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# An Exploratory Factor Analysis of Logistics Capabilities for Manufacturing Industries in Thailand

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**ABSTRACT**

This research aims to explore the critical factors of logistics capabilities for manufacturing firms. Data are collected by using a questionnaire-based survey with the sample, consisting of 370 manufacturing firms. The exploratory factor analysis is conducted by using the principle component analysis method. The results indicate that there are five critical factors for manufacturing firms, comprising demand management capability, value creation capability, measurement capability, delivery capability, and cost capability. There are some different findings from the previous research as follows: (1) New variables are found in demand management capability, including building good relationship between organizations and customers or suppliers, communication skills between organizations and customers or suppliers, and coordination skills within and outside the organization; and (2) A new factor, value creation capability, is found in this study. The new factor is made up of two major attributes, including flexibility and innovation and technology.

*JEL Classification: L60*

*Keywords: logistics capability; exploratory factor analysis; manufacturing industries*

## I. INTRODUCTION

Logistics had been considered as a source of competitive advantage over the past several years (Bowersox et al., 1999; Zhao et al., 2001; Mentzer et al., 2004). Therefore, many organizations devised logistics strategies to ensure greater competitiveness than their competitors, such as cost reduction, work efficiency improvement, and customer satisfaction creation. The findings of the previous studies mentioned about the organization competitiveness that the said competitiveness emerged from resources available in the organization, and these resources would contribute to organizational core competency development (Barney, 1991; Teece et al., 1997). Many organizations possessed various resources, so they should develop specific capabilities so that these capabilities would encourage superior performance of the organization (Morash et al., 1996). Thus, to create sustainable competitiveness, the organization had to develop specific capabilities and ensure superior performance (Gallon et al., 1995).

Logistics capability was regarded as a significant factor contributing to the organization competitiveness (Bowersox et al., 1999; Zhao et al., 2001, Liu and Luo, 2012; Mentzer et al., 2004). Therefore, logistics capability development of the organization is very important, especially in the current time when business operations are complicated and highly competitive. A large number of foreign studies explored the concept of logistics capability, and these studies suggested that logistics capability was a significant factor contributing to outstanding performance (Gligor and Holcomb, 2012; Ralston et al., 2013; Cho et al., 2008). This concept is consistent with the Third National Logistics Development Strategy (2017-2021), with the aim of encouraging Thailand to have logistics competitiveness, enhancing efficiency in trade facilitation, enabling Thai logistics operators to achieve business performance domestically and internationally, and increasing productivity of logistics personnel. The development plan was clearly specified in the third strategy. The development of contributing factors to logistics in the second strategy described the development of logistics personnel's quality to meet the international standards, as well as fulfilling requirements of the business sector. Accordingly, the 12$^{th}$ National Economic and Social Development Plan (2017-2021) described how to develop and raise standards of logistics and supply chain management system to meet the international standards, support value added throughout the supply chain, as well as enhance and develop the capability of human capital by encouraging human workforce to acquire occupational knowledge and skills as required by the job market. This study recruited samples from factories in Chonburi province which possesses high capabilities in the industrial sector of Thailand, as well as being designated for the development of the Eastern Economic Corridor (EEC), a government-driven project for industrial promotion and enhanced competitiveness of Thailand under the Thailand 4.0 national policy. The province is home to Laem Chabang Port, the main deep sea port of Thailand, plus a great location near Suvarnabhumi Airport, serving as the country's main commercial gateway.

Nevertheless, there has been a few studies in Thailand on logistics capability as required by the organizations in the manufacturing industry. Therefore, this study aims to explore logistics capability as required by the organizations in order to provide business operators with useful data for planning human resources development so as to enhance efficiency and effectiveness of manufacturing companies in Thailand.

The objectives of this research are as follows: (1) To explore logistics capability of manufacturing companies in Chonburi province; and (2) To conduct the exploratory factor analysis on logistics capability of manufacturing companies in Chonburi province.

## II. LITERATURE REVIEW

Many researchers conducted studies and categorized logistics capability as per the following details:

Innovation Capability is considered a key capability necessary to be developed by each organization to ensure greater competitiveness than competitors. Fawcett et al. (1997) stated that the innovation capability was a rapid increase in value-added logistics services, including lead time reduction, and the capability of the logistics system in providing new better logistics services. Similarly, De Martino et al. mentioned that the innovation needed to be able to increase customers' satisfaction. "New" and "helpful" services would be regarded as the innovation. Thus, logistics innovation needed to be new services that had not been previously offered. Successful innovation had to rely on key components, i.e., technology, knowledge, and network. Ho and Chang (2015) defined the innovation capability as the ability to apply a new concept to creating new products and services or new processes. In addition, the results of the study presented a positive relationship between the innovation capability and superior performance. Likewise, the study of Yang et al. (2009) revealed that the innovation capability enhanced the ability of container transport service providers in providing logistics services. Therefore, container transport service providers should develop the innovation capability in order to be distinguished from other logistics companies offering similar services. Moreover, Ralston et al. (2013) stated that key capabilities of the organizations that had significant impacts on logistics performance were logistics innovativeness and logistics service differentiation. The study of Ralston et al. (2013) also found that logistics innovativeness stimulated logistics service differentiation since the organization had the ability to develop new logistics processes or services in response to new initiatives of competitors. In this regard, variables used to assess the innovation capability in previous studies included the ability of the logistics system to offer new better logistics services, use of new and competitive technologies to enhance work efficiency, packaging innovation, and so on (Fawcett et al., 1997; Lu and Yang, 2006; Rajapathirana and Hui, 2018).

Information Technology Capability – Useful information technology could encourage organizations to make right decisions in business operations, and contribute to long-term competitiveness (Fawcett et al., 1997) since the information technology capability enabled organizations to analyze the market demand ahead of their competitors, and fulfill customers' requirements by launching new products as required by customers (Jie and Zefu, 2013). The study of Fawcett et al. (1997) revealed that the improvement of the information capability could be achieved by investing in the innovation technology because modern technologies helped collect the data in a correct and timely manner, resulting in continuous improvement of corporate performance. Accordingly, the study of Pisitkasem (2016) on effects of logistics capabilities on efficiency of automotive parts industry in Thailand suggested that any organization with information technology capabilities would achieve cost, time, and reliability efficiencies. Moreover, the study of Shang and Marlow (2005) stated that the information-based

capability consisted of 2 major components as follows: (1) Information sharing; and (2) Information technology. The information technology would support the improvement of multiple tasks in organizations; such as cost reduction together with service improvement. Therefore, several organizations put emphasis on the investment in the information technology so as to ensure competitiveness. Meanwhile, the information sharing is defined as sharing the key information with supply chain partners in a correct and timely manner that could fulfill requirements and benefit business operations. Common variables used by organizations to assess this kind of capability included accuracy of organizational information, availability of information that was functionally convenient, additional applications in the logistics information system of organizations, and so on (Shang and Marlow, 2005; Zhao et al., 2001).

Delivery Capability – Normally, the delivery is defined as speed and reliability (Sarmiento et al., 2007). If any organization achieved on-time delivery, this indicated remarkable performance of the organization, for example, Proctor & Gamble reduced the delivery lead time in order to accelerate the delivery time and fulfill product demands of Wal-Mart (Fawcett et al., 1997). The study of Morash et al. (1996) defined the delivery into 2 items as follows: (1) Delivery speed was defined as the ability to reduce lead time from receiving orders until delivering products and services to customers to be as nearly zero as possible; and (2) Delivery reliability was defined as the ability to deliver the right quantity on the date as required. In addition, the study also found that the delivery reliability was extremely important to senior executives' perception. Accordingly, the study of Boonpattarakan (2012) on competitive capabilities of logistics businesses in Thailand revealed that reliability and speed of services were regarded as key factors contributing to competitive capabilities. Similarly, several studies used speed and reliability to assess the logistics capability of organizations (Cho et al., 2008; Morash, 2001; Fawcett et al., 1997; Sarmiento et al., 2007; Morash et al., 1996). Thus, to ensure competitiveness, executives needed to put emphasis on the delivery reliability and delivery speed. In addition, on-time delivery and coverage were also significant variables that reflected the delivery capability, while several studies found that the organizations used these variables to assess the business performance (Morash et al., 1996; Lu and Yang, 2006; Fawcett et al., 1997).

Demand Management Capability – According to the study of Morash (2001) on the supply chain strategy, capability, and performance, it was found that customer service and quality were ranked as the first priority and the second priority, respectively. When comparing with other capabilities of the supply chain, customer service and quality belonged to demand-side capabilities that tended to be more important than supply-side capabilities that included cost, productivity, and speed. Accordingly, the study of Mentzer et al. (2004) stated that "demand-side capabilities" consisted of 2 items, namely, "quality" and "customer service". Logistics quality was defined as the ability to supply products or materials in accordance with customers' requirements and standards (Morash et al., 1996), as well as customers' satisfaction with logistics services (Fawcett et al., 1997). Meanwhile, the customer service was defined as the process of delivering products to customers through an added-value approach (Liu and Lyons, 2011 cited in Kuo et al., 2017). Variables used to explore the said capability included customer services before and after sales, delivery speed and reliability, ability to fulfill customers' requirements, availability of inventory, data accuracy, and so on (Morash et al., 1996; Mentzer et al., 2004; Cho et al., 2008; Yu et al., 2017).

Quality Capability – Fawcett et al. (1997) defined the quality capability as customers' satisfaction with logistics services, including the ability of the logistics system to promote success of customers. Moreover, the quality could be also assessed by the number of complaints against logistics services. Lin et al. (2012) defined the quality capability as the delivery of products and services with ultimate quality on a regular basis. In addition, Yu et al. (2017) stated that the quality of logistics services included timeliness, availability, and condition and quality. The study of Morash (2001) revealed that the quality was important to business operations of each organization, while variables used to assess the quality in the study included delivery reliability, regular fulfillment of purchase orders, avoidance of problems, avoidance of material discontinuity, solutions and complaints, product replacement, product recall, and so on (Fawcett et al., 1997; Morash, 2001; Lin et al., 2012; Yu et al., 2017).

Cost Capability – The ability of cost management was one of strategic capabilities which could positively affect the companies' accomplishment in business competitions (GroBler, 2010). Likewise, the study of Chavez et al. (2017) found that the cost could significantly affect the improvement of corporate performance. Normally, the cost was defined as expenses for providing products and services for customers through efficient methods in relation to the cost, as well as being able to sell at a low price (Lin et al., 2012). Several studies revealed that most organizations used logistics cost to assess corporate performance (Morash, 2001; Esper et al., 2007; Fawcett et al., 1997; Cho et al., 2008). Some examples of the cost used to assess organizational capability included the cost of goods distribution (Morash et al., 1996), the cost of transportation, the cost of inventory, and the cost of logistics workforce, and so on (Fawcett et al., 1997).

Flexibility Capability – Fawcett et al. (1997) defined the flexibility as the ability to fulfil specific and non-routine requirements, involving the ability of the logistics system to manage unexpected incidents, and the ability of the logistics system to fulfill customers' requirements promptly. Similarly, Lorenzinia et al. (2018) defined the logistics flexibility as the ability of the organization to fulfill customers' changing requirements. Liu and Luo (2012) defined the flexibility capability as the ability to adapt to unexpected situations. Although the findings of the study of Liu and Luo (2012) revealed that the flexibility capability did not affect business performance, it could have impacts on organizational competitive advantages. Therefore, each organization should put emphasis on the flexibility capability that would affect long-term competitiveness of the organizations. The study of Chavez et al. (2017) found that the flexibility could significantly affect the improvement of corporate performance. Accordingly, the study of Hartmann and De Grahl (2011) revealed that the flexibility of logistics service providers could have impacts on customer loyalty. Similarly, the study of Pisitkasem (2016) found that any organization with flexibility capability would also achieve time efficiency. Therefore, the flexibility could be regarded as a capability significant to corporate performance.

Measurement Capability – Esper et al. (2007) defined the measurement capability as the level of monitoring of both internal and external operations performed by each organization that had to be in line with strategies so as to ensure accurate, detailed, relevant, and prompt information for strategic planning and daily decision-making. In addition, the measurement capability could transform business goals into specific measurement of operations and financial targets being of importance to the supply chain. Several studies reported that the measurement of logistics performance was very

important to organizational success (Fawcett and Copper, 1998). The study of Shang (2004) divided the measurement capability into 2 types as follows: General measurement, and benchmarking. General measurement involved the assessment of each operational function, total cost analysis, and customer-oriented measurement. Meanwhile, the benchmarking was an important process leading to the reengineering so as to support work improvement. The results of the study found that the general measurement was significant to the organization as it did not only enhance the benchmarking capability, but also promoted good performance of the organization. Also, the benchmarking took a significant role as it could directly affect financial performance of the organization. Likewise, the study of Fawcett and Copper (1998) explored the measurement of logistics performance from 5 types of indicator, including asset management, cost, productivity, customer service, and logistics quality. The findings of the study revealed that the number of variables or indicators for measurement in each type increased from the year 1989, compared to the year 1994, based on the survey conducted in leading companies. This indicated that each organization had improved its measurement capability. Therefore, the findings implied that when leading companies put emphasis on the performance measurement, these companies would acquire information that were more sufficient, accurate, detailed, relevant, and functionally available, such as for strategic decision-making. Therefore, the measurement capability took a significant role in improving organizational performance.

Based on the aforementioned literature review, there had been some studies on the logistics capability mainly in the viewpoint of foreign researches. Thus, this study aimed to explore the logistics capability in the viewpoint of Thai industry. This study defined the *"logistics capability" as the ability of the organization to manage logistics operations that was distinguished or superior to competitors"*, comprising cost, quality, delivery, flexibility, innovation, measurement, demand management, information technology, etc.

## III. RESEARCH METHODOLOGY

The research methodology of the study on the logistics capability consisted of characteristics of population and sample, research instruments, and analytical statistics as described below.

### A. Population and Sample

The populations in this study were manufacturing firms in Chonburi province. Based on the data of the Department of Industrial Works, Ministry of Industry, there were 4,987 registered factories with industrial licenses as of the end of 2017 in Chonburi province. As for the sample size, the researcher used the formula of Taro Yamane to calculate the sample size from finite populations (Pasunon, 2007). In this regard, the error bound was determined to be 0.05, resulting in the sample size being equal to approximately 370.

### B. Research Instruments and Validation of the Instruments

This study used the questionnaire to collect the data. The questionnaire consisted of 2 parts: Part 1 – Information on logistics capability of the manufacturing industry; and Part 2 – General information of organizations and respondents.

The questionnaire on logistics capability of the manufacturing industry was validated by 4 experts in the field of logistics and supply chain in order to ensure content validity and item-objective congruence. Then, the researcher revised the questionnaire as recommended by the experts.

The researcher had 30 samples in the target group try responding to the questionnaire in order to test the reliability, resulting in 0.954 of Cronbach's Alpha Coefficient that indicated the data appropriateness.

### C. Data Analysis

Part 1 – General information of organizations and respondents would be analyzed by the descriptive analysis. Details of the information on the samples were presented by frequency distribution and percentage in order to explain the collected data regarding details of factories and respondents, such as characteristics of business types, types of business ownership and company size of respondents.

Part 2 – The data of logistics capability of the manufacturing industry in this study would be analyzed by the exploratory factor analysis in order to explore the factors of logistics capability necessary for personnel at work so as to enhance efficiency and effectiveness of organizational performance as required by business operators. This study would use the factor extraction to find the factors being able to replace all variables through the Principal Component Analysis (PCA), and Varimax.

## IV. RESULTS

The analysis results could be divided into 2 parts as follows: Part 1: General information of organizations and respondents; and Part 2 – The information on logistics capability of the manufacturing industry in Chonburi province.

### A. Part 1 – General Information of Organizations and Respondents

The analysis of general information on organizations and respondents provided the following results:

Most surveyed organizations were 183 companies owned by Thai people, accounting for 49.5%, followed by 119 foreign companies, accounting for 32.2%, and 68 joint venture companies, accounting for 18.4%. When analyzing the data of countries which invested in the form of joint venture or owned foreign companies, it was found that Japan was in the first rank with a total of 131 companies, accounting for 71.6%, followed by Netherlands, accounting for 9.3%, and other countries, i.e., Hong Kong, China, Dubai, England, Germany, India, Indonesia, Turkey, Korea, Mexico, Sweden, Taiwan, USA, and so on.

Most businesses in the study were in the small scale type. There were 106 companies having less than 200 employees, accounting for 28.6%, followed by 78 companies in the large scale type having more than 2,000 employees, accounting for 21.1%, 75 companies having 200-500 employees, accounting for 20.3%, 59 companies having 501-1,000 employees, accounting for 15.9%, 35 companies having 1,001-1,500 employees, accounting for 9.5%, and 17 companies having 1,501-2,000 employees, accounting for 4.6%.

As for the type of business, most surveyed companies, totalling 75 companies, were in an auto accessories/auto parts/automobile business, accounting for 20.3%, followed by 72 companies in an electrical appliances/electronics/computer business, accounting for 19.5%, 65 companies in a food and beverage business, accounting for 17.6%, 17 companies in a plastic business, accounting for 4.6%, 16 companies in a construction tools and equipment business, accounting for 4.3%, 13 companies in a furniture and woodworking business, accounting for 3.5%, 11 companies in a petrochemical and chemical supplies business, accounting for 3.0%, 9 companies in a rubber and rubber products business, accounting for 2.4%, 8 companies in a shoes and leather products business, accounting for 2.2%, 5 companies in a clothing/garment/textile business, accounting for 1.4%, and 2 companies in a healthcare products/cosmetics products/pharmaceutical business, accounting for 0.5%, respectively. As for companies in other types of business, accounting for 20.8%, they were in the following businesses: medical devices, steel, sports equipment, safety equipment, packaging, consumer products, sheet glass, and so on.

## B. Part 2 – The Results of the Exploratory Factor Analysis

Based on Table 1, Kaiser-Meyer-Olkin Measure of Sampling Adequacy or KMO was equal to 0.952, a higher value than 0.5 and a value as nearly as 1. This indicated that the surveyed data were appropriate with the factor analysis technique (Vanichbancha, 2009). As for the results of Bartlett's Test of Sphericity, Chi-Square was equal to 9050.130. This revealed that variables were related to one another with a 0.000 level of statistical significance, suggesting that the surveyed variables could be used to conduct the exploratory factor analysis.

**Table 1**
KMO and Barlett's test

| | |
|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy. | 0.952 |
| Bartlett's Test of Sphericity Approx. Chi-Square | 9050.130 |
| df | 435 |
| Sig. | 0.000 |

**Table 2**
Total variance and Eigenvalues

| Total Variance Explained | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 14.859 | 49.528 | 49.528 | 14.859 | 49.528 | 49.528 | 6.031 | 20.104 | 20.104 |
| 2 | 2.226 | 7.421 | 56.949 | 2.226 | 7.421 | 56.949 | 5.048 | 16.827 | 36.931 |
| 3 | 1.877 | 6.256 | 63.205 | 1.877 | 6.256 | 63.205 | 3.915 | 13.050 | 49.981 |
| 4 | 1.240 | 4.133 | 67.338 | 1.240 | 4.133 | 67.338 | 3.159 | 10.530 | 60.511 |
| 5 | 1.077 | 3.589 | 70.927 | 1.077 | 3.589 | 70.927 | 3.125 | 10.415 | 70.927 |

As shown in Table 2, based on the factor analysis by exploring total variance explained with Eigenvalues of more than 1, it was found that the factors consisted of 5 factors, with a total of 30 variables. Cumulative variance reached 70.927%, being higher than 60% that met with the criteria of determining the number of factors (Kaiwan, 2013). In case of the Varimax rotation, the factor loading saw changes as shown in Table 3. A total of 30 variables could be allocated to 5 factors.

**Table 3**
Classification of factors after the Varimax rotation

| | Factor | | | | |
|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Variable 21 | **.750** | .228 | .233 | .131 | .211 |
| Variable 23 | **.741** | .222 | .305 | .268 | .113 |
| Variable 25 | **.697** | .180 | .216 | .181 | .156 |
| Variable 20 | **.693** | .222 | .372 | .191 | .188 |
| Variable 19 | **.616** | .244 | .460 | .149 | .215 |
| Variable 24 | **.612** | .199 | .338 | .295 | |
| Variable 12 | **.602** | .355 | | .298 | .135 |
| Variable 22 | **.586** | | .260 | .105 | .295 |
| Variable 9 | **.538** | .426 | .436 | .127 | .130 |
| Variable 18 | **.534** | .294 | .197 | .383 | .221 |
| Variable 11 | .309 | **.798** | | .110 | .154 |
| Variable 13 | .282 | **.777** | | .121 | .181 |
| Variable 14 | .170 | **.731** | .309 | .193 | .142 |
| Variable 16 | | **.729** | .320 | | .200 |
| Variable 15 | .165 | **.717** | .393 | .241 | |
| Variable 18 | .198 | **.660** | .441 | | .117 |
| Variable 17 | .529 | **.631** | | .148 | .101 |
| Variable 30 | .310 | .267 | **.707** | .112 | .179 |
| Variable 28 | .426 | .155 | **.706** | .208 | .157 |
| Variable 29 | .487 | .210 | **.654** | .191 | .187 |
| Variable 27 | .380 | .314 | **.645** | .236 | .212 |
| Variable 26 | .466 | .387 | **.546** | .172 | .112 |
| Variable 2 | .148 | .150 | .243 | **.785** | .135 |
| Variable 3 | .309 | .177 | | **.746** | .253 |
| Variable 1 | .391 | | | **.682** | .248 |
| Variable 4 | .153 | .215 | .291 | **.654** | .277 |
| Variable 5 | .142 | .125 | .140 | .223 | **.846** |
| Variable 6 | .231 | | .101 | .248 | **.835** |
| Variable 7 | .164 | .409 | .149 | .126 | **.727** |
| Variable 8 | .310 | .178 | .256 | .318 | **.581** |

Based on the above 5 factors, variables in each factor were sorted by the factor loading, and each factor was named as shown in Table 4.

**Table 4**
Summary of variables in each factor

| Factor | Variable (factor loading) |
|---|---|
| Demand management | 1. Build good relationship between organizations and customers or suppliers. (.750)<br>2. Effective management system of the customer service. (.741)<br>3. Completeness of purchase orders, including quantity, type of product, document, and delivery date. (**.697)**<br>4. Communication skills between organizations and customers or suppliers. (**.693)**<br>5. Coordination skills within and outside the organization. (**.616)**<br>6. Good after-sales service system. (**.612)**<br>7. Ability to manage transportation in response to customers' changing requirements. (**.602)**<br>8. Reduced number of complaints against logistics services, management of complaints. (**.586)**<br>9. Information of the organization is accurate, timely, and convenient for use. (**.538)**<br>10. Ability of the logistics system to deal with unexpected incidents. (**.534)** |
| Value creation | 1. Ability of the order-picking system to be adjustable in line with new purchase orders or in priority order. (**.798)**<br>2. Ability of the order-costing model to be adjustable in line with customers' requirements. (**.777)**<br>3. Ability of the logistics system to offer better logistics services. (**.731)**<br>4. Packaging innovation. (**.729)**<br>5. Use machines, tools, or equipment with modern technologies at work in order to enhance work efficiency. (**.717)**<br>6. Information sharing. (**.660)**<br>7. Ability to store inventory that matches customers' demands. (**.631)** |
| Measurement of logistics performance | 1. Do benchmarking to compare organizational performance with industrial standards (**.707)**<br>2. The organization has improved performance in each assessed unit over the past 5 years (**.706)**<br>3. Any person in charge of measurement understands indicators used to measure performance in each unit (**.654)**<br>4. Logistics performance indicators are accurate and appropriate with measurement in various activities (**.645)**<br>5. Good quality of information used to measure performance (**.546)** |
| Delivery | 1. Speedy delivery. (**.785)**<br>2. Reliable delivery. (**.746)**<br>3. On-time delivery. (**.682)**<br>4. Coverage of goods distribution. (**.654)** |
| Cost | 1. Cost of logistics workforce (**.846)**<br>2. Cost of transportation. (**.835)**<br>3. Cost of inventory. (**.727)**<br>4. Cost of goods distribution (**.581)** |

## V. CONCLUSION AND RECOMMENDATIONS

This research explored the critical factors of logistics capabilities of manufacturing companies in Chonburi province, Thailand, comprising 370 samples. Based on the exploratory factor analysis, 5 factors and 30 variables could be identified as described below.

The 1st factor "Demand Management" was the most significant factor which could explain 49.528% of the variance. Therefore, executives in the supply chain had to focus more on developing this kind of capability. According to the factor analysis, it was found that the demand management capability was related to variables in relation to quality and logistics services, as well as completeness of purchase orders, including quantity, type of product, document, and delivery date, information of the organization which was accurate, timely, and convenient for use, effective management system of the customer service, good after-sales service system, and reduced number of complaints against logistics services. These variables were consistent with the study of Morash et al. (1996) and Mentzer et al. (2004).

Moreover, the study of Mentzer et al. (2004) stated that the demand management capability also involved the ability to adapt to unpredictable situations or so called flexibility, and the ability to fulfil specific customers' requirements or so called responsiveness. This was consistent with the outcomes of variables, i.e., the ability of the logistics system to manage unexpected incidents, and the ability to manage transportation in line with customers' changing requirements, respectively.

However, unlike the past studies, the factor of demand management capability found new variables, namely, building good relationship between organizations and customers or suppliers, communication skills between organizations and customers or suppliers, and coordination skills within and outside the organization. The variable of building good relationship between organizations and customers or suppliers occupied the factor loading at most (Factor Loading = 0.750). The said variable was in accordance with the study of Yu et al. (2017) which stated that the relationship satisfaction was related to good relationships at work so as to achieve the work outcome efficiently. The relationship satisfaction was within the quality logistics services which served as a key component of the demand management capability. Moreover, the study of Mentzer et al. (2004) also reported that the coordination skills within and outside the organization was considered a key component of the demand management capability as well. Similarly, the study of Gambetti and Giovanardi (2013) on communication for supply chain management revealed that the communication took a significant role in enhancing efficiency of organizational operations and supply chain. Furthermore, efficient communication would help raise the quality of services. In this regard, communication also involved the relationship development and coordination within and outside the organization (Mohr et al., 1996). Therefore, new variables included in this factor had impacts on the demand management capability of the organization.

The 2nd factor "Value Creation" was the second most significant new factor which could explain 7.421% of the variance. According to the factor analysis, it was found that the variables in this factor consisted of 2 items, namely, flexibility, and innovation and technology. The flexibility would include the ability of the order-picking system to be adjustable in line with new purchase orders, the ability of the order-costing model to be adjustable in line with customers' requirements, and the ability to store inventory that

matches customers' demands. Meanwhile, the innovation and technology involved the ability of the logistics system to offer new better logistics services, packaging innovation, and use of machines, tools, or equipment with modern technologies at work in order to enhance work efficiency.

The researcher found that the aforementioned 2 items were consistent with "Value Creation." Priem (2007) stated that "Value creation was associated with the innovation which generated or added value to consumption of consumers." Cosso-Silva et al. (2016) mentioned that "Value creation was the initiatives of both organizations and customers in creating new invention, and new approaches to support the process of mutual value creation." Schumpeter (1934) as cited by Dominguez-Pe´ry et al. (2013) stated that value creation was usually discussed under the logic of the innovation and technology. Thus, the innovation and technology could be a part of value creation in the viewpoint of both customers and organizations. As for the flexibility, it was defined as the ability to change or adjust to fulfill customers' requirements (Naim et al., 2010; Fawcett et al., 1997; Lorenzinia et al., 2018). In this regard, the researcher found that the variables in this study were the ability of the order-picking system to be adjustable in line with new purchase orders, the ability of the order-costing model to be adjustable in line with customers' requirements, and the ability to store inventory that matches customers' demands. These variables were consistent with the study of Oh et al. (2015) which reported 4 types of value creation as follows: (1) Standard-type value creation; (2) Customized-type value creation; (3) Solution co-creation-type value creation; (4) Solution option-type value creation. The variables in terms of the flexibility in this study belonged to (2) Customized-type value creation, i.e., to create value for customers by providing tailor-made products and services to fulfill customers' demands. Such process required an exchange of knowledge and skills between customers and organizations. Therefore, apart from the ability to fulfill customers' changing requirements, the information sharing within and outside the organization also served as a significant variable for creating value to customers and organizations. In addition, the information sharing in the organization did not only provide helpful information for operations and competitions, such as marketing, price, and sales promotion, but also encouraged manufacturers to adopt ideas or feedbacks of customers so as to further improve and develop new innovative products and services in order to fulfill customers' requirements more specifically (Lin and Germain, 2004 and Dean and Evan, 1994 cited in Lin et al., 2010). Accordingly, the study of Lin et al. (2010) revealed that the information sharing positively affected the innovation capability. For the aforementioned reasons, the researcher renamed this new factor as "Value Creation Capability".

Furthermore, according to the Third National Logistics Development Strategy (2017-2021), the third strategy titled the development of contributing factors to logistics described the intention to encourage Thai industries to conduct research and development on logistics technologies, create own innovation, and enhance efficiency of the national logistics system. This was in accordance with the analysis results of the 2nd factor "Value Creation Capability". Therefore, manufacturers should fully put emphasis on this factor.

The 3rd factor "Measurement of Logistics Performance" could explain 6.256% of the variance. According to the factor analysis, it was found that the items related to the measurement of logistics performance consisted of the following: Do benchmarking to compare organizational performance with industrial standards; improve performance in each assessed unit over the past 5 years; the researcher gained understanding about

indicators used to measure performance in each unit; the indicators of logistics performance were accurate and appropriate with the measurement in various activities; and the information was of good quality for the measurement of performance. It was found that all variables from the factor analysis were consistent with the study of Shang (2004) which revealed that the measurement of logistics performance capability could affect organizational performance, comprising both general measurement and benchmarking. Also, this was in accordance with the study of Fawcett and Copper (1998) which stated that the measurement of logistics performance was very significant to organizational success. This indicated the importance of the development of this capability made by the organization.

The 4th factor "Delivery" could explain 4.133% of the variance. According to the factor analysis, it was found that the items related to the delivery consisted of speedy delivery, reliable delivery, on-time delivery, and coverage. This was similar to several studies (Morash et al., 1996; Lu and Yang, 2006; Fawcett et al., 1997; Sarmiento et al., 2016) which found that the delivery capability indicated that the organization was outstanding and competitive.

The 5th factor "Cost" could explain 3.589% of the variance. According to the factor analysis, it was found that the items related to the cost consisted of the cost of logistics workforce, the cost of transportation, the cost of inventory, and the cost of goods distribution. This was consistent with several studies which used the cost to measure the organizational capability (Morash, 2001; Esper et al., 2007; Fawcett et al., 1997; Cho et al., 2008) since the cost capability could affect the improvement of organizational performance (Chavez et al., 2017). Therefore, many organizations put emphasis on the development of this capability in order to ensure competitiveness.

The classification of all 5 factors could reflect the attitudes of industrial business operators in Thailand toward the development of logistics personnel to be made in line with the logistics capability as required by the organization.

The recommendations for future research are provided as follows: (1) The researcher could use this study as a basis to develop other related variables, especially new variables in the 1st factor and new factors found in this study so as to further develop the body of knowledge on the logistics capability; and (2) The researcher could use this study as a basis to analyze the casual model related to the logistics capability.

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