, with the aim of using the findings to provide guidance for enhancing the success of maritime transport entrepreneurs in achieving their objectives.

LITERATURE REVIEWS

Concepts and Theories on the Promotion of Water Logistics Systems

The promotion of water logistics systems is a critical issue in the development of Thailand's transportation network, particularly along the route between Bangkok Port and Laem Chabang Port, which constitutes an important international trade infrastructure. Numerous studies have indicated that utilizing water logistics systems enhances transportation efficiency across multiple dimensions, including energy conservation, reduction of transportation costs, alleviation of road congestion, and mitigation of air pollution. These factors contribute to increasing the competitiveness of entrepreneurs and align with the country's sustainable development objectives. 1) Energy conservation is a prominent advantage of water transportation. The Marine Department (2021) reported that transporting large volumes of goods by ship is significantly more energy-efficient than land transport, with energy consumption per unit of cargo being 3-5 times lower. Similarly, Li and Chen (2020) indicated that water transportation can reduce fuel consumption by more than 20% compared to long-distance trucking, enabling entrepreneurs to save costs and mitigate risks associated with fuel price fluctuations. 2) Reducing logistics costs is a key driver for entrepreneurs in choosing water transportation. The Office of Transport and Traffic Policy and Planning (2022) reported that the unit transportation cost of water transport is 30-50% lower than that of road transport, depending on the type of goods. Additionally, water transport can carry large volumes of cargo, creating economies of scale. Similarly, Wang and Liu (2021) found that opting for water routes reduces vehicle maintenance and labor costs, which are major expenses in land transportation systems. 3) Reducing road traffic volume is a significant outcome of modal shift in transportation. The Ministry of Transport (2021) reported that shifting transport from road to water along the Bangkok-Laem Chabang route can decrease the number of trucks on major roads by more than 10,000 vehicles per month, thereby alleviating congestion, reducing accidents, and improving overall travel efficiency. In addition, Zhang (2020) indicated that reducing road usage helps minimize economic losses caused by delays and enhances the stability of the supply chain, and 4) Reducing air pollution is considered a significant environmental benefit. Waterway transportation emits fewer greenhouse gases per ton-kilometer compared to land transportation. The World Maritime Organization (2020) demonstrated that water transport can reduce CO_2 emissions by 40-60% compared to road

transport. Meanwhile, research by Chai et al. (2021) confirmed that the development of inland waterway logistics systems helps reduce PM2.5 and NOx, which are the primary pollutants from road vehicles. In summary, numerous studies support that promoting waterway logistics between Bangkok and Laem Chabang ports enhances economic, social, and environmental efficiency comprehensively, including energy conservation, cost reduction, traffic alleviation, and air pollution mitigation. Therefore, it serves as a crucial strategy for developing the national logistics system in alignment with the country's national strategies and sustainable development goals.

The promotion of water logistics systems is a key strategy in Thailand, as it can help reduce transportation costs, minimize environmental impacts, and enhance supply chain efficiency. The factors influencing the promotion of water logistics consist of four main dimensions: the role of government, entrepreneurs' characteristics, entrepreneurs' needs, and the service processes of port officials. Numerous studies in the literature have highlighted the importance of these components in achieving successful water transportation. 1) The role of government is crucial in setting direction and establishing infrastructure for water logistics systems. The Marine Department (2021) indicated that port development policies, budgetary support for infrastructure, and enforcement of safety standards are key factors that enhance entrepreneurs' confidence. Similarly, Li and Chen (2020) found that countries with continuous policies supporting water transportation exhibit significantly lower logistics costs and higher utilization of water routes. 2) Entrepreneurs' characteristics, such as technological readiness, experience, and managerial capabilities, influence their choice to utilize water transportation routes. The Office of Transport and Traffic Policy and Planning (2022) found that entrepreneurs with logistics knowledge and digital cargo tracking systems are more likely to opt for water transport. Similarly, Wang and Liu (2021) reported that entrepreneurs who can adapt to smart port technologies experience reduced transportation costs and enhanced competitiveness. 3) Entrepreneurs' needs serve as a key driving force for the adoption of water logistics systems, including the desire to reduce costs, conserve energy, and enhance supply chain stability. The Ministry of Transport (2021) reported that many entrepreneurs are increasingly interested in water transportation due to its capacity to carry larger volumes of goods per trip and to mitigate risks associated with road congestion. Similarly, Zhang (2020) found that responding to market demands is a critical factor motivating entrepreneurs to shift their transportation mode toward water routes. 4) The service processes of port officials, including operational efficiency, transparency, and information support, help build entrepreneurs' confidence. According to the World Maritime Organization (2020), ports with efficient service systems can significantly reduce vessel waiting times and operational costs. Meanwhile, Chai et al. (2021) found that the quality of port officials' services directly affects entrepreneurs' satisfaction and their intention to reuse the services. In summary, numerous studies support that the role of government, entrepreneurs' characteristics, entrepreneurs' needs, and the quality of officials' services are key factors collectively promoting the use of water logistics systems, thereby enhancing supply chain agility, efficiency, and sustainability in Thailand.

Based on the literature review, the following research hypotheses can be formulated:

H1 From the literature review, it can be concluded that the factors of government role, entrepreneurs' characteristics, entrepreneurs' needs, and service processes of officials influence the promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province. Based on this, the conceptual framework can be illustrated as shown in Figure 1.

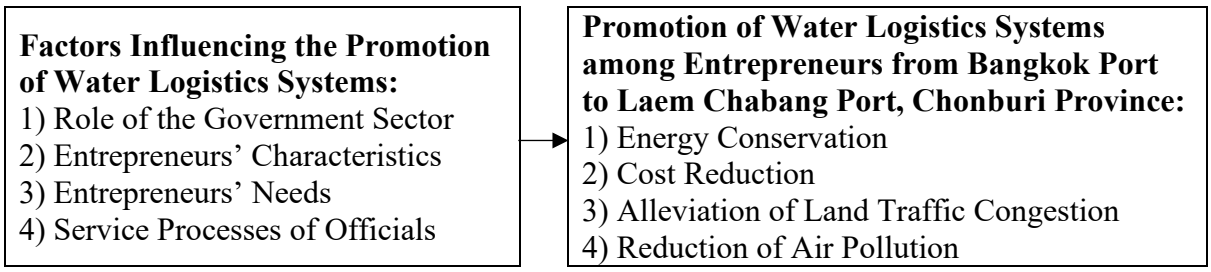

Figure 1 Conceptual Framework

RESEARCH METHODOLOGY

The population of this study consisted of 1,580 entrepreneurs engaged in cargo transportation from Bangkok Port to Laem Chabang Port, Chonburi Province (Port Authority of Thailand, 2023). The sample comprised 400 respondents, determined based on the concept of Grace (2008) and selected using stratified sampling. The research instrument was a questionnaire divided into three parts. Part 1 addressed respondents' personal factors and consisted of multiple-choice items. Part 2 examined factors influencing the promotion of water logistics systems, using a 5-point Likert scale, with scores ranging from 5 = The highest, 4 = The high, 3 = The moderate, 2 = The low, to 1 = The lowest. Part 3 measured the promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, also using a 5-point Likert scale with the same scoring criteria.

Before employing the data collection instrument, systematic procedures were conducted to test its content validity according to the research objectives (IOC) and its reliability using Cronbach's alpha. The results indicated an IOC value of 0.954 and a Cronbach's alpha of 0.893, demonstrating that the research instrument was of sufficient quality (Polit & Beck, 2006; Hair et al., 2012). To obtain the data, the questionnaire was distributed to entrepreneurs engaged in cargo transportation from Bangkok Port to Laem Chabang Port, Chonburi Province. Descriptive statistics, including frequency, percentage, mean, and standard deviation, as well as multiple regression analysis, were employed to analyze the data.

RESEARCH RESULTS

1) The majority of respondents were male (64%), aged between 41 and 50 years (65.67%), and held a bachelor's degree (60%). Most had been conducting their business for more than five years (68.93%) and reported an average monthly income exceeding 100,001 THB (65.67%).

2) The promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province, was found to be at a high level overall and across all dimensions, particularly in terms of energy conservation, cost reduction, air pollution reduction, and alleviation of land traffic congestion, respectively, as presented in Table 1.

Table 1 Mean and Standard Deviation of the Promotion of Water Logistics Systems among Entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province

Aspect	Description	$\bar{X}$	S.D.	Result
1.	Energy Conservation	3.91	0.50	Much
2.	Cost Reduction	3.89	0.49	Much
3.	Alleviation of Land Traffic Congestion	3.81	0.45	Much
4.	Reduction of Air Pollution	3.85	0.50	Much
Total		**3.87**	**0.48**	**Much**

3) The factors of government role ($\beta = 0.235$), entrepreneurs' characteristics ($\beta = 0.329$), entrepreneurs' needs ($\beta = 0.243$), and service processes of officials ($\beta = 0.131$) were found to

have a significant positive influence on the promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province, at a 0.05 significance level, with Sig. values of 0.000, 0.000, 0.001, and 0.002, respectively, supporting the formulated hypotheses. The correlation coefficient (R) was 0.759, indicating a strong relationship between the independent variables and the dependent variable, while the coefficient of determination (R^2) was 0.659, showing that the independent variables collectively explain 64.1% of the variance in the promotion of water logistics systems among entrepreneurs along this route.

Consequently, the equations can be formulated as follows:

$Y = 0.947 + 0.329X_1 + 0.243X_3 + 0.235X_1 + 0.132X_4$

The regression analysis revealed that the factors of government role, entrepreneurs' characteristics, entrepreneurs' needs, and service processes of officials collectively predict the promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province. Among these factors, entrepreneurs' characteristics had the strongest predictive effect (Beta = 0.243), followed by entrepreneurs' needs (Beta = 0.192), the government role (Beta = 0.123), and the service processes of officials (Beta = 0.120). The detailed results are presented in Table 2.

Table 2 Multiple Regression Analysis of Factors Influencing the Promotion of Water Logistics Systems among Entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province

Factors	**Unstandardized (b)**	**SE**	**Standardized (β)**	**t**	**Sig.**
(Fixed value)	1.101	0.104		10.632	0.000
Role of the Government Sector	0.123	0.020	0.235	10.662*	0.000
Entrepreneurs' Characteristics	0.243	0.022	0.329	9.818*	0.000
Entrepreneurs' Needs	0.192	0.032	0.243	4.405*	0.001
Service Processes of Officials	0.120	0.101	0.131	3.632*	0.002
$R = 0.756$, Adjusted $R^2 = 0.659$, $R^2 = 0.580$, SE = 0.103					

* Statistical significance at the 0.05 level

DISCUSSION & CONCLUSION

In the study on the promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province, the researcher discussed the key findings in accordance with the research objectives as follows:

1) The promotion of water logistics systems among entrepreneurs from Bangkok Port to Laem Chabang Port, Chonburi Province, was found to be at a high level. The study revealed that the promotion of water logistics systems significantly contributed to energy conservation, cost reduction, air pollution mitigation, and alleviation of land traffic congestion. These findings are consistent with numerous studies supporting the benefits of utilizing water transport systems, particularly in terms of energy savings. According to the Marine Department (2021), transporting goods by ship consumes 3-5 times less energy than truck transportation, as ships can carry larger quantities of cargo in a single trip. This finding is consistent with Li and Chen (2020), who reported that water transport significantly reduces fuel consumption compared to land transport, particularly in terms of cost reduction. The Office of Transport and Traffic Policy and Planning (2022) reported that water transportation has a unit cost 30-50% lower than road transport, due to reduced maintenance and labor costs. This finding aligns with Wang and Liu (2021), who indicated that operators using water routes can effectively reduce operational costs, particularly in terms of mitigating air pollution. The World Maritime Organization (2020) reported that water transportation emits 40-60% less CO_2 compared to land transport, while Chai et al. (2021) noted that reducing the number of trucks on the road

helps decrease PM2.5 and NOx, which are the main pollutants from road transportation. Regarding the alleviation of land traffic, the Ministry of Transport (2021) highlighted that reducing the number of trucks along the Bangkok-Laem Chabang route significantly decreases congestion and traffic accidents, which is consistent with Zhang (2020), who confirmed that shifting transportation to water routes enhances supply chain stability and reduces delays caused by traffic problems. These findings indicate that water logistics systems are an effective alternative, providing benefits in economic efficiency, environmental sustainability, and transportation infrastructure.

2) The factors of entrepreneurs' characteristics, entrepreneurs' needs, the role of the government sector, and the service processes of officials were found to influence the promotion of water logistics systems. The study indicated that all four factors have a significant impact on the promotion of water logistics systems, which is consistent with numerous studies in the fields of logistics and port systems. Regarding entrepreneurs' characteristics, the Office of Transport and Traffic Policy and Planning (2022) reported that entrepreneurs with logistics knowledge and the ability to utilize cargo tracking technology tend to prefer using water transport systems. Wang and Liu (2021) further indicated that entrepreneurs who are able to adapt to smart port systems experience reduced costs and enhanced competitiveness. Regarding entrepreneurs' needs, the Ministry of Transport (2021) found that the desire to reduce costs and minimize risks from traffic problems serves as a key motivation for choosing water transport systems, which supports Zhang (2020), who identified supply chain stability as a critical factor driving the shift in transportation mode. Concerning the role of the government sector, the Marine Department (2021) noted that the development of infrastructure, enforcement of safety standards, and promotion of waterway usage increase entrepreneurs' confidence and adoption of these systems. This finding aligns with Li and Chen (2020), who highlighted that countries investing in waterway infrastructure achieve higher logistics efficiency. Regarding the service processes of officials, the World Maritime Organization (2020) reported that ports with efficient, transparent operations and supportive technological systems help reduce vessel waiting times and enhance transport quality. Meanwhile, Chai et al. (2021) indicated that the quality and professionalism of port officials directly affect entrepreneurs' satisfaction. Overall, the research confirms that all four factors collectively influence the promotion of water logistics systems and must be developed in tandem to enhance the national transportation system's capacity.

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Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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