

**DETERMINANTS OF LOGISTICS INFORMATION
TECHNOLOGY (LIT) INNOVATION
IMPLEMENTATION TOWARDS FIRM
PERFORMANCE BY LOGISTICS SERVICE
PROVIDERS (LSPs) IN MALAYSIA**

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**DETERMINANTS OF LOGISTICS
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FIRM PERFORMANCE BY LOGISTICS SERVICE
PROVIDERS (LSPs) IN MALAYSIA**

by

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LIST OF ABBREVIATIONS

AEC	ASEAN Economic Community
AGVs	Automated Guided Vehicles
ASEAN	Association of Southeast Asian Nations
B2B	Business to Business
BDA	Big Data Analytics
CP	Competitive Pressures
DFTZ	Digital Free Trade Zone
DOI	Diffusion of Innovation
EAS	Electronic Article Surveillance
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
E-SCM	Electronic Supply Chain Management
FP	Firm Performance
GDP	Gross Domestic Product
GIS	Geographical Information System
GPS	Geographical Positioning System
HTMT	Heterotrait-monotrait
ICT	Information and Communications Technology
IDS	Information Directed System
IFF	Identity Friend and Foe
IILS	International Integrated Logistic Services
ILS	Integrated Logistics Services

IoT	Internet of Things
IS	Information Systems
IT	Information Technology
KLIA	Kuala Lumpur International Airport
KM	Knowledge Management
LIT	Logistics Information Technology
LPI	Logistics Performance Index
LSPs	Logistics Service Providers
LV	Latent Variable
MATRADE	Malaysian External Trade Development Corporation
MIDA	Malaysia Investment Development Authority
MIMA	Maritime Institute of Malaysia
ML	Maximum Likelihood
MLC	Malaysia Labour Centre
MLC	Malaysian Logistics Company
MOT	Ministry of Transport
MPC	Malaysia Productivity Corporation
OP	Organizational Performance
PL	First Party
PLS	Partial Least Square
PPP	Purchasing Power Parity
RA	Relative Advantage
RBV	Resource-Based View
RFID	Radio Frequency Identification

SEM	Structural Equation Modelling
SMEs	Small and Medium-sized Enterprises
SPSS	Statistical Packages for Social Sciences
TEU	Twenty-foot Equivalent Units
TMS	Top Management Support
TOE	Technology Organization Environment Framework
USM	Universiti Sains Malaysia

**PENENTUAN PENERIMAAN INOVASI TEKNOLOGI MAKLUMAT
LOGISTIK (TML) OLEH PENYEDIA PERKHIDMATAN LOGISTIK (PPL)
DI MALAYSIA**

ABSTRAK

Kajian ini bertujuan untuk mengenal pasti penentu pelaksanaan inovasi Teknologi Maklumat Logistik (TML) terhadap Prestasi Firma (PF) oleh Pembekal Perkhidmatan Logistik (PPL) di Malaysia. Walau bagaimanapun, banyak PPL di Malaysia tidak menyedari keperluan untuk menggunakan teknologi dalam operasi mereka dan tidak melaksanakan penggunaan IT dan menyelaraskan strategi mereka dengan perubahan dalam teknologi. Teknologi telah digunakan sebagai alat kompetitif untuk memberikan kelebihan daya saing terhadap persaingan dan, dalam kebanyakan keadaan, mereka dapat membentuk semula proses jualan. Dengan perkembangan ini, kecekapan dalam penyampaian perkhidmatan telah menjadi kunci dalam mendorong banyak organisasi ke arah melaksanakan sistem komputer. Penggunaan inovasi TML mempunyai potensi yang luas kerana pelbagai sistem logistik boleh dilaksanakan ke arah meningkatkan penyampaian perkhidmatan PPL moden. Penyelidikan ini berpandukan Model TOE dalam mengenal pasti faktor yang menentukan penggunaan inovasi TML oleh PPL di Malaysia. PLS-SEM digunakan untuk menganalisis hubungan setiap konstruk menggunakan pemodelan persamaan struktur. Penyelidikan ini menyimpulkan keperluan untuk PPL untuk lebih memahami kepentingan penggunaan inovasi TML dan bagaimana ia boleh membentuk operasi mereka ke arah meningkatkan penyampaian perkhidmatan.

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ABSTRACT

This study aims to identify the determinants of Logistics Information Technology (LIT) innovation implementation towards Firm Performance (FP) by Logistics Service Providers (LSPs) in Malaysia. However, many LSPs in Malaysia have not realized the need to employ technology in their operations and haven't implemented IT and aligned their strategies with the changes in technology. Technology has been used as a competitive tool to give a competitive edge against competition and, in most instances, redesigning the sales process. With these developments, efficiency in service delivery has been the key in pushing many organizations towards implementing computer systems. LIT innovation implementation has vast potential as various logistics systems could be implemented towards improving the service delivery of modern LSPs. This research is guided by the TOE Model in identifying factors determining LIT innovation implementation by LSPs in Malaysia. PLS-SEM was used to analyzed the relationship of each construct using structural equation modelling. This research concludes a need for LSPs to further understand the importance of LIT innovation implementation and how it can shape their operations towards improving service delivery.

CHAPTER 1 INTRODUCTION

This chapter provides brief descriptions of the following points: background of the research study, problem statement, research objectives, research questions, scope of the study, significance of the research, definition of key terms, and organization of the remaining chapters.

1.1 Introduction

1.1.1 Global logistics scenario

The logistics industry has been one of the primary enablers for economic sectors like manufacturing, farming, and retail; it also promotes trade with other economies. Such an enabler would boost a country's global competitiveness due to its ability to promote interconnectivity worldwide. The logistics sector is vital because it can strengthen a country's economic and social prospects by creating positive multiplier effects such as increased market accessibility and employment.

The logistics industry has been undergoing rapid changes for the last few years and has started digitizing its processes. According to the literature, IT has changed conventional logistics and supply chains, resulting in several benefits such as greater efficiency and responsiveness (Gunasekaran & Ngai, 2004, 2011). This has occurred to some extent as a result of the customers' demand. Consumers demand fast and improved experiences when it comes to their online purchases and distribution of those items. This has led to a butterfly effect, as other industry segments are also being forced to improve.

The industry needs to create strategies and value differentiators using

information technology (IT) to improve the consumer buying experience (Ngai et al., 2011). Change, on the other hand, always has two sides: risk and opportunity. New technological advances provide more possibilities than threats in the long run. Adapting to evolving technologies and becoming more digital is a continuous process that requires a well-thought-out plan and strategy, innovation in new platforms and products and extensive engagement with technology suppliers. However, neglecting to recognise new technology and the benefits they provide might risk the future of logistics companies. Fresh and youthful entrants have emerged in the sector, ready to disrupt the market by providing more innovative services that better satisfy client expectations. LSPs should view new technologies and services as instruments to "fill in the gaps" between older, more expensive, and established technologies and services. This will also allow for a controlled transition to actual LIT innovation adoption cost and agility advantages. This section aims to provide an overview of the logistics industry from the global and domestic perspective to highlight the key trends within the logistics subsectors and the policies in place to drive the industry's growth.

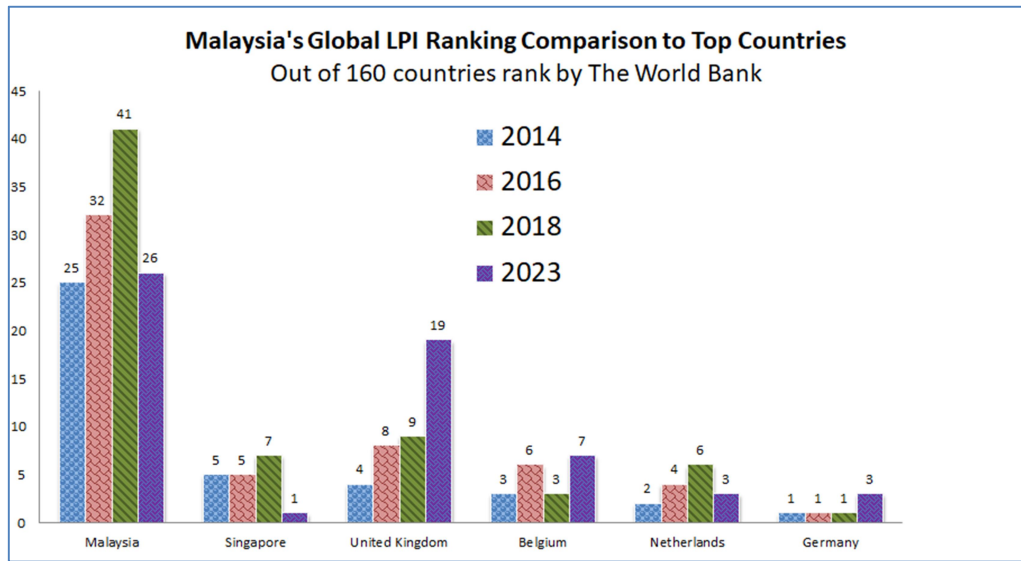
1.2 Global and regional trends in the logistics industry

1.2.1 Global industry trends

Malaysia's economic freedom score is 74.7, gaining 0.7 points from 2019, making it the 24th freest economy in The Heritage Foundation's 26th edition of the 2020 Index. This was aided by improvements in corruption, business freedom, and trade freedom, which outweighed declines in labour freedom and government spending management. Malaysia is placed 6th in the Asia–Pacific region out of 42

countries, with an overall score higher than the global and regional norms. Since 2011, Malaysia has been designated as a “mostly free” country, with its economic freedom increasing by 43.9 points from the previous year, the highest gain in the Asia–Pacific region.

Despite improvements in competitiveness rankings, the country's productivity performance is still relatively poor. Malaysia's productivity lags considerably below other Asian nations such as Hong Kong, Singapore, and Japan. Malaysia's Purchasing Power Parity (PPP) productivity (US\$67,290) is substantially lower than Hong Kong's (US\$124,130), Japan's (US\$81,220), and Korea's (US\$79,650) in 2018. Singapore's productivity (US\$153,410) in PPP was the highest among Association of Southeast Asian Nations (ASEAN) countries, about 2.3 times greater than Malaysia's (Productivity Report 2018/2019). Malaysia was placed 41st in the World Bank's Logistics Performance Index, with a score of 3.22 out of a maximum of 5, a substantial decline over the previous six years. The comparison with the benchmarked economies is shown in Figure 1.1.



Sources: [https:// lpi.worldbank.org](https://lpi.worldbank.org) 2023 report

Figure 1-1 Malaysia and top 5 LPI ranking; 2014-2023

1.2.2 Regional industry trends

Within the Asia region, numerous bodies and initiatives have been implemented to drive the development of the logistics industry. For instance, in the Asia Pacific region, the Supply-Chain Connectivity Framework was developed by the Asia Pacific Economic Cooperation (APEC) forum, targeting to improve eight (8) key areas in logistics and supply chain performance in terms of time, cost, and uncertainties. The eight (8) key areas are (1) transparency; (2) infrastructure; (3) logistics capacity; (4) clearance; (5) documentation; (6) connectivity; (7) regulations and standards; and (8) transit. 1) Transparency: Lack of transparency/awareness of the full scope of regulatory issues affecting logistics; lack of awareness and coordination among government agencies on policies affecting the logistics sector;

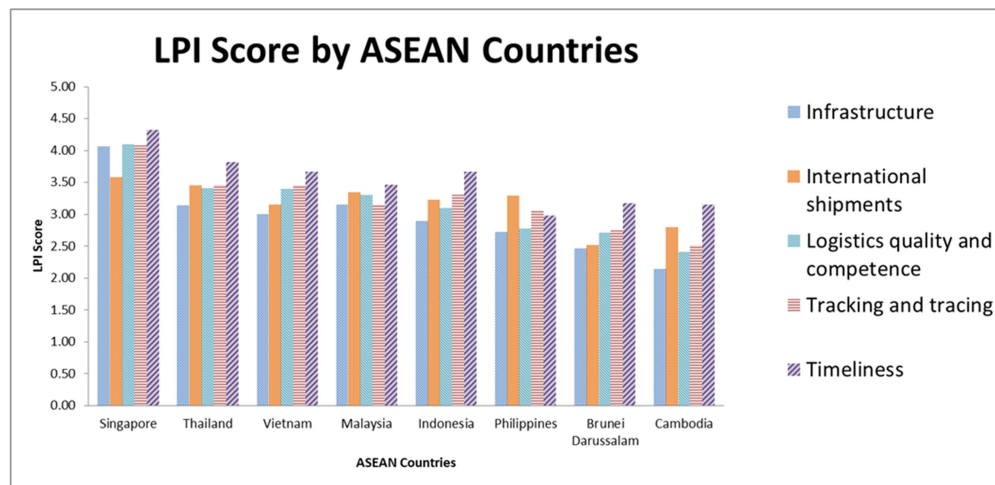
absence of a single contact point or champion agency on logistics matters 2) Infrastructure: Inefficient or inadequate transport infrastructure; lack of cross-border physical linkages such as roads, bridges 3) Logistics capacity: Lack of capacity of local/regional logistics sub - providers 4) Clearance: Inefficient clearance of goods at the border; lack of coordination among border agencies, especially relating to clearance of regulated goods ‘at the border’ 5) Documentation: Burdensome procedures for customs documentation and other procedures (including for preferential trade) 6) Multimodal connectivity: Underdeveloped multimodal transport capabilities; inefficient air, land and multimodal connectivity 7) Regulations and standards: Variations in cross-border standards and regulations for movements of goods, services and business travellers 8) Transit: Lack of regional cross-border customs-transit arrangements.

China has also introduced its international initiative known as ‘One Belt, One Road’ (OBOR), which aims to enhance trade and political cooperation between China and countries in Asia and Europe in terms of policy coordination, infrastructure development, trade barrier reduction, currency and financial integration and improvement sharing, and dissemination of best practices..

Since 2006, the logistics sector has been identified as a priority sector within ASEAN, resulting in initiatives such as the ASEAN Strategic Transport Plan (ASTP) 2011-2015 and the Kuala Lumpur Transport Strategic Plan (KLTSP) 2016-2025, both of which aim to promote collective regional development by establishing a single market and production base: enhancing the region’s economic competitiveness, driving equitable economic development, and facilitating integration into the global economy. In addition, the ASEAN Economic Community (AEC) Blueprint 2025 was

developed to guide long-term initiatives to increase connectivity and sectoral cooperation in the land to air and maritime transport facilitation by 2025, to create greater collaboration between member countries.

In the Logistics Performance Index (LPI) 2018 by the World Bank, Malaysia ranked 41 out of 160 countries behind Singapore, Thailand and Vietnam. Malaysia’s score for Logistics competence and Tracking & Tracing category is lower than the top 3 countries in ASEAN (Figure 1-2). This indicates that there is room for Malaysia to improve in this competitive and challenging industry.



Sources: [https:// lpi.worldbank.org](https://lpi.worldbank.org) 2018 report

Figure 1-2 LPI score by ASEAN countries

1.2.3 Malaysian logistics scenario

1.2.3.1 Overview of Malaysia’s logistics scenario

The government's Eleventh Malaysia Plan, which runs from 2016 to 2020, intends to expand all sectors that fuel the country's economy, including services,

manufacturing, and others. It also strived to strengthen the country's logistics system. By 2040, West Port, Port Klang's newest port town, intends to boost its capacity by 50% to 30 million TEUs (Twenty-foot Equivalent Units) per year. The developments of container terminals 8 and 9 were completed in 2017 with a capacity of 14 million TEUs. According to the Malaysian External Trade Development Corporation (MATRADE), Digital Free Trade Zone (DFTZ) will double the nation e-commerce sector GDP to US\$ 47.68 billion by 2020. The hub is equipped with centralized customs, warehousing and fulfilment functions.

Increasing investment in infrastructure and human capital: The Malaysian government is pouring money into infrastructure projects, including port restorations and expansions, road networks, and advanced information technology (IT) systems. However, all of these initiatives need a high level of dedication and engagement with the private sector. The primary objective of this investment in the logistics business is the training of more competent workers and professionals, primarily local Malaysians. The government encourages greater cooperation between training providers, logistics associations, and industry players to establish industry-relevant training programmes.

Increasing e-commerce growth in Malaysia: The introduction of the Digital Free Trade Zone in Malaysia Strategic Roadmap (2016) intends to double the country's e-commerce development and increase GDP contribution to MYR 211 billion (approximately USD 47.7 billion) by 2020, in accordance with Industry 4.0. It will facilitate cross-border trade and allow local businesses to export their goods, emphasising e-commerce. The DFTZ would create physical and virtual zones to assist and encourage Small and Medium-sized Enterprises (SMEs) to expand the Internet

economy and cross-border e-commerce operations.

Encouraging trade with ASEAN countries and China: The ASEAN Economic Community, founded in 2015, was created to improve regional commerce by allowing people and products to move throughout the ASEAN bloc freely. ASEAN leaders agreed upon the Blueprint for 2025 during the 27th ASEAN Summit in 2015 to facilitate the use of the ASEAN Trade in Goods Agreement and allow access to logistics services among all ASEAN countries, including Malaysia. China's Belt and Road Initiative has also sparked the expansion of trade between adjacent nations, particularly ASEAN countries, boosting Malaysia's logistics industry.

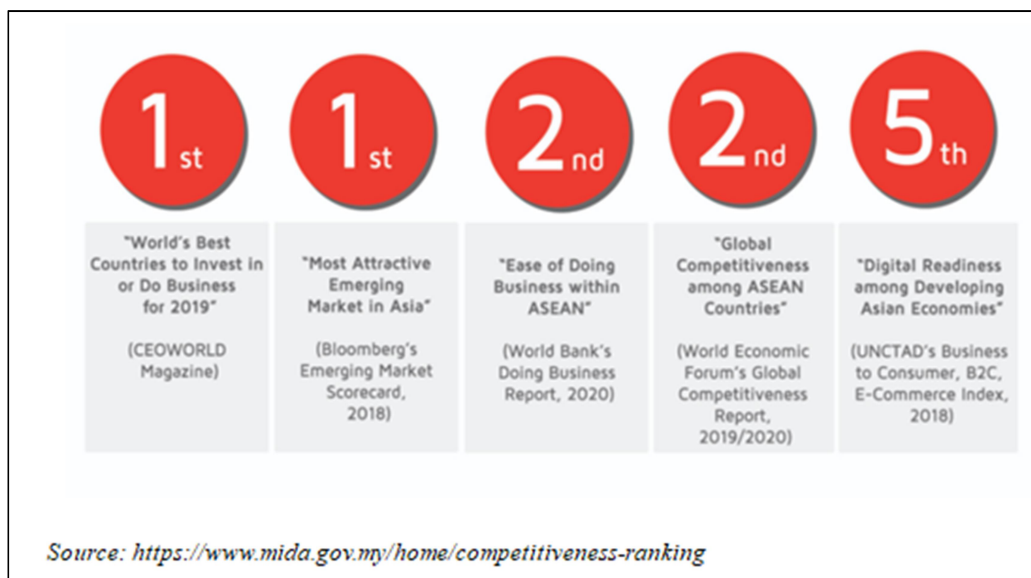


Figure 1-3 Competitiveness ranking for Malaysia

Malaysia's government is constantly working to ensure that the country remains a favourable investment destination. Intending to become a high-income economy by 2020, the Malaysian government is stepping up efforts to attract investments and boost productivity and innovation via political, economic, and regulatory changes. These initiatives have been favourably accepted worldwide, as

evidenced by increased rankings in different international institutions' reports. Malaysia's competitiveness ranking is shown in Figure 1.3.

Malaysia is Asia's first attractive emerging market for 2018. Malaysia is the best country in the world to invest in or conduct business in for 2019. Then, in 2020, Malaysia was ranked second in ASEAN for ease of doing business. Malaysia's foreign commerce has increased dramatically during the previous two decades, rising from US\$ 9.38 billion in 2000 to US\$ 346.7 billion in 2019. Except for 2009, 2015, 2016, and 2017, Malaysia has maintained a positive trade balance, exporting more products than it imports. Malaysia had a trade surplus of US\$ 39.6 billion in 2018. After the global recession of 2008, the highest figure was US\$ 43 billion in 2010. Malaysia's overall trade increased by 1.7% in 2019, reaching US\$ 364.7 billion, up from US\$ 358.6 billion in 2018. Figure 1-4 shows the trend of trade growth.

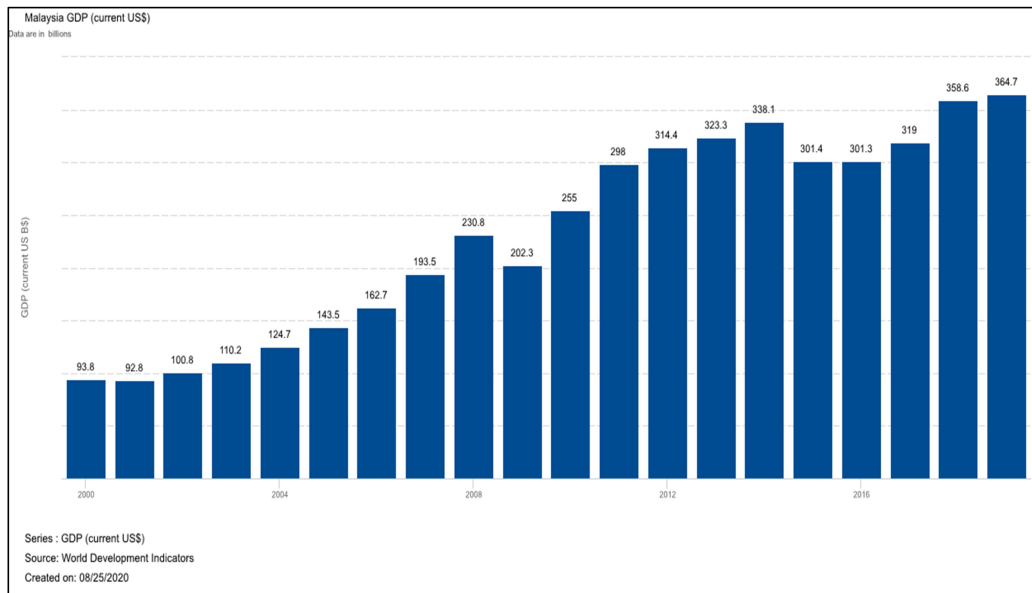


Figure 1-4 Malaysia's international trade and GDP from 2000 to 2019

1.2.3.2 Logistics Service Providers (LSPs) in Malaysia

In recent years, Malaysia's logistics sector has changed, owing to significant development enablers including improved logistics infrastructure, increased freight volumes, and structural growth in LIT. The Malaysian government is pushing Malaysia as ASEAN's preferred logistics gateway through a variety of measures, providing chances for local logistics companies to expand. The following items are included in the Logistics and Trade Masterplan (2015-2020): The Ministry of Transportation aims to improve road and rail infrastructure, reduce red tape, and decongest ports and airports. In 2019, the DFTZ - Alibaba logistics centre was launched. The core of the airport's air cargo and logistics ecosystem is KLIA Aeropolis. Carey Island/Port Klang — A planned port-industrial metropolis will bring 30 million TEUs to Carey Island (Source: Ministry of Transport, Channel News Asia & The News Strait Times).

Electronic material that can be readily transported from the source to the customers is gradually replacing traditional paper documentation. With multi-channel distribution capabilities, electronic generation of a large volume of documents, frequently in several sets, is required, particularly for export-related operations. Various documents, such as a packing list, delivery letter, insurance certificate, bill of lading/airway bill, permits and licences or certifications, are required to be attached to products imported into Malaysia. Products shipped from Malaysia to other nations are subject to the importing country's paperwork requirements. Depending on the nation to which they are being exported, this might necessitate a complex set of paperwork. It would be challenging for a logistics player to deal with both import and export documentation obligations. Firms that specialise in logistics services such

as transportation, warehousing, and freight forwarding are known as logistics service providers (LSPs). Customer logistical activities like order processing, inventory, transportation carriers, as well as a combination of warehousing, materials handling, and packaging are all handled by LSPs through a wide range of facilities. Such services are critical in supporting manufacturers or retailer's procurement, production, and customer accommodation operating needs (Bowersox, 2007; Grant et al., 2006).

In Malaysian LSPs, there are five primary interconnected layers of logistics services that entail increasing degrees of service and supply chain integration: Logistics for the First Party (1PL). Definition of First Party Logistic provider is a company that doesn't outsource transport and logistics activities to a third party service provider. Every function regarding these activities is handled by their own departments in their companies. Beneficial cargo owners who are shippers (for example, a manufacturing business delivering to clients) or consignees frequently utilize this type of logistic provider (such as a retailer picking up cargo from a supplier). They are in charge of the goods' origin (supply) and destination (demand), with distribution being an entirely internal activity. However, due to the globalisation process and the resulting outsourcing and offshore manufacturing facilities, distribution activities formerly handled domestically are increasingly being outsourced to third-party service providers.

Second Party Logistics provider (2 PL), on the other hand, only owns means of transportation. This type of logistics provider is made up of carriers who provide transportation services along with a particular component of a transportation chain. A maritime shipping company, a rail operator, or a trucking company are examples of

this type of service provider that is hired to move cargo from one point to another, such as a distribution centre to a port terminal.

Third-Party Logistics providers (3 PL) are responsible for more solutions: transport, warehousing, packing, inventory management, and freight forwarding activities until the item reaches the receiver. It's about freight forwarders who may be interested in a particular transportation industry and its physical assets and offer complete freight distribution and transportation chain services. These services include warehousing, transloading, terminal operations, and even small manufacturing such as packing and labelling. As a result, a 3PL company strives to coordinate physical distribution activities so that components and completed items may be transported as a complete solution from the point of origin to the destination. 3PL offers various logistical services for its clients and consumers (Langley, Allen & Dale, 2004).

Fourth Party Logistics provider (4 PL) is a more comprehensive business that handles the entire supply chain functions such as sourcing, storage, distribution, and transportation processes. Whereas 3PL only focuses on a single role in the entire chain. Agreements (subcontracting) between 3PLs and 2PLs are common. 4PL, also known as a lead logistics provider, is a non-asset based company, meaning it does not own its own vehicles or warehouses. They provide logistics consulting services to assist their clients in managing, developing, and constructing supply chains. Even though there is some confusion about the exact role and definition of 4PLs as a result of the emergence of a few categories in logistics consulting and management firms, this emerging sector continues to provide invaluable services in managing large-scale, complex supply chain functions from the top down and overseeing innovative

technology solutions. A Fifth Party Logistics provider (5PL) will combine the needs of 3PLs and other layers of logistic providers into a bulk volume to negotiate better pricing with airlines and shipping companies. This sort of provider has the advantage of not being asset-based. They can collaborate across many disciplines with ease. These companies primarily provide logistical services, such as planning, organising, and implementing logistics solutions on behalf of a contractual party using the necessary technology as needed. Fifth-party logistics is frequently associated with e-business.

1.2.3.3 Importance of IT in Malaysia's logistics sector

The logistics industry is the backbone of the Malaysian economy, and it is imperative in today's economy. Malaysia is the world's 24th largest trading nation, emphasising the importance of the logistics business. MIDA (Malaysia Investment Development Authority) lists six major logistics services in Malaysia in their 2019 logistic booklet: warehousing, storage and inventory management services. The services are as follows:

- Transportation services
- Freight forwarding/customs clearance and shipping services
- Integrated Logistics Services (ILS)
- International Integrated Logistic Services (IILS)
- Cold chain facilities

Ports, airports, roads, and trains are among the logistics facilities that enable these activities. As a result, logistic service providers and government authorities must collaborate to create a comprehensive logistics ecosystem. Many businesses

rely on transportation and logistics to keep their operations running smoothly. Companies with solid infrastructure and record-keeping may be able to benefit from technological developments in the future. As time goes on, the role of technology in the logistics sector grows. Every year, a new collection of developing technologies enters the research and development phase, and a new group of technologies makes their way toward commercial availability in the logistics sector. Over the last ten years, a number of new technology fields for research have arisen, while others have progressed from development to commercialization. In essence, logistics technology is constantly changing. Logistics has a beneficial impact on companies in towns and cities, and creates additional employment in these areas. It coordinates the efficient forward and reverse movement of goods and services from origin to destination. Therefore, logistical support for moving goods and delivering them to consumers is crucial, providing other firms with an indirect competitive advantage. For future competitive survival, information technology is making logistics more efficient. Information technology has improved the whole logistics operations capabilities in terms of productivity and service quality through on-time and precise information at low costs. Furthermore, according to Elfirdoussi (2020), ICT may make logistical processes more relevant and successful. This technology aids companies in obtaining a competitive edge in terms of cost-effectiveness. As a consequence, cycle times are reduced, productivity is increased, and dependability is improved. It is not new to use logistics innovation to tackle challenges in logistics and transportation. Industry 4.0 is primarily concerned with the notion of smart production, which necessitates new technology and creative skills (Frank et al., 2019). Logistics service providers compete based on their competencies (Elfirdoussi, 2020). Companies may improve

their competitiveness and maintain a competitive edge by utilizing Logistics Information Technology (LIT). Logistics information technology (LIT) refers to the software and hardware that facilitates logistical processes such as order, inventory, warehouse, and transportation management (Zhu et al., 2020).

Furthermore, Malaysia's logistics industry has grown at an exponential rate throughout the years. Computer and information technologies have been utilized to help logistics for multiple decades. IT is often regarded as the most crucial factor influencing logistics growth and development. As a result, Malaysia presents a fantastic potential for business development due to its outstanding accessibility, plenty of warehouse space, and enhanced logistics connection. Hence, IT is viewed as a critical component influencing the growth and development of LSPs in Malaysia. LSPs (Logistics Service Providers) enhance the value of a company's product.

1.3 Definition of LIT

The software and hardware that supports logistical tasks such as order, inventory, warehousing, and transportation management are referred to as logistics information technology (LIT) innovation (Chikwanda, 2019). IT has impacted the overall logistics activities abilities in terms of productivity and quality of services by providing timely and precise information at a cheap cost. Furthermore, according to Zakaria et al. (2014), information technology may make logistical processes more meaningful and successful. This technology will assist the firm in gaining a competitive edge, particularly in terms of cost-effectiveness, due to shorter cycle times, increased production, and increased dependability. Companies may improve

their competitiveness and maintain their competitive edge by using logistics information technology. Patterson (2012) asserted that investing in information technology is beneficial to future businesses. Because of its ability to monitor inventory at all regions and facilitate intercompany collaboration, the system will be even more helpful to logistics businesses in the future. Today's managers have relatively few tools at their disposal for generating significant productivity gains. Information Technology (IT), together with innovation in an organization and management, is one of the essential tools, and these innovations must be connected. According to Zhu et al. (2021), information technology has a crucial role in boosting business and national productivity.

Table 1.1 Definitions of Logistics Information Technology in the literature

Author(s)	Logistic Information Technology (LIT) Innovation
Wang et al. (2016), Patterson (2012) Hazem and Byrd (2011)	<ul style="list-style-type: none"> • LIT is the combination of two technologies such as RFID and EDI. • An IT application that is perceived as new to the organization of adoption and used for planning, implementing, and/or controlling procedures for the transportation and storage of goods and services from the point of origin to the point of consumption.
Zhu et al. (2021)	<ul style="list-style-type: none"> • The software and hardware that facilitates logistics activities which include order, inventory, warehousing and transportation management.

In recent literature, Wamba et al. (2018) introduced an analysis of Big Data Analytics in logistic and supply chains. Bhandari (2014) also listed some of the technologies used in the logistics industry, such as Barcoding, Auto-ID (RFID and RFT), EDI, GPS, GIS, Web-Based Tracking, AGVS, IDS and ERP.

1.4 Background of the study

The logistics process is coordinated throughout a network of facilities where orders are processed, inventories are kept, transportation is made, and materials are handled and packaged. Determining where raw materials, work-in-process, and finished inventory should be stored is also a component of the logistics leadership job. To achieve the lowest overall cost, financial and human resources allocated to logistics must be maintained to a minimum. As a result, LSPs face additional problems due to globalisation, increased imports and exports, service-oriented economies, and logistics outsourcing. Clients expect them to handle it all from the front end to the customer's location where delivery is performed, and their responsibility is expanding rapidly (Ellinger et al., 2008). Customers expect LSPs to provide additional services as needed, which may go beyond the LSP's capabilities, such as a broader range of logistical services, geographical coverage, and advanced information technology (Langley & Capgemini, 2013). Consequently, LSPs find themselves in a scenario where each of their clients has a distinct set of criteria and requests. The increasing demands on logistics service providers have challenged companies with strategic difficulties in terms of maximising the productivity of logistics resources as a source for competition in a dynamic and uncertain industry. The vital role of logistics will be supported for many years to come by the expansion of the service sector, environmental issues, and information technology (Ballou, 2004). Nonetheless, some LSPs operate with insufficient resources, such as high-cost low-end technology. LSPs are also having difficulty finding qualified and educated employees with formal logistics education and training. Difficulties with lateness, inability to deliver inter-linkage services, high operational costs, inaccuracies, as well

as a paucity of adaptability in the face of changing and demanding needs are some of the problems LSPs encounter, according to Hsieh et al., (2022). As a result of these obstacles, LSPs are unable to satisfy the ever-expanding scope of customer needs.

1.5 Problem Statement

Despite the fact that logistics has been around since the dawn of time, implementing 21st-century best practices is one of the most challenging and intriguing areas for LSPs to work in. None of the other business operations has the same level of complexity or geographic coverage as logistics. Logistics is concerned with delivering the right items to the correct location at the right time 24 hours a day, 7 days a week, 52 weeks a year, all over the world. It's impossible to imagine any production, marketing, or global commerce being possible without logistics. The majority of customers in highly developed industrial countries take a high level of logistical expertise for granted. When these clients buy items in a shop, over the phone, or online, they want product delivery to be timely and accurate. Customers demand quick, error-free logistics every time they place an order, especially during peak times. Failure to complete all of the tasks is met with minimal or no tolerance.

LSPs in Malaysia have been reluctant to implement LIT owing to a lack of knowledge about the variables that influence LIT innovation adoption and how to use LIT within their organizations properly (Hwang et al., 2016). The fundamental issue with LIT is that some LSPs lack the necessary understanding of the factors that impact LIT innovation adoption. According to the initial investigations, Malaysia's logistics industry faces several risks and difficulties. Hence, it is regarded critical to take these problems and challenges seriously. According to Kang's (2016) report: *The*

current state of Malaysia's logistics industry is far behind the advanced economies. A thorough reform is needed for Malaysia in order to establish a modern and competitive logistics system. Similarly, firms need to improve their logistics management in order to fulfill the increasingly diverse customers' needs (The Star, Jun 6, 2016).

According to earlier research, the use of IT significantly affects how well businesses perform (Karia, 2018). By integrating information across the supply chain, logistics information technologies, such as data acquisition technologies (such as RFID), information technologies (such as EDI), warehousing technologies, and transportation technologies (such as GPS, GIS), assist businesses in reducing delivery times (Yang et al., 2009). Nevertheless, despite spending money on logistics IT, many logistics companies still struggle to improve their financial performance (Lai et al., 2007). It is simple for logistics organisations to lose cost benefits while implementing IT due to the high cost of sophisticated technology, the challenge of developing complex information systems, and the absence of IT specialists' supervision (Jeffery and Leliveld, 2004).

However, the economic and environmental performance of LSPs from a global perspective is unclear. On the other hand, good facilities and related services help develop a logistics-friendly environment that improves profitability and is consistent with growth theory (Vilko et al., 2011). In addition, improving the quality of the infrastructure for logistical needs also entails creating ICT and automobiles, both of which have a high dependence on energy. In both situations, it makes sense to consider whether this might have a negative impact on the amount of carbon emissions on a worldwide scale. Finally, human capital needs to be given great

consideration. Education has been shown to be positively correlated with income, which may have an impact on how much energy-intensive goods are purchased (Fang and Chang, 2016; Salim et al., 2017; Yao et al., 2019; Wang et al., 2020).

LSPs must continuously enhance their service efficiency by adopting information or automation technologies to fulfill customers' changing needs (Sauvage, 2003). In addition, numerous studies have discovered that innovation is the most crucial instrument for businesses to maintain their competitive edge (Duhan, 2007).

According to Saghafian et al., (2021), IT adoption procedures are difficult to achieve. He also highlighted some difficulties that many organizations have encountered, and these issues have an influence on the organizational processes connected with each stage of implementation. These factors include characteristics of the organization (top management support and organizational readiness), characteristics of the technology being adopted (relative advantage and compatibility), characteristics of the organizational environment (government support and competitive pressure), and characteristics of the firm business environment (complexity, uncertainty, and munificence) which impact technology adoption towards the results of the efforts. Technological advancements and inventions were critical sources of productivity and long-term growth. As a result, the key to properly adopting and using technology is to perceive it as a continuous process. Firms' ability to successfully embrace technology has a substantial strategic impact on their competitive advantage, particularly their performance (Ramanathan et al., 2017). Many studies have claimed that the use of technology has had a major impact on the performance of businesses (Adewoje & Akanbi, 2012). The influence

of technological adoption, on the other hand, is yet uncertain. According to some studies, IT adoption increased output by up to 81 percent, reduced labour costs by up to 40 percent (Al-Qirim, 2007), increased efficiency and total productivity of adopting firms (Delen, 2020), increased profitability (Akter et al., 2016), and improved financial profits.

In conclusion, this study used the TOE Model to examine the factors of LIT Innovation Implementation. It might provide a valuable theoretical lens for LSPs to utilize as a reference. At the same time, this study looks at LIT innovation adoption, LIT innovation capability, and firm performance to evaluate the consistencies of findings in regards to performance implications and LIT Innovation Implementation.

1.6 Scope of the study

The primary emphasis of this research is on how many factors may influence LSPs' implementation of LIT and how that implementation can be reflected in company performance. As previously stated, existing research from the standpoint of LSPs, particularly in the logistics context, is lacking. This research does not seek to provide a complete picture of LSPs' LIT status; instead, it aims to provide a "snapshot" of how things are now. The investigation's firms were chosen because they had taken a more proactive approach to bring LIT thinking into the organization and putting it into practice. It's worth mentioning whether the LSPs' reported implementation of LIT has a beneficial impact on their performance in this study. Furthermore, the purpose of this study is not to provide a comprehensive review of all the factors and constraints that may impact the acceptance of LIT. Instead, it presents a list of the most often stated and highlighted drivers and barriers in the

literature and the influencing variables emphasised by LSPs to investigate the influence of these factors on LIT Innovation Implementation. Furthermore, this study aims to establish a relationship between logistics and information technology sectors by demonstrating how LIT may be represented in LSP service offers. As a result, this research aims to better understand how LSPs function and what services they provide. Moreover, the purpose of this study is to develop well-defined, valid, accurate, and objective tools for evaluating LIT Innovation Implementation factors. Finally, this research focused on Malaysian firms that provide logistical services. However, this study does not have the resources to examine all LSPs in Malaysia. As a result, this study's sample frame will be the Malaysia Logistics Directory (www.msialogistics.com).

1.7 Research questions

1. Which determinants significantly influence LIT innovation adoption among LSPs in Malaysia in terms of technological, organizational, and environmental context?
2. Which determinants significantly influence LIT innovation capability among LSPs in Malaysia in terms of technological, organizational, and environmental context?
3. How LIT innovation adoption affect the performance of LSPs?
4. How LIT innovation capability affect the performance of LSPs?

1.8 Research objectives

The main aim of this research is to develop a research model that is able to examine the factors influencing LSPs to implement LIT Innovation Implementation. The primary research aim is comprised of the following particular interrelated research goals:

1. To examine the determinants in terms of technological, organizational, and environmental context on LIT innovation adoption among LSPs in Malaysia.
2. To examine the determinants in terms of technological, organizational, and environmental context on LIT innovation capability among LSPs in Malaysia.
3. To analyze the impact of LIT innovation adoption on LSPs performance.
4. To analyze the impact of LIT innovation capability on LSPs performance.

1.9 Significance of the study

In terms of theoretical contribution, this study is one of the first attempts that

advance the LIT Innovation Implementation, particularly at the firm level, to justify the implementation decision. This study plans to successfully determine the significant factors of LIT Innovation Implementation towards firm performance from technological, organizational, and environmental contexts. The significant relationships between these variables in LIT Innovation Implementation will set a new direction for future studies.

This study is a practical contribution since it offers management ideas for LSPs in Malaysia. Such recommendations include system characteristics that may be integrated into LIT Innovation Implementation and the challenges that will encourage LSPs to implement these new technologies. Therefore, this research supports the LSPs management in better understanding LIT.

The proposed model extends the research model of Maroufkhani et al. (2019) and Ghobakhloo et al. (2011) by systematically using the TOE Model to test their influence on LIT innovation adoption from the LSPs or organization perspectives. This TOE Model theory on LIT Innovation Implementation and LSPs performance provide a new perspective to the logistics industry.

This study initially developed and empirically validated the antecedents and outcomes of the LIT Innovation Implementation within the LSPs context as a new context Besides, this study collected a set of ranked TOE Model from the IT innovation literature to be uniquely tested in the LIT Innovation Implementation context. Therefore, this research has a significant contribution to the knowledge in IT innovation implementation in Malaysia by LSPs as it has not been explored yet.

Additionally, the study findings will have significant practical implications for LSPs stakeholders since it will give an insight into the influence factors of the