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UNDERSTANDING THE LINK BETWEEN LOGISTICS TECHNOLOGY, PERFORMANCE, AND COMPETITIVE ADVANTAGE IN THAILAND'S THIRD-PARTY LOGISTICS SECTOR

[1]Weerasak Sojipun, Zuraimi Abdul Aziz, & Rosmaizura Mohd Zain

Faculty of Entrepreneurship and Business, Universiti Malaysia Kelantan, Malaysia

[1]Corresponding author: vcool99@hotmail.com

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ABSTRACT

In Thailand, third-party logistics (3PL) companies operate at a loss of 35 percent, indicating their inability to compete with other logistics service providers. Due to technology being one of the factors involved, the objective of this study aims to investigate the relationship between logistics technology, logistics performance, and competitive advantage in small third-party logistics (3PL) enterprises in Thailand. This study used partial least squares structural equation modelling (PLS-SEM) as a statistical approach for data analysis. The sample size was 159 respondents, who are small 3PL enterprises in three southern border provinces of Thailand. The finding indicated that logistics technology has a positive relationship with logistics performance and competitive advantage of 3PL in Thailand. Moreover, logistics performance, as a mediating factor is linked to logistics technology and competitive advantage. This study could be beneficial for the 3PL firms for improving technology in logistics operations, thereby achieving better outcomes and success in company competition.

Keywords: Logistics technology, logistics performance, competitive advantage, third-party logistics, logistics management.

INTRODUCTION

The service sector, encompassing cross-border trade services, distribution services, computer services, and financial services, has emerged as a significant driver of global economic expansion in a competitive and complex market. The logistics service sector is the most rapidly expanding globally and represents about 66% of international trade in services, according to (Loungani et al., 2017; Wingwon & Piriyakul, 2010). These are enhancing internal procedures to boost efficiency while simultaneously attempting to minimize supply chain expenses for suppliers and outsource services (Solakivi et al., 2018). These modifications

have exerted pressure on third-party logistics (3PLs) from several angles. In response to the substantial rise in industrial output and shipping volumes in the 21st century, third-party logistics have made significant investments to enhance their production capacity. Contemporary society intricately associates economic progress with logistics. As economies expand, the demand for logistics services to facilitate this expansion increases. Logistics has emerged as a crucial element for enterprises in an evolving global economy (Filha, 2022).

Thailand ranks as the second biggest economy in Southeast Asia, with a GDP of USD 514.9 billion in 2023. According to the World Bank Categorization Council (2022), Thailand's economy has markedly changed from a low-income to a middle-to-high-income nation. The council has previously highlighted in its publications that structural changes are essential for facilitating this transition, particularly trade and investment liberalisation, along with regulatory reforms that are favourable to business policies, which have enhanced participation across global supply chains (OECD, 2020). The expansion of products corresponding to the nation's economy has affected the influence of goods transport on the competitiveness of the transport sector (Wongwilai & Hotrawaisaya, 2022). Over the past five years, Thai 3PLs have faced intense competition from large global logistics firms, primarily serving the export market. The corporation has begun augmenting its investment in Thailand by offering services to a greater number of manufacturers seeking to market their products domestically. The organization intends to leverage digital technology to enhance the effectiveness of its logistics management and secure a competitive edge (Center, 2019). The majority of road transport operators are tiny businesses, comprising 94.4% of all registered operators, which leads to a restricted client base and minimal investment in technology and personnel. Thai businesses engaged in comprehensive transport services through international logistics exhibit enhanced competitiveness and negotiating power in the market, particularly medium to large operators (Sathapongpakdee, 2019).

The 2020 report from the Chamber of the nation of Thailand indicates that third-party logistics providers are now encountering obstacles in their business operations. The study highlights that the proficiency and integrity of third-party logistics (3PL) are pivotal in assessing the value and quality of their services. Furthermore, to improve domestic logistics services, the nation must elevate performance to satisfy customer demand. Moreover, the progression of logistics technology has placed small 3PL companies at a disadvantage (Professionals, 2023). The Thailand Transport Department has suggested a solution to the issue by upgrading 3PL to the classification of a high-income nation with competitive advantages. The integrated development plan for transport and logistics systems, designed to enhance competitiveness, will achieve this (Transport, 2023). The 3PL services encompass enhancing technology innovation and operational efficiency in business management. The primary objective is to enhance technological innovation and efficiency in the transport services provided by third-party logistics (Office of the National Economic and Social Development Council, 2022).

Thongkruer and Wanarat (2021) proposed that logistics services in Thailand can assist consumers in recognizing the value of the service, enhancing the service provider's reputation, and enhancing consumer satisfaction (Meathawiroon, 2020). One important factor that can lead to logistics service performance is technology. Technology can make logistics service performance more efficient in many aspects, such as flexibility in product delivery. In addition, technology can be an important factor that helps create a competitive advantage over competitors in terms of efficiency and superior quality, which helps organizations to respond better to customers (Distanont, 2020). Today's logistics service providers in Thailand are starting to pay more attention to technology, with the goal of providing excellent customer service.

Third-party logistics (3PL) in Thailand have emphasized and developed the adoption of digital technology by systematically relating warehouse and distribution management to transportation activities via the Internet. Consequently, Thai 3PL is obliged to adopt digital technology to effectively manage transportation, reduce costs, and support the expanding logistics market in the digital era, particularly the e-commerce sector, which directly influences the transportation industry. Integrating and advancing technology within the E-Logistics framework will present opportunities for transport operators capable of timely adaptation. Consequently, third-party logistics providers must develop and deploy logistics technology to address the particular requirements of their clients.

A study by Izadi ZD et al. (2020) demonstrated that technological innovation is a critical determinant of corporate performance, highlighting that business success and technology management are vital for establishing a competitive edge in the contemporary market. However, an examination of the competitive advantage of third-party logistics providers in Thailand reveals several constraints. Consequently, to sustain and augment their competitiveness, third-party logistics providers in Thailand must comprehend the essential factors in advancing technology and performance in order to get a competitive edge over rivals. This study explores the relationship between logistics technology, logistics performance, and competitive advantage among Thai 3PLs.

This paper is divided into six main parts. Firstly, the introduction that briefly describes the study's background and research objective. Secondly, the literature review consists of the theories in resource-based view, competitive advantage, logistics technology and performance. Next is the problem statement and theory and followed by methodology. The final part is the result of the study and the conclusion.

LITERATURE REVIEW

Resource-Based View (RBV)

The resource-based view paradigm (RBV) posits that organizations may enhance their performance through the strategic use of their special assets and abilities (Barney, 1991; Wernerfelt, 1984). Barney (1991) argues that a corporation can establish a competitive advantage if its resources are rare, challenging to imitate, and non-replaceable. Nevertheless, the mere existence of these resources does not ensure that an organization will attain a competitive advantage. Capabilities, as described by Amit and Schoemaker (1993), refer to a company's proficiency in effectively using its assets, such as resources and technology, in order to attain specific goals. Capabilities allow a corporation to enhance its resource utilization efficiency and achieve economic returns faster than its competitors. Capabilities are challenging to duplicate due to their profound integration with an organization's processes and routines. Grant (1991); (Makadok, 2001) contend that these characteristics facilitate a company's acquisition and preservation of a competitive edge over its rivals.

Thanaruch (2021) asserts that a firm's competitive advantage has traditionally been characterized by strategy, process skills, and resources. Resources may generate competitive advantages and enhance a firm's success (Kumar & Prashar, 2024). Recent studies on 3PL based on the RBV investigate the influence of information technology (IT) adoption on a firm's innovative capacity and competencies. In addition, a recent research study by Arun and Yildirim Ozmutlu (2022) investigated the role of strategic management as a mediator in the link between innovation capability and organizational performance, particularly with environmental prudence among logistics service providers (LSPs) in Turkey. As a result, this study used the resource-based view (RBV) to investigate the relationship between logistics technology, logistics performance, and the competitive advantage of small 3PLs in Thailand.

Competitive Advantage (CAD)

Scholars and researchers have concentrated on the foundations of the competitive advantage, establishing this as a significant domain in the fields of business strategy, transportation, and logistics management (Barney, 1991; Chang et al., 2021; Spillan et al., 2013). The competitive advantage demonstrated a profound comprehension of recent developments in business organization economics. This comprehensively addressed subjects such as market signals, overcoming obstacles, and committing to long-term investments. The examination of competitive advantage attempted to clarify the origins of advantage from the principles of price, differentiation, and concentration (Huggins & Izushi, 2012).

Third-party logistics (3PL) can achieve a competitive edge by smartly choosing distinctive marketing strategies that offer a higher market position. 3PLs are more proficient than company employees at fulfilling logistical operations with superior effectiveness and productivity (Hwang & Kim, 2019). Competitive advantage allows an enterprise to deliver better goods or services relative to other business competitors, facilitating a comprehensive examination of a 3PL by determining the factors that influence the company's competitive advantage. The potential of the 3PL to develop and maintain a competitive edge over other companies in the market influences the company's competitiveness.

Logistics Technology (LTE)

Scholarly studies on technology and innovation management characterize innovation as the introduction of novelty to a service, method, or good (Wongwilai et al., 2022). Technologies and innovation stem from the business implementation of a creation to enhance its industry or organizational worth (Sommanawat et al., 2021; Tirastittam et al., 2020). Technology and innovation enhance service quality and performance, demonstrating a substantial positive correlation with the success of logistics service providers (Zawawi et al., 2017). Innovative competence is essentially the proficiency to provide specialized services that meet consumer needs. Third-party logistics (3PL) often intricately links its primary expertise to the organization's actual assets. Technological capabilities are defined by transportation capacity, availability of warehouse space, assurance of distribution timelines, confirmation of freight assurance, and the ability to quickly and flexibly adapt to urgent or unforeseen client needs.

Technology innovation is a process that organizations use to transform ideas into new products or services, including improvements from existing products, or a process where organizations create differences to succeed in the market (Baregheh et al., 2009). According to Wanarat (2018), logistics service technology creates business value that impresses customers, both during and after the service delivery. Furthermore, Grawe et al. (2014) posited that innovation in logistics technology encompasses all types of logistics services that can generate value for particular target groups. Over the past two decades, innovations in supply chain security, RFID technology, and environmental sustainability Tao et al. (2022) have led to the application of numerous new technologies in logistics services, including blockchain and artificial intelligence (Klumpp & Zijm, 2019; Zinn & Goldsby, 2019).

Advanced competencies in logistics technology reorganize processes to enhance logistical functions and reduce potential risks within the supply chain. Both external and internal resources can transform innovation or technology to align with the company's strategy (Teece et al., 1997). Innovation positively influences the logistics service sector and is crucial for integrating the relationship between logistics service providers and clients, enhancing customer loyalty, securing competitive advantages, and improving the effectiveness of the business's supply chain services (Asian et al., 2019). Beltramino et al. (2020) examined

the innovation practices and performance of manufacturing SMEs in Argentina, revealing that management innovation has a crucial role in establishing an organization's long-term sustainability and effectiveness.

Logistics Performance (LPM)

Past investigations indicated that logistics performance incorporates efficiency, effectiveness, and differentiation. The number of indicators exist for measuring logistics performance (Fugate et al., 2010). Mentzer et al. (2001) demonstrated through the study they conducted that logistical performance is an important determinant of logistics service enterprises. Duong and Paché (2016) assert that performance in logistics constitutes one element of a more extensive framework for organizational outcomes. The enhanced usefulness of location and timing predominantly dictates conventional logistics performance. This denotes the attributes of the goods or services offered by a company, termed logistics acceleration systems, which enhance the effectiveness of its logistics activities.

Wong and Karia (2010) established the impact of an organization's activities, business strategies, operational competencies, and management systems on the performance of essential logistics indicators used to assess logistics operations. These criteria are crucial in assessing the distinct competitive advantages of 3PL. Logistics performance represents the degree of effectiveness, efficiency, and uniqueness in the delivery of logistics services (Mentzer et al., 2004). The management of logistics should strive to optimize resource utilization to boost efficiency, achieve targets, and gain a competitive advantage through differentiation (Tuan, 2017).

Problem Statement and Theoretical Gaps

The contemporary society intricately associates economic progress with logistics. As economies expand, the requirement for logistics services to facilitate this expansion rises. Logistics has emerged as a crucial element for enterprises in an economy that is growing worldwide (Filha, 2022). Logistics is essential to international commerce, supply chain effectiveness, and economic development, facilitating the acquisition, manufacturing, and distribution of products and services globally including Thailand (Professionals, 2023).

The Thai Ministry of Commerce conducted a research study in 2020 that revealed significant operational obstacles for logistics service providers (LSPs). The research emphasized that the experience and reliability of LSPs are essential for providing excellent value and exceptional service quality to customer organizations. Furthermore, to improve the nation's logistics services, it is imperative to expand logistics effectiveness to satisfy customer expectations. Facilitating the implementation of innovative technologies in Thailand logistics system and supply chain is essential to enhance the competitiveness of the transportation and logistics industry (Office of the National Economic and Social Development Council, 2022). Furthermore, small 3PLs in Thailand face significant disadvantages due to inadequate technology and service management capabilities. Certain organizations are deficient in their capacity to utilize and maximize their service potential (Office of the National Economic and Social Development Council, 2021). The transportation and operations sector aspires to strengthen capabilities and raise the quality and efficiency of LSPs in order to reduce operational expenses and deliver internationally competitive services (Transport, 2023).

According to current data, more than 35 percent of 3PL in Thailand, who have registered with the Department of Business Development and submitted financial statements, are still operating at a loss (DBD, 2022; Meathawiroon, 2023). This reflects the problems that have occurred and the need to resolve

them. In case 3PL are operating at a loss, it could lead to a decrease in the number of available options for entrepreneurs seeking to hire, potentially resulting in higher hiring costs. Therefore, if 3PL can build their own service capabilities to be efficient, it may help improve the organization's performance.

As a result, 3PL providers must create and implement technology in logistics services to fulfil the particular requirements of these customers. Furthermore, the integration of technology and innovation in logistics system development includes the utilization of intelligent technology systems for the effective management of logistics transportation (Office of the National Economic and Social Development Council, 2021). However, there are few researches on 3PL in Thailand have conducted studies on the relationship between logistics technology, performance and competitive advantage such as Pimonrattanakan and Jadesadalug (2020) who studied the development of logistics and supply chain management creating competitive advantage and performance of agricultural product in Thailand or (Meathawiroon, 2023) who studied the creation of competitive advantage for logistics service providers in Thailand through the application of logistics service capability, total quality management, and innovation. As a result, the investigation of competitive advantages of third-party logistics providers in Thailand remains constrained. Therefore, in order for 3PL providers to maintain and improve their competitiveness, it is crucial for businesses to increase their understanding of the role of technology in the small logistics service sector in order to foster competitive advantages.

Logistics Technology and Logistics Performance

Data analytics technology facilitates a methodical approach to smart logistics, encompassing the design, creation, management, and implementation of a transition system for company operations to enhance performance in the transportation of products, information, and assets. Modern innovations and assistance from technology facilitate structure identification, determining its scope, and organizing itself (Moldabekova et al., 2021). Furthermore, Cillo et al. (2019) have developed transformative skills that are essential for integrating corporate performance into the supply chain for monitoring purposes. Moreover, Strange and Zucchella (2017) an examination of the effects of extensive implementation of online offerings and modern technologies (such as automation, large amounts of data, and conservation-focused enterprises) on the operations of supply chain organizations worldwide. Consequently, it is reasonable to conclude that the implementation of new technologies has benefits for supply chain players and other interested parties (Dallasega et al., 2018). Consequently, then this can evaluate the ensuing hypothesis based on the preceding study review.

H1: There is a positive relationship between logistics technology and logistics performance of third-party logistics.

Logistics Technology and Competitive Advantage

The integration of technology can improve corporate competitiveness. Innovation in technology is an essential ingredient of improvement and an important driver of competitive advantage for companies, as well as an essential element in the success of numerous enterprise types (Azubuike, 2013). Technology possesses significant opportunities in supply chain management and fast response methods Sun et al. (2017); (Yu et al., 2021) classify technology, information, and communication as forms of technological innovation. Many logistics managers perceive emerging technologies as essential elements for enhanced efficiency and a competitive advantage (Sun et al., 2017). Discovering the variables that could possibly signify the sustainability of a competitive advantage. The researchers analysed the influence of logistics

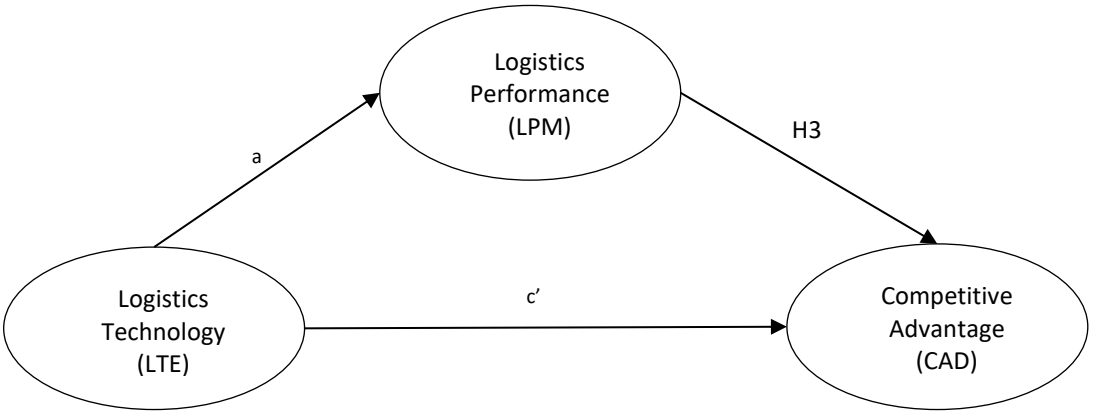
technology on competitive advantages. Based on the analysis of the previous studies, it can now investigate the following hypothesis:
H2: There is a positive relationship between logistics technology and competitive advantage of third-party logistics.

Logistics Performance as Mediating Factor on Logistics Technology with Competitive Advantage

Logistics performance describes the degree of efficiency, effectiveness, and uniqueness involved in delivering the logistics service (Mentzer et al., 2004). Logistics management should primarily focus on minimising resource utilisation for outcomes (efficiency), attaining the desired objectives (effectiveness), and securing a competitive advantage over opponents (differentiation) (Tuan, 2017). According to Victer (2014), worth and provision elements produce a more significant influence on performance than habits and distinctiveness in the context of knowledge dimensions. Price and uniqueness are strongly correlated with performance and competitive advantage (Maket, 2017). Baia et al. (2020) proposes that the favourable correlation between performance and competitive advantage is reliant upon the integration of valuable and different assets and persons. Presently, enterprises have two key challenges. The primary objective is to efficiently leverage their talents to acquire, generate, and enhance value in the market in accordance with their company strategy. The second is to comprehend and assess their performance across the broader industry supply chain. The resource-based view (RBV) suggests that a corporation may achieve a competitive advantage through leveraging the resources and capabilities of its third-party vendors. Logistics performance plays an important role in predicting and explaining competitive advantages (Piriyakul & Kerdpitak, 2011). An examination of prior research will facilitate the assessment of the study's hypothesis.

H3: There is a relationship between logistics technology and competitive advantage of third-party logistics with logistic performance as mediating factor.

Figure 1
Conceptual framework of logistics technology, logistics performance and competitive advantage



METHODOLOGY

Research design is a methodical structure that explores the procedures and processes for collecting and analysing information from studies, alongside establishing the technique for solving the subject of the study (Roger, 2009). The primary objective of this research investigation is to examine the correlations

among specified elements, specifically the influence of logistics technology on logistics performance, with the aim of gaining a competitive advantage for 3PL providers (Filho & Moori, 2020). This study employs a quantitative methodology, which involves the collection and analysis of primary data using quantitative methods. According to Saunders et al. (2019), quantitative research uses a methodical approach to examine the correlations among variables and evaluate those using numerical data, statistical techniques, and graphical representations. This study involved small 3PL enterprises in Thailand that offer logistical services in the logistics industry. Representatives from 3PL answered questions regarding the elements influencing their firms' competitive advantage, encompassing technology and performance.

The population and sample size in this study refer to the list of 3PL companies in the three southern border provinces of Thailand (Pattani, Yala, and Narathiwat) that were collected from the Department of Business Development Thailand. There are currently 196 3PL companies in the three southern border provinces of Thailand. Hair et al. (2010) advised using a minimum sampling size of 100 for a model comprising not more than five components and exceeding three items with a substantial number of common products (0.6 or higher). Therefore, the unit of analysis in this study encompasses all 3PL companies. This study employed a questionnaire as the primary instrument for data collection and analysis. The researcher uses multiple-choice checkboxes and rating scales in a quantitative questionnaire. The data collection in this study involved the use of questionnaires, with all correspondence being directed towards specific respondents. The researcher formatted the surveys on A4-sized paper, each consisting of 10 pages that are divided into 4 major parts: general information, logistics technology of 3PL, logistics performance of 3PL, and competitive advantage of 3PL. The cover letter on the initial page clearly explains the purpose of the survey to the respondents. The letter also underscores the significance of the survey and the confidentiality of the information supplied by the respondents. Moreover, the researcher attached an envelope with an address for the respondents to return the questionnaires In addition, the researcher invited the responders to contact the author with any questions or for further clarification. Researchers examined the data in this investigation with the statistical software Smart PLS because PLS-SEM is a technique for data evaluation that primarily focuses on advancing the study model (Ringle et al., 2018). The researcher assessed the provided information using quantities, average ratings, and percentage metrics (Ünal & Turan, 2020). The SEM technique is advantageous in the fields of social science. Researchers achieve this by focusing on the description of the component within the independent variables during model evaluation (Hair et al., 2017). SEM assists researchers in assessing each dimension and the dependability of constructs. Moreover, SEM concurrently conducts a comprehensive model fit assessment alongside testing for individual parameter estimates. The researcher informed participants about the research's objectives, methodologies, potential risks and benefits, and the use of their data for ethical considerations. Moreover, the independence and worth of those participating are protected and preserved through the assurance of secrecy.

This study assessed the reliability of each measurement by using 30 respondents' data from the pilot study, which was not a sample of the study. The adoption of a prior instrument evaluates the internal consistency of the scales, as measured by Cronbach's alpha reliability coefficients. According to Roger (2009) Cronbach's alpha levels above 0.7 are considered acceptable, while those above 0.8 are considered outstanding. Consequently, dependability rose when Cronbach's alpha neared 1.0. Table 1 demonstrated satisfactory reliability, with Cronbach's alpha values falling within the acceptable range of 0.822 to 0.912. Therefore, these construction measures can be considered to be reliable.

Table 1
Reliability coefficient for the variables

Variable	**Cronbach's Alpha**
Logistics Technology (LTE)	0.911

Logistics Performance (LPM)	0.822
Competitive Advantage (CAD)	0.912

Shapiro-Wilk test was employed to evaluate the normality of the data for this study. The Shapiro-Wilk test offers a reliable method for evaluating normality in various variations and samples (Aziz, 2017). Table 1 displays the outcomes of the Shapiro-Wilk test. The findings demonstrate that all variables possess a significance value of 0.00, suggesting that the data do not conform to the normal distribution. Hair et al. (2014), underscored the significance of dataset normality in performing SEM studies, including AMOS. However, PLS-SEM analysis removes this worry when the data does not follow a normal distribution. It does this by using non-parametric methods to find important relationships within the data framework that do not follow normality. This makes the reason for using PLS-SEM clear.

Table 2

Result of the Shapiro-Wilk test of normality

Variable	**Kolmogorov-Smirnov[a]**			**Shapiro-Wilk**		
	Statistic	df	Sig.	Statistic	df	Sig.
LTE	.150	159	.000	.928	159	.000
LPM	.082	159	.004	.969	159	.000
CAD	.103	159	.000	.954	159	.000

RESULTS

The questionnaire results detailed the positions, ages, highest educational qualifications, and experience of 159 participants in the logistics field. The numerical data reveals that the majority of respondents held managerial positions, with managing directors and managers also participating. 51–60 years was the majority age of responses, followed by 41–50 years. The main level of education among respondents was a bachelor's degree and followed by an associate degree. The majority of respondents, or 33.51%, have 6–10 years of expertise in logistics. Subsequently, 26.49% of respondents possessed 11–15 years of experience in the logistics business.

A correlation exists between logistics technology, logistics performance, and competitive advantage. The results of the study, corroborated by H1 and H2, indicated a strong relationship between logistics technology and both logistical performance (H1: $t = 17.137$, $p < 0.01$) and competitive advantage (H2: $t = 6.191$, $p < 0.01$). Table 2 presents the results of the fundamental relationships, together with the significance of the paths, t-values, and p-values.

Figure 2

The original path analysis

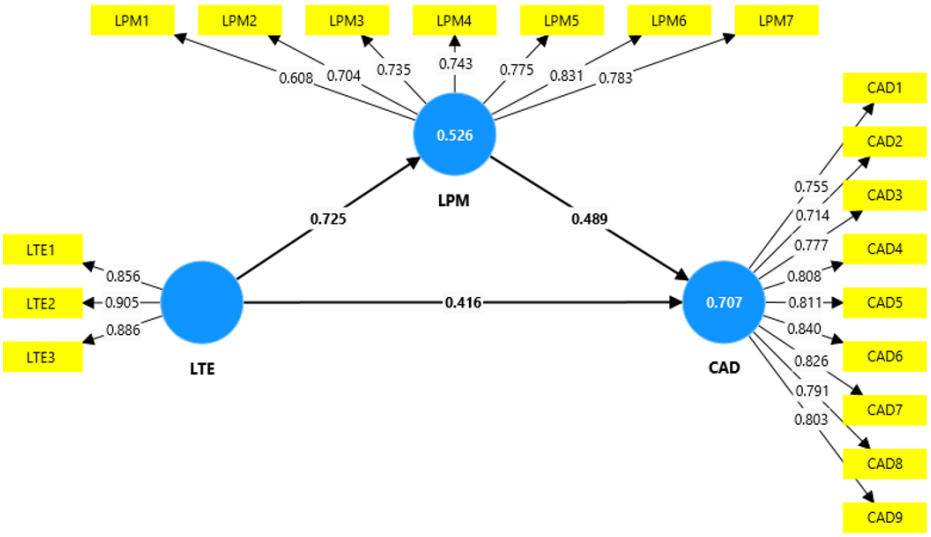


Table 3

Results of hypothesis testing for logistics technology factor

Hypothesis	Relationship	Beta Value (β)	t-value	p-value	Decision
H1	LTE -> LPM	0.725	17.137**	0.000	Supported
H2	LTE -> CAD	0.416	6.919**	0.010	Supported

*Note: Significant level = ** p<0.01; * p<0.05; ns not significant; LTE=Logistics Technology; LPM=Logistics Performance; CAD= Competitive Advantage*

The study's findings use accelerated bias-corrected bootstrap confidence interval analysis (BCa) to help us understand the H3 hypothesis's relationship with other ideas by using bootstrapping to look at certain indirect effects. Table 3 presents the outcomes of the mediating study by LPM between LTE and CAD, employing 5,000 bootstrapping repetitions. Table 3 delineates the analytic results, emphasising the structural correlations and the importance of the routes, including t-values and p-values.

Table 4

Results of hypothesis testing for logistics performance as mediating factor

Hypothesis	Relationship	Beta Value (β)	t-value	p-value	Confidence LL	Interval UL	Decision
H3	LTE->LPM -> CAD	0.355	6.197**	0.000	0.254	0.455	Supported

*Note: Significant level = ** p<0.01; * p<0.05; ns not significant; LTE=Logistics Technology; LPM=Logistics Performance; CAD= Competitive Advantage*

The results of the analysis make it easier to gain a competitive edge by using a consistent method, starting with bootstrapping specific indirect effects and then moving on to bootstrapping confidence intervals (CIs). Table 3 presents evidence of a mediating factor influence ($\beta = 0.355, t = 6.917, p < 0.01$). The bootstrapping analysis of 5,000 data points reveals a two-tailed significance of 0.05, with the highest boundary of the 95% bootstrapping confidence interval (CI) at 0.455 and the lowest boundary at 0.254, indicating support for H3.

CONCLUSION

Regarding logistics technology, it has become a crucial element in various industries, boosting both competitive advantage and logistical performance. This study examines the relationship between logistics technology, logistics performance, and competitive advantage from the perspective of small third-party logistics (3PL) providers in Thailand. Researchers have found a substantial direct positive correlation between logistics technology and both logistics performance and competitive advantage that conformed with Chatzoglou and Chatzoudes (2017) studied that technological innovation has a direct and positive influence on the development of competitive advantage for the organization and Chen (2018) research, which examined manufacturing businesses in Taiwan, found a positive relationship between supply chain innovation and competitive advantage. Moreover, a positive correlation of statistical significance exists between logistics efficiency and the competitive advantage of third-party logistics in Thailand. In addition, logistics performance as a mediating factor correlate with the relationship involving logistics technology and the competitive advantage of small third-party logistics (3PL) providers in Thailand. This study aims to understand the impact of logistics technology on the logistical performance and competitive advantage of small 3PL businesses in Thailand, which could be beneficial for the logistics service industry. Furthermore, 3PL firms may use the study's findings to improve guidelines for improving technology in logistics operations, thereby achieving improved outcomes and success in company competition.

Limitation of the study and future study

The researcher must acknowledge the limitations of this study when assessing the results and their consequences. This study focused on how logistics technology influences the performance and competitive advantage of third-party logistics (3PL) in three southern border provinces of Thailand only. In addition, this study focuses just on logistics technology as an approach to achieving competitive advantage through logistics performance as a mediating element. Future research should initially focus on identifying the aspects that may influence competitive advantage in the logistics sector, enabling 3PL providers to address other issues, such as collaboration among smaller 3PL firms or the relationships between buyers and suppliers and other factors like customer satisfaction that involve competitiveness in the future. Secondly, research suggests that management should enhance the company's unique capabilities, particularly by leveraging intangible assets that competitors cannot easily replicate.

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