

## The effect of guidelines on reducing logistics costs

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### CHRONICLE

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### ABSTRACT

In an operating business amidst fierce competition, the operational process needs to be developed and improved in order to reduce logistics costs which are hidden costs in all business activities. This study aimed to investigate guidelines for reducing logistics costs in the industrial business sector, and to develop a structural equations model. It was conducted quantitatively and qualitatively.

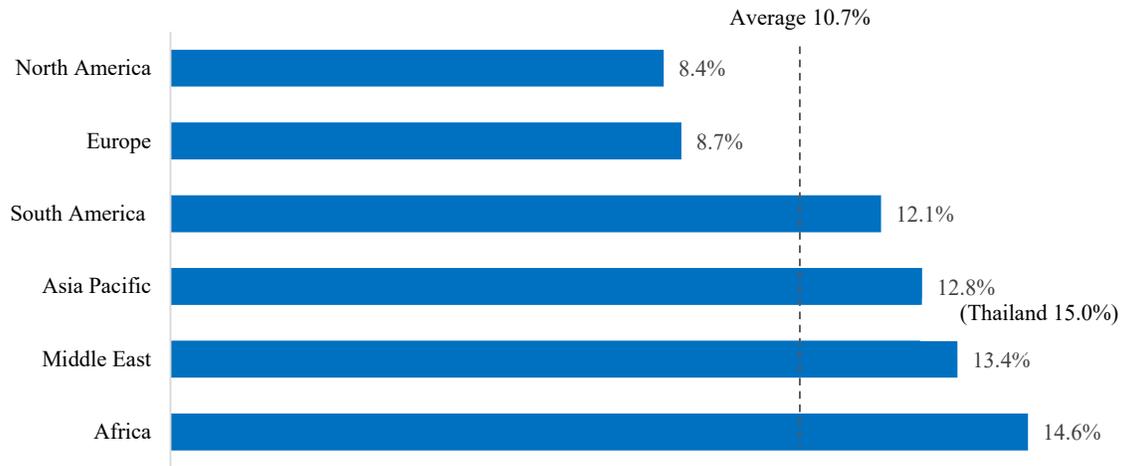
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## 1. Introduction

Business operations in an era where needs of customers are varied and unlimited, consumers have more bargaining power than manufacturers do. Businesses are putting their efforts on developing and improving operational processes to reduce their operational costs and to maximize profitability. The use of tools and different strategies to help operating activities to reduce logistics costs (Han & Wang, 2021) is one of the methods they use to achieve their goal since the logistics costs are a major factor inherent in all business activities (Zwelakhe, 2020; Marcin et al., 2016). Presently, logistics systems are connected with a wide variety of information technology enabling us to quickly respond to sales and control inventory storage well. Any business that has a good transportation system or logistics will result in advantages over competitors as well as customers' satisfaction (Sakhapov et al., 2018; Chaghooshi et al., 2015). Logistics management is an integral part of a supply chain process that can help planning; supporting; efficiently controlling the flow of raw materials and goods; and holding storage of the products, services, and anything related to information from the beginning to the end to meet the needs of customers (Council of Supply Chain Management Professional, 2020). The first priority of logistics management in business systems is to benefit from time and space or to create values by bringing products to the place of needs i.e. bringing the products with the right form, quality, quantity, and costs, from the right place to another (Havenga, 2018). A systematic and efficient management of logistics can, therefore, help to reduce costs and increase profitability for the organization in the long run (Thanasit, 2016). According to a survey conducted by Armstrong & Associates, the global average proportion of logistics costs to GDP of all countries around the world was 10.7% with Africa contributing the highest at 14.6% while North America positioning the lowest at 8.4% (Armstrong & Associates, 2020). As for Thailand, the proportion of logistics costs to GDP was 15.0% which was higher than the global average and higher than those in every continent (See Fig. 1.). This, therefore, becomes an issue that is worth studying to find the guidelines to reduce logistics costs in Thailand.

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**Fig. 1.** Proportion of logistics costs to GDP in 2020

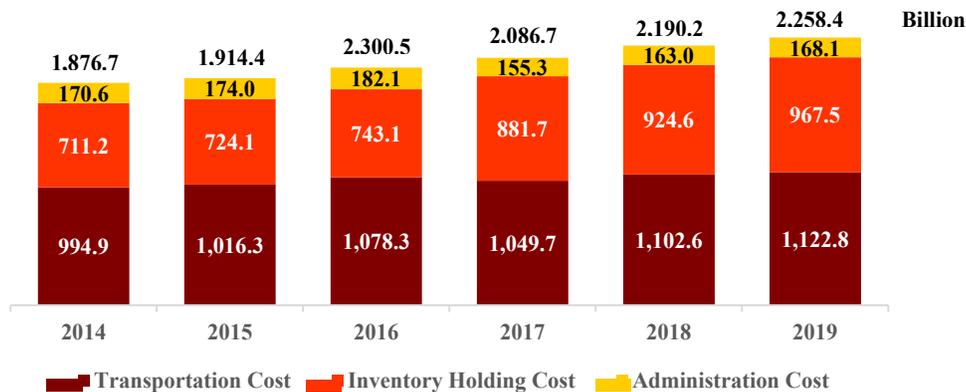
Source : Armstrong & Associates, 2020.

Business operations under the national development policy to Thailand 4.0 resulted in the industrial sector in Thailand including small, medium, and large enterprises to adjust themselves not only in terms of production process but also delivery of goods. Thai entrepreneurs recognize the importance of delivering the right products i.e. right quality, quantity, and time under the appropriate costs. Entrepreneurs need to have basic understanding of work processes and the flow of interconnected systems in order to design the logistics of their own organization to minimize the costs first. Logistics activity is considered as an activity to help support the connection of the work inside and outside the organization both in terms of demand and supply (Nivarat, 2018). In general, the principal components of logistics costs are of three types, namely, transportation cost, inventory holding cost and warehousing cost, and administration cost. Transportation cost may be defined as the cost of transporting the goods from the origin or the place of production to the destination or the final consumer whereas inventory holding cost is a total cost of inventory carrying and warehousing. Regarding the administration cost, it refers to the expenses or administrative cost associated with other logistics activities such as procurement process, raw materials management, and product demand forecast (see Fig. 2). The proportion of logistics costs varies according to business types.



**Fig. 2.** Components of logistics costs

Source : Zanjirani, Nasrin, & Hoda, 2009; Office of the National Economic and Social Development Council, 2020.



**Fig. 3.** Thailand logistics costs

Source : Office of the National Economic and Social Development Council, 2020.

The Office of the National Economic and Social Development Council has analyzed the logistics costs of Thailand from 2014-2019 and found that logistics costs of Thailand tended to increase annually (See Fig. 3). This is in line with Maidan (2020)'s forecast, that global total logistics costs will continue to grow at an annual growth rate of more than 5% through year 2023. Cost reduction is considered a very important matter for management because increasing costs means lower profits. If business costs, or logistics costs in particular can be reduced, business can certainly make more profits. This study aims to find guidelines to reduce logistics costs of the industrial business sector in order for business to operate for higher returns.

## 2. Hypotheses

This study emphasized guidelines to reduce logistics costs in industrial business in 3 components, namely, transportation cost, inventory holding cost, and administration cost. The hypotheses were set as follows:

**H<sub>1</sub>:** Management factors directly influence freight transport factors.

Transport is an economic activity that causes the movement of goods and services from one place to another at a particular time as wished to achieve the required utility. In many businesses, transport is considered an important cost affecting the total costs (Yan & Zhang, 2015). A good management to reduce the expense in this respect is, therefore, needed.

**H<sub>2</sub>:** Management factors directly influence inventory holding factors.

Inventory holding is an activity within the workplace where an organization can control the expenses through good management (Isaac & David, 2020).

**H<sub>3</sub>:** Freight transport factors directly influence inventory holding factors

Inventory holding cost consists of various sub-costs partly arising from transportation, which are obsolescence, damage costs, shrinkage costs, and relocation costs. Whether they are high or low depends on the efficiency of the transportation (David, 2015).

## 3. Research Methods

This study is of a new theory creation type using mixed methodology including qualitative investigation with an in-depth interview technique, and qualitative one. Three latent variables, namely, transportation cost, inventory holding cost, and administration cost; and 56 observational variables were set. The population for the qualitative research part was 9 logistics management specialists. An in-depth interview was used to collect the data. As for the quantitative part, the population was 500 the executives responsible for logistics management of industrial business. The number of samples was set according to Comrey and Lee's criterion (Lawrence, Glenn & Guarino, 2017). Multistage sampling technique was employed to obtain the samples, and an interview was used to collect the quantitative data. The instrument used for collecting quantitative data was a structural interview form while that used for the qualitative data was a check-list questionnaire with a 5-point rating scale based on Likert methodology (David & Sutton, 2011). According to the analysis of the Index of Item-Objective Congruence (IOC) of the 56 observable variables, it was found that their IOC ranged from 0.80 to 1.00. The analysis of the questionnaire with Cronbach's alpha coefficient and corrected item-total correlation showed that its reliability and discrimination were .991 and 0.59-0.95 respectively. Descriptive, referential, and multivariate statistics were applied to develop a structural equations model (SEM) using SPSS and AMOS software. The 4 criteria set for evaluating the data-model fit (Arbuckle, 2011): were (1) Chi-square Probability Level > .05, (2) Relative Chi-square < 3, (3) Goodness of fit Index > .90, and (4) Root Mean Square Error of Approximation < .08.

## 4. Research Results

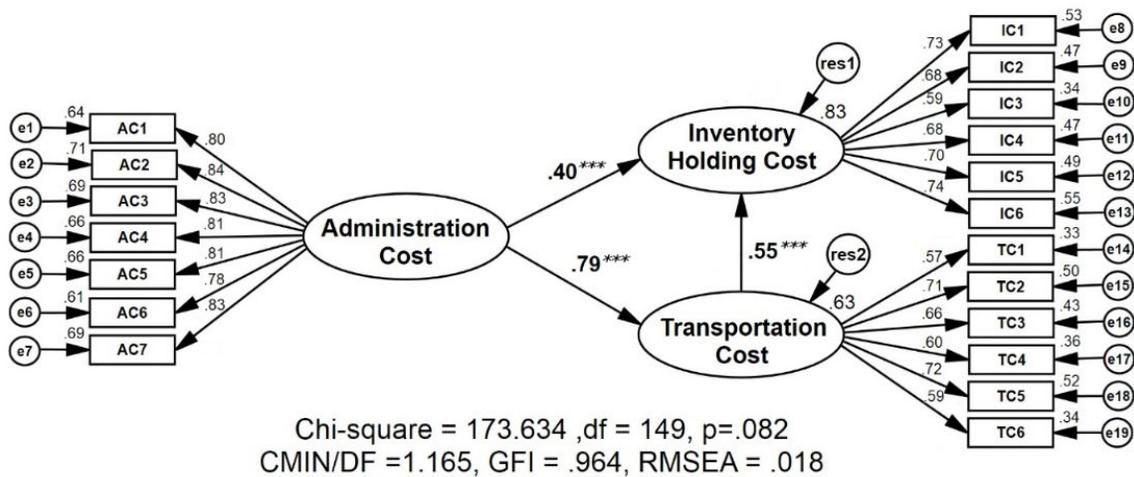
The analysis of the significance level of guidelines for reducing logistics costs in industrial business sector after the structural equations model was modified showed that 19 observational variables could be used. Their means were ranged from 3.77-4.11 as shown in Table 1.

The analysis of the developed structural equations model after being modified showed that it was consistent with the empirical data. The values of its Chi-square Probability Level, Relative Chi-square, Goodness of fit Index, and Root Mean Square Error of Approximation were 0.082, 1.165, 0.964, and 0.018 respectively. The hypothesis testing at the level of significance at 0.001 proved that all hypotheses set were true, i.e. Management cost factors directly influenced those factors related to freight transport and inventory holding costs. Their regression weights were 0.79 and 0.40. The factors related to freight transport costs directly influenced those concerning inventory holding costs. Its regression weight was 0.55 as shown in Fig. 4 and Table 2.

**Table 1**

Mean and Standard deviation of each guideline for reducing logistics costs in industrial business sector

Abbreviation	Guidelines for reducing logistics costs in industrial business sector	Mean	S.D.
<b>Transportation costs</b>			
TC1	Calculate the size and weight of the goods to fit in the transportation cycle.	4.11	0.79
TC2	Use milk run transportation system and arrange to receive raw materials at the precise time.	3.86	0.96
TC3	Establish a distribution center for delivering goods on the same route together.	3.83	0.96
TC4	Have specialists to plan the transportation routes.	3.83	0.95
TC5	Analyze the bottleneck activities in goods transportation process and improve them.	3.89	0.87
TC6	Hire purchase transportation vehicles instead of purchasing assets to reduce the maintenance expenses.	3.81	0.96
<b>Inventory holding costs</b>			
IC1	Use inventory management techniques (ABC Analysis) to classify the goods according to the hierarchy of importance and how to store them.	3.88	0.84
IC2	Push the inventory to partners to control the storage space in the warehouse.	3.92	0.87
IC3	Use technology such as bar code scanner to record the information of goods entering and leaving the warehouse instead of recording on paper.	3.77	0.88
IC4	Keep the warehouse clean so that anything unusual or damaged spots can be easily noticed.	3.97	0.83
IC5	Cooperate with raw materials suppliers to deliver goods just in time to reduce the storage costs.	3.95	0.87
IC6	Control inventory using Enterprise Resource Planning system (ERP).	4.00	0.98
<b>Management costs</b>			
AC1	Accurately forecast customers' demand to be used for volume planning of freights and services.	3.94	0.87
AC2	Equip personnel with knowledge and understanding of logistics process in their area of work so that they can be a mechanism to drive organization's strategies.	3.95	0.86
AC3	Link the communication system in each organization, both internal and external, to reduce mistakes arising from coordination and information delivery.	3.94	0.88
AC4	Create a large database (Big data) to store the data for quick usage.	3.90	0.94
AC5	Provide the right equipment and use them in a timely manner to facilitate logistics operators.	3.97	0.86
AC6	Manage the risk of exchange rate fluctuation arising from shipping the goods abroad.	3.89	0.89
AC7	Continuously assess logistics performance to be used for further improvement.	3.97	0.85



\*\*\* Significant at the 0.001 level

**Fig. 4.** A structural equations model of guidelines to reduce logistics costs in industrial business**Table 2**

The statistics values of the developed model after being modified

Variable	Standardized Estimates	R <sup>2</sup>	Variance	C.R.	P
<b>Administration Cost</b>					
Transportation Cost	0.79	0.629	0.077	11.532	***
Inventory Holding Cost	0.40	0.827	0.065	6.190	***
<b>Transportation Cost</b>					
Inventory Holding Cost	0.55	0.827	0.065	7.106	***

\*\*\* at a statistical significance level of 0.001

The analysis of the direct, indirect, and total effects of the model after being modified revealed that management costs, as a whole, directly influenced the factors related to inventory costs the most. Its total effect value was 0.83 as shown in Table 3.

**Table 3**

The values of the direct, indirect, and total effects between the variables

Variable	Direct Effect	Indirect Effect	Total Effect
<b>Administration Cost</b>			
Transportation Cost	0.79	-	0.79
Inventory Holding Cost	0.40	0.43	<b>0.83</b>
<b>Transportation Cost</b>			
Inventory Holding Cost	0.55	-	0.55

The results of analysis of the relationship between the variables with bivariate correlation method after the model was modified disclosed that 171 pairs of variables were related with each other at the statistical significance level of 0.001. The pair of variable AC2; equip personnel with knowledge and understanding of logistics process in their area of work so that they can be a mechanism to drive organization's strategies, and variable AC 3; Link the communication system in each organization, both internal and external, to reduce mistakes arising from coordination and information delivery, had a high relationship with the value of 0.727. as shown in Table 4 below.

**Table 4**

Variables' relationship values obtained after the model was modified with bivariate correlation analysis

	TC1	TC2	TC3	TC4	TC5	TC6	IC1	IC2	IC3	IC4	IC5	IC6	AC1	AC2	AC3	AC4	AC5	AC6	AC7	
TC1	1.000																			
TC2	.414***	1.000																		
TC3	.359***	.472***	1.000																	
TC4	.345***	.391***	.451***	1.000																
TC5	.366***	.532***	.451***	.434***	1.000															
TC6	.368***	.388***	.382***	.362***	.434***	1.000														
IC1	.383***	.428***	.448***	.410***	.432***	.341***	1.000													
IC2	.409***	.411***	.370***	.350***	.413***	.320***	.547***	1.000												
IC3	.247***	.326***	.387***	.316***	.364***	.279***	.462***	.407***	1.000											
IC4	.408***	.407***	.385***	.360***	.449***	.360***	.519***	.504***	.328***	1.000										
IC5	.354***	.455***	.405***	.354***	.431***	.380***	.467***	.442***	.421***	.484***	1.000									
IC6	.338***	.491***	.429***	.383***	.470***	.393***	.538***	.485***	.472***	.487***	.528***	1.000								
AC1	.348***	.465***	.400***	.352***	.504***	.356***	.488***	.444***	.360***	.447***	.537***	.505***	1.000							
AC2	.405***	.492***	.422***	.403***	.501***	.387***	.501***	.456***	.421***	.468***	.523***	.516***	.654***	1.000						
AC3	.396***	.469***	.399***	.349***	.467***	.398***	.493***	.467***	.401***	.462***	.523***	.522***	.685***	.727***	1.000					
AC4	.391***	.467***	.446***	.375***	.505***	.386***	.482***	.507***	.401***	.475***	.527***	.554***	.661***	.669***	.674***	1.000				
AC5	.386***	.447***	.368***	.334***	.488***	.365***	.469***	.448***	.397***	.436***	.506***	.467***	.642***	.704***	.671***	.639***	1.000			
AC6	.376***	.439***	.397***	.374***	.456***	.386***	.471***	.459***	.401***	.470***	.474***	.499***	.604***	.664***	.648***	.613***	.636***	1.000		
AC7	.388***	.429***	.416***	.389***	.471***	.361***	.512***	.463***	.401***	.488***	.530***	.519***	.682***	.679***	.659***	.681***	.688***	.675***	1.000	

\*\*\* at statistical significance level of 0.001

## 5. Discussion

According to the finding, calculating the size and weight of the goods to fit in the transportation cycle was found the most important guideline to reduce logistics costs in the industrial business sector. This was in line with the study of Radovic, et al (2018) who mentioned that transport was the most important logistics activity and it cost the highest. It is necessary that the dimensions and weight of each shipment meet the transport cycle. Although, presently, the trading is easier and more convenient, and the payment can be made through an online platform, the process of delivering the goods from the seller to the purchaser still has to rely on transportation (Hu et al., 2016). Calculating the dimensions and weight of the cargo in order to reorder and free up more space for delivering more goods to customers can help lower transportation costs (Thanasit, 2016). Entrepreneurs must, however, not forget to consider some other factors too, such as transportation route planning, cargo insurance during transportation, adopting technology for tracking goods and shipping, as well as establishing a distribution center for delivering goods on the same route together.

Controlling inventory with the Enterprise Resource Planning system (ERP) was found in this study as the most important guideline to reduce the inventory holding costs. This was consistent with the study by Ignatio and Charles (2016) who found that for organizational management to be more effective, many businesses incorporated information technology systems into their business processes by putting the information in the warehouse and in other departments into the same database for sharing in the organization. Technology most recognized is Enterprise Resource Planning system (ERP). When industrial business has a good inventory management system, it will result in the lowest total logistics costs (Lambert, Stock, Ellram, & Grant, 2006).

The guideline, linking logistics information communication systems together is an activity, was found to have a relationship with the one that read equipping personnel with knowledge and understanding of logistics processes in their area of work so that they can be a mechanism to drive organization's strategies. This is so because nowadays the trend of ordering products online is likely to increase steadily. This requires a communication system as one of the key foundations for online trading to be effective (He et al., 2020). A link between manufacturers, wholesalers, retailers, and consumers must be

established in a harmonious manner. It is, therefore, necessary for personnel to be equipped with various skills, especially, the one concerning digital technology. Industrial entrepreneurs have, as a whole and worldwide, have started to adjust themselves by investing in technology that helps create new experiences for service users, such as creating smart warehouses that connect the robots' working systems together (van Geest et al., 2021). There have been command connection systems for end-to-end logistics processes worldwide. Since these systems require good information communication, logistics personnel must develop themselves to be ready for growth in the same direction.

Logistics management is the factor affecting the cost of inventory holding the most as inventory storage is the necessity for establishments to smoothly facilitate manufacturing or sales. However, having too much inventory may cause the problems of high storage costs, products deteriorated or obsolete, and cost sunk all of which lead to the loss of opportunity to use the money in other areas. On the other hand, too little inventory can result in shortage of products causing interruption of both manufacturing and sales as well as the loss of opportunity to sell the products to customers (Sebatjane & Adetunji, 2021). Therefore, for logistics management to be efficient maintaining quality of inventory with appropriate quantity is required (Zhu, 2018).

## 6. Suggestions

For product arrangement to be more efficient, organizations can choose an application to calculate the dimensions and weight of goods to help manage loading in containers, trucks, or pallets to fit the transportation cycle. Apart from this, business has to realize the importance of in-time delivery, the right number and quality of goods as well.

At present, fierce competitive business practices cannot keep the business running smoothly. Therefore, in addition to industrial business entrepreneurs having to set up a logistics system with raw material suppliers, they should also focus on building cooperation among entrepreneurs who are competitors in the same industry. Such a strong bond and network will lead to a logistics system based on the sharing economy concept to reduce logistics costs such as by sharing space in warehouses, helping transport goods going in the same route etc. Cooperation creation among entrepreneurs can lead to new business relationships in the form of co-opetition resulting in further market expansion.

A systemic logistics cost reduction should begin with both short-term and long-term strategic planning to be used for directing the operations, providing adequate resources, as well as finding proper management methods. Continuously monitoring and evaluating is also very important and cannot not be ignored. Entrepreneurs should bear in mind, when planning, that the relationship across supply chains in terms of freight transportation, inventory storage, and management, must be taken into account. Modern tools and technology should be provided to facilitate timely decision-making that always relies on accurate and up-to-date information to catch up with changing situations at all times.

The advancement of technology plays a very important role in development of logistics work in industrial business. In the near future, the growth of industry with advanced technology in manufacturing processes will certainly be seen. Therefore, the people involved both in private and public sectors need to formulate policies and promote logistics development to support industry growth with logistics management in harmony with each other. Information flow link, demand predictive, and automated warehouse management with a software system should be provided to reduce inventory costs. In addition, the use of modern robot technology is recommended so as to increase the efficiency of logistics work to meet the society changing into the digital economy one. All of these suggestions are expected to lead to the ability of national and global competition.

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