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THE RELATIONSHIP BETWEEN INFORMATION TECHNOLOGY AND LOGISTICS INTEGRATION: A CASE STUDY OF THE LOGISTICS AND DISTRIBUTION INDUSTRY IN MALAYSIA

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Abstract

The purpose of this paper was to analyze the impact of the use of information technology (IT) on a firm's logistics integration (LI), through a survey conducted in Malaysia. The research methodology was based on designing and administering a survey instrument. Descriptive statistic and paired sample t-test were used to analyze the data. The findings revealed that the effect of IT on LI was positively significant. Further, since all the respondents

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belonged to manufacturing firms, the findings of this paper could be relevant to the manufacturing sector. Additionally, although a logistics-related factor is necessary for a firm's performance, it is not sufficient unless the factor interaction is taken into consideration, as evidenced by the significant positive relationship between IT and LI.

Keywords: *Information Technology, Logistic Integration, Logistics and Distribution Industry.*

JEL Code: C93 and D24

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1. Introduction

The supply chain is the most crucial part of any business organization. Some studies, conducted by **Sivan et al. (2022)**, **Sundram et al. (2020)**, and **Akmal et al. (2016),** on the effect of supply chain integration on performance, found that logistics integration (LI) was the most important of all supply chain factors, in its impact on performance. It is believed that LI is "the quality of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment". Thus, integration ensures the management of the entire process across the supply chain as one unit where each member of the supply chain focuses on what it does best, leaving the rest to the other **(Chen et al., 2009; Kahn & Mentzer, 1996)**.

Companies need to create better value for their customers. By looking at suppliers as strategic partners, can add value and be a source of competitive advantage **(Syakirah, et al., 2020; Zulfakar, et al., 2019; Sundram et al., 2016a)**. Effective supply chain should have a network of information with each other, to ensure uninterrupted flow, to match supply and demand. This flow needs integration from supply chain partners to ensure there are no obstacles to movement at each buyer-supplier interface in a supply chain information network **(Sundram et al., 2018b)**.

2. Literature Review

2.1. Logistics Integration

In recent years, the heightened intensity of retail competition has drastically changed the way distribution companies operate their distribution systems. These changes include the application of the integrated logistics management concept, to design their supply chains and what is most important, extensive use of information technology to gain a competitive edge **(Rasi et al., 2021; Sundram et al., 2016b)**. In addition, distribution firms should maintain close relationships and effective communications with their channel/trading partners, render necessary support to them and provide customers with satisfactory service. These have been deemed the key factors for distributors' success in managing their logistics systems. Nowadays, to retain a customer in the organization, logistics management and supply chain management are more important to ensure the success of a firm. Since every firm wants to improve its distribution systems, information technology is an important prerequisite to good logistics management **(Sundram et al., 2018a)**, integration of information technology with logistics management and logistics integration **(Sivan et al., 2022; Sundram et al., 2020)**.

At present, logistics plays a very important role in organizations. Due to the highly competitive environment, organizations have tried

to deploy brand new strategic approaches within their organizations, to generate a higher competitive edge. Logistics plays a key role in supporting organizations as they strive for more efficient management systems **(Munir, et al., 2021; Sundram, et al., 2011; Lin, 2007; Wallenburg & Weber, 2005)**. Further, as in business practices, the inefficient logistics system, together with the inefficient internal management, would disable the organization to respond to the needs of customers with the lowest price in the shortest feasible time frame **(Ali et al., 2020; Bakar, et al., 2016)**. Moreover, this would also include the quality level which does not meet customer expectations and would lead the organizations to a competitive disadvantage against their rivals **(Selvaraju, et al., 2017; Sundram et al., 2017a)**. With a broad range of manufacturers and distributors for our customers to choose from, they can choose to purchase the products from the manufacturers and distributors who are capable of offering products that match their specified quality at the lowest prices and to be delivered on time **(Mkumbo, et al., 2019; Sundram, et al., 2018c; Akmal, et al., 2016; Atikah & Sundram, 2014; Adobor & McMullen, 2007)**.

2.2. Information Technology

Information is the glue that holds the supply chain together. Since IT enables sharing of information among supply chain partners, it is crucial to the management of supply chains **(Kearns & Lederer, 2003)**. Incorrect or delayed information between supply chain partners, can lead to high order volatility and related inefficiencies **(Lee et al., 1997)**. Theoretical support for the use of IT comes from the Resource-Based View (RBV). While the use of IT *per se* does not guarantee improved performance, IT capabilities, if properly harnessed, can add value to supply chain processes and performance **(Wu et al., 2006; Tippins & Sohi, 2003)**.

IT linkages aid such logistics activities as inventory management, order fulfillment, production planning and delivery planning and coordination **(Vatumalae, et al., 2022)**. It can reduce inventory buffers, by postponing costly value-adding operations, reducing cycle time from order to delivery and leading to better tracking and reduced transaction costs **(Selvaraju, et al., 2017)**. Integration of IT, across the supply chain, enhances flexibility and responsiveness and helps overall competitiveness **(Sundram, et al., 2018c; Rajagopal, et al., 2016; Gunasekaran & Ngai, 2004)**. By enabling sharing of demand and production data, IT facilitates collaborative planning and supplier integration which in turn impacts operating performance **(Karoway, 1997; Vickery et al., 2003)**.

3. Statement of the Problem

Logistics integration is a strategic model, that is increasingly used to accelerate product delivery and to improve customer service. In this model, all departments, processes and resources are aligned to work in perfect sync and operate as one cohesive unit, with the help of timely and quality information sharing, across the partners in the supply chain. Nevertheless, most of the time, the causes of logistics integration failure are due to the lack of timely information flows, across supply chain partners, to ensure unhindered movement **(Vatumalae, et al., 2022)**. This is the reason why logistics integration is not very effectively implemented in our country **(Selvaraju, et al., 2017)**. Further, the focal firm and their suppliers, lack technological information towards completing tasks, which hinders the sharing of advanced knowledge and enhance the logistics integration. Hence this study to identify the effects of

information technology on logistics integration, among firms in the logistics and distribution industry.

4. Need of the Study

There are several studies, which had examined the association between information technology and organizational performance in Malaysia but the relationship between information technology and logistics integration, has not been studied, especially in the logistics and distribution industry **(Sundram et al., 2017b; Akmal et al., 2016)**. Further, the study has offered a new theoretical framework, to highlight the role of information technology for the enhancement towards logistics integration, especially in the logistics and distribution industry in Malaysia. Hence the need to undertake a study, that determines the relationship between information technology and logistics integration, which could help the logistics industry to provide better services to the supply chain partners and their customers at all times.

5. Objective of the Study

The objective of this study was to identify the effect of information technology on logistics integration, concerning supply chain management, in Malaysia.

6. Hypotheses of the Study

According to Handfield & Nicholas, information technology encompasses the information that business creates and uses as well as a wide spectrum of increasingly convergent and linked technologies, that process the information. This study is focused on the information, related to the flow of materials, products and services, including the reverse flow contained in a logistics information system. Information technology is crucial to management. Incorrect or delayed information between supply chain partners, can lead to high order volatility and related inefficiencies **(Lee et al., 1997)**.

Informations techonolgy is related to logistics in areas such as inventory management, order fulfillment, production planning and delivery planning and coordination. It can reduce inventory buffers by postponing costly value-adding operations, reducing cycle time from order to delivery, leading to better tracking and reduced transaction costs **(Vatumalae, et al., 2020; Selvaraju, et al., 2017)**. Integration of IT across logistics integration will enhance flexibility and responsiveness and help overall competitiveness **(Sundram, et al., 2018c; Rajagopal, et al., 2016; Gunasekaran & Ngai, 2004)**. A reliable communication infrastructure paves the way for timely and efficient information exchange among partners.

Moreover, without information technology, it is difficult to ensure all the activities flowing as we want. Information technology also influences logistics integration where it facilitates all the activities in manufacturing until the products or services reach the hand of customers **(Ali et al., 2020)**. In adition to this department, the whole organization depends on IT to deliver the information on time, without the need to move from one place to another place or from one department to another department, just to share the information. Thus, the use of IT positively influences the performance of logistics integration. **(Figure-1)**

H-1: Information technology positively affects logistics integration.

7. Research Methodology

This study uses a quantitative research method, which includes structured observation and survey, through the use of questionnaires. The quantitative technique uses statistics to analyze numerical data, gathered by researchers as responses to their research questions **(Sundram et al., 2016c)**. This method was used to examine the relationship between information

technology and logistics integration. Using scientific inquiry, this study relied on data gathered from the sample population of the logistics and distribution industry in Malaysia.

7.1. Sampling Selection

The target population for this study included firms from the logistics and distribution industry in Malaysia. The sampling frame was obtained from the Department of Statistics, Malaysia. There are approximately 1,047 firms in the logistics and distribution industry. As displayed in **Table-2**, a sample of 100 respondents was selected from the population, by using stratified random sampling, by separating the population into non-overlapping groups (strata) and then selecting a simple random sample from each stratum **(Sundram et al., 2012; Sundram et al., 2012).** Respondents were mainly senior managers with vast experience in the area of logistics and supply chain.

7.2. Sources of Data

The study relied mainly on primary data, obtained from responses to the questionnaire regarding the logistics integration and information technology, in the supply and distribution industry in Malaysia.

7.3. Period of Study

This study was conducted during the period Jan 2022 to December 2022. The data collection took about six months. After data collection, the next step was data analysis, to analyse the result.

7.4. Tools used in the Study

This study employed a quantitative research approach and data were collected by using the questionnaires that included eight (8) items of questions to measure the IT and LI. Moreover, a seven-point Likert Scale was used on all items, with response options ranging from 1 (strongly disagree) to 7 (strongly agree). Data were analyzed by using a specific software, named, SPSS version 26.

8. Data Analysis

In this study, the data, collected from the survey were analyzed by using Statistical Package for Social Science System (SPSS). A descriptive statistic and paired sample t-test were used to analyze the data. Through descriptive statistics, a frequency distribution was used to identify and obtain the number of responses associated with the different values of the variable. On the other hand, the interpretation of the paired sample *t*-test examined the *p*-value. Generally, if the *p*-value or the significant difference is less than 0.05, the null hypothesis can be rejected.

8.1. Demographic Profile of Manufacturing Firms in Malaysia

Completed questionnaires for this study comprised 100 responses from the manufacturing industry in Malaysia. According to **Table-1,** majority of survey respondents were firms manufacturing consumer products, which represented 40.85%, followed by electrical and electronic products at 35.14 %. In terms of the number of employees, majority of organizations were within the range of 100 to 1000 employees. **Table-1** also reveals that the manufacturing firms, that participated in this study, reported more than 5 years of operating experience. The number of suppliers, contracted by the manufacturing firms, was from 25 to 75 suppliers which constituted 70% of the total respondents. This indicated that information management is essential, to ensure a seamless operation of supply chain logistics and supplier management in the manufacturing industry in Malaysia.

8.2. Reliability Test of Information Technology and Logistics Integration

Reliability analysis examines the properties of measurement scales and the items that compose the scales. According to the **Table-3**,

the reliability analysis procedure calculated several commonly used measures of scale reliability and provided information about the relationship between individual items in the scale. A relatively high internal consistency of reliability analysis must have a reading of Cronbach Alpha (α), that is more than 0.7. A generally accepted rule is that α of 0.6-0.7 indicates an acceptable level of reliability, and 0.8 or greater is a very good level. **Table-3** shows that information technology and logistics integration recorded reliable measurement items. Further, the measurement items for both variables (information technology and logistics integration), were considered to be consistently reliable.

8.3. Correlation Analysis of Information Technology and Logistics Integration

Pearson correlation analysis was employed, to examine the correlation between logistics integration and the independent variable of information technology. According to **Table 4**, information technology reported strong correlation with logistics integration ($r = 0.540$, $p < 0.01$). In other words, information technology was positively correlated with logistics integration.

8.4. Multiple Regression Analysis of Information Technology and Logistics Integration

Table 5 presents the results of multiple regression analysis of the relationship between information technology and logistics integration. It was found that the model was significant with an *F*-value of 22.43 and it could explain 38.4 percent ($R^2 = 0.384$) of the variance of logistics integration. Further examination of the results revealed that information technology did have positive significant relationship with logistics integration ($\beta = 0.483$, $p < 0.000$). **Table 4** indicates that more advanced the information sharing through electronic transfer, higher the success of logistics integration. Therefore, based on the findings, *H1* was accepted.

9. Findings of the Study

The study established that logistics integration needs to have good relationship with information technology. When it comes to optimizing logistics, it was found that for many customers, the key to success was found through implementing information technology. Further, information technology provides a better step in every method that adds value to suppliers. Information technology is one of the factors which is essential for an organization to work together with their suppliers, for a variety of tasks, with advanced knowledge to fulfill customer demands and wants. Information technology also improves knowledge, quality, and productivity by managing the inventory. Thus it will take cost and waste out of all facets of an operation, from the procurement of raw materials to the shipment of finished goods.

10. Suggestions

This study could help researchers, who might investigate the factors affecting logistics integration. Logistics managers, especially in the manufacturing sector, could further understand the role of information technology and how it can have a positive effect on logistics integration. Practitioners can utilize information technology for logistics performance when it comes to generating real-time data, that serve as the basis for effective management. It makes processes more dynamic and practical. Some software, validated by large companies in this sense, is the most used in logistics. One way is to streamline the process of tracking and distributing inventory. But the biggest benefits of technology in supply chain management, come from reducing costs, improving customer staisafaction and increasing operational efficiency.

11. Conclusion

The importance of information technology, applied to the logistics industry, implies that innovating and seeking modernity within firms, is not a luxury, but a necessity. In other words, information technology in the organization would enhance the knowledge needed by the organization, to improve logistics integration with suppliers, for a long-term commitment and appropriate technological preparedness. For example, information technology activities such as inventory management, product design and packaging, continuous improvement and other collaborative efforts, positively affect organizations' performance. In addition, the relationship between supplier and organizations needs to practise "give and take" when it comes to sharing information between both partners.

In addition, IT in distribution processes plays a big role when it comes to facilitating, optimizing, streamlining and ensuring the quality of operations. Information technology, applied to logistics, has great impact when it comes to generating real-time data that serve as the basis for effective management. It makes processes more dynamic and practical. Some software, validated by large companies in this sense, is the most used in logistics such as CRM - Customer Relationship Management, EDI - Electronic Data Interchange, WMS - Warehouse Management System, ERP - Enterprise Resource Planning and TMS - Transportation Management Systems.

12. Limitation of the Study

Some limitations such as the time period for gathering the data needed, did hamper the study. Another was the difficulty in obtaining the information through a questionnaire because many respondents did not participate, in order to maintain secrecy of internal information.

13. Scope for Further Research

It is recommended to examine the possible involvement of a mediating or moderating variable to obtain a more favorable result for logistics integration. Another suggestion would be extending the period of investigation. Other than that, data many be collected by using an interview method for data collection. Hopefully, these recommendations can give some insight for the new researchers towards the determination of the factors affecting logistics integration.

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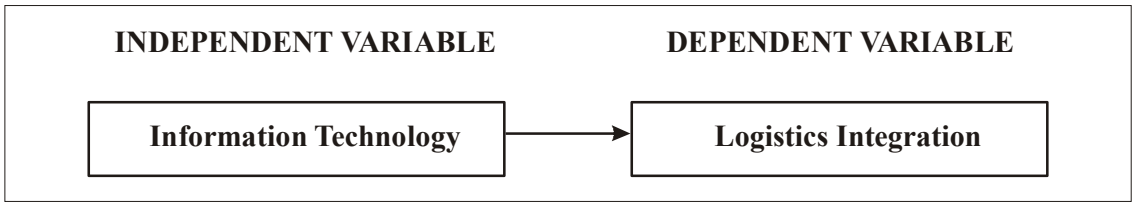
Figure-1: Theoretical Framework: Relationship between Information Technology and Logistics Integration



Source: Framed by Authors

Table-1: Demographic Profile of Manufacturing Firms in Malaysia

Basis	Categories	Frequency	Percentage (%)
Area of manufacturing	Electrical and electronic products	26	35.14
	Consumer products	29	40.85
	Chemical/gases products	16	19.05
	Metal products	11	12.36
	Others	18	21.20
Number of employees	Less than 100	19	23.46
	100-200	37	58.73
	501-1000	32	47.05
	More than 1000	12	13.64
Years of establishment	Less than or equal to 5	21	26.60
	6-10	36	56.25
	11-15	25	33.33
	More than 15	18	21.95
Numbers of suppliers	Less than 25	16	19.05
	25-50	28	38.88
	51-75	24	31.58
	76-100	15	17.65
	More than 100	16	19.05

Source: Primary data computed using SPSS

Table-2: Strata for the Population, Sample Frame, and Survey Responses Regarding Information Technology and Logistics Integration in Malaysia

Strata	Population	Sample	Responses (response rate)
20 – 49	198	22	15 (15%)
50 – 99	22	27	32 (28%)
100 – 199	190	20	16 (17%)
200 – 499	199	23	20 (20%)
500 – 999	128	4	8 (13%)
1000 – 4999	85	3	5 (13%)
5000	17	1	2 (22%)
	1046	**100**	**100**

Source: Generated by Authors

Table-3: Reliability Test of Information Technology and Logistics Integration in Malaysia

Variables	Cronbach Alpha
Information Technology	0.713
Logistics Integration	0.825

Source: Primary data computed using SPSS

Table-4: Correlation Analysis of Information Technology and Logistics Integration in Malaysia

Variable	IT	LI
IT	1.000	
LI	0.540**	1.000

** Significant at 0.01 level (2-tailed)

Source : Primary data computed using SPSS

Table-5: Multiple Regression Analysis of Information Technology and Logistics Integration in Malaysia

Independent Variable	Logistics Integration			Hypothesis	Result
	Beta (β)	t-value	Sig.		
Information Technology	0.483	4.356	0.000	H1	Accepted
F-value	22.438				
R-square	0.384				

***Significant at the 0.001 level

Source : Primary data computed using SPSS