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EMPIRICAL STUDY ON LOGISTICS SERVICE FLEXIBILITY MEDIATED BY INNOVATION ON LOGISTICS PERFOMANCE DURING COVID-19 IN MALAYSIA

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Abstract:

Advancements in information technology and reduced trade barriers have increased the demand for logistics services, while deregulation and liberalization have intensified the challenges for logistics service provider (LSP) in maintaining high performance. The unprecedented COVID-19 has exacerbate the complications in logistics industry and heightened the challenge for logistics service providers (LSPs) to achieve performance. Therefore, this study is to determine the impact of logistics flexibility capability in achieving performance and to determine the role of innovation as mediator to connect the model framework. This research employed 127 LSPs in Malaysia through stratified random sampling. The study utilized Structural Equation Modelling (SEM) with Partial Least Squares (PLS) estimation to investigate and evaluate the hypotheses proposed in this study. The findings found that LFC failed to significantly relate with logistics performance and innovation also failed to mediate the relationship between LFC and logistics performance. This research contributes to the current knowledge base, especially within the framework of the COVID-19 pandemic, accentuating the necessity for additional scholarly investigation to expand our comprehension of this occurrence.

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Keywords:

Logistics Service Providers, Logistics Service Flexibility, Innovation, Logistics Performance, Third-Party Logistics

Introduction

In todays' business landscape, corporations worldwide are facing with significant and overwhelming challenges to achieve optimal productivity and profitability in order to stay competitive (Santoro et al., 2018). This is in alignment with the shared aspiration of countries worldwide to become the most advanced and developed countries. Thereby, every workforce is straining every endeavour to be standing neck to neck with other countries. It is of utmost importance for countries to strategically address and prioritize sectors that offer them the greatest potential for enhancing their growth and productivity. Service sector is among the most rapidly growing Gross Domestic Product (GDP) in the world where the sector alone is accountable and responsible for more than 60 per cent of the world service trade (Carlos, 2019; Islam, 2022; The World Bank, 2021). Malaysia, in its current trajectory towards achieving the status of a developed nation, is also engaged in a competitive pursuit to join the ranks of high-income and high-performance countries. The service sector has emerged as a key driver in navigating the rapid transformation of Malaysia's global economic development (Malaysian Investment Development Authority, 2021). This is illustrated in Malaysia's National Key Economic Areas (NKEAs), where the service sector encompasses the majority of the economic areas (Ministry of Agriculture and Agro-based Industry Malaysia, 2018).

Also, logistics sector is a crucial element in supporting Malaysia's growth and ensuring sustainable industrialization. This aligns with the Third Industrial Master Plan 2006-2020 (IMP3), where the government has highlighted the logistics sector as a fundamental component of the service sector, crucial for catalysing Malaysia's trade (Hazim, 2021; Ministry of International Trade and Industry, 2021). A Logistic Services Provider (LSP) is utilized in supply chain management and logistics when an organization outsources part or all of its business distribution and fulfilment services. The concept of outsourcing aims to reduce the logistical workload of an organization by delegating it to a LSP, who possesses a superior understanding of logistics and can efficiently manage and connect the supply chain (Bulgurcu & Nakiboglu, 2018). Thus, organisation can concentrate on their core competencies while LSP will manage the logistics from the point of origin to the end of the supply chain. In earlier days, most organizations directly possessed and administered their assets. As time goes by, organizations across various industry sectors are consistently adopting logistics outsourcing as an integral component of their logistics operations, demonstrating a continuous upward trend (Doratiotto et al., 2022; Rodrigues et al., 2018)

In an era of escalating global competition, LSPs in Malaysia face significant internal and external pressures to stay competitive. LSPs are under immense pressure to meet consumer demands, as customers expect high levels of timely and precise delivery services at reduced costs. Simultaneously, LSPs must fulfil customer requirements while maintaining operational efficiency and financial stability (Domingues et al., 2015; Fu et al., 2021). With the decreasing of trade barriers, accompanied by the rise of contemporary information technology and plenty of new prospects, these would enhance the organization's need on logistics. Deregulation and

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liberalisation have increased the rising challenges for LSPs in achieving performance. Exacerbating these issues, the COVID-19 pandemic has revealed the weaknesses in global supply chains severely disrupting the world economy and challenging logistics service providers (LSPs). Factory closures, lockdowns, and geopolitical tensions caused supply breaks and manufacturing shutdowns, leading to retail shortages and supplier surpluses. Cargo backlogs and travel restrictions further hindered logistics, reducing transportation capacity. The pandemic also caused erratic demand fluctuations, with essential goods seeing increased demand and other sectors, like aviation, experiencing sharp declines. These challenges forced LSPs to adapt their long-term logistical plans and adopt new technical solutions (Liu et al., 2022). Therefore, it became increasingly clear that flexibility within logistics networks is essential during unprecedented situations. Flexibility is also encompassed by a firm's capacity to tailor its products or expertise to meet customer specifications, leveraging factors such as ownership, learning experiences, skills, and process knowledge (Fayezi et al., 2017).

The literature demonstrates that the logistics services business is a growing in importance issue for scholars (Akbari, 2018; Marchet et al., 2017). But, research on LSP in Southeast Asia has been relatively scarce (Nadarajah, 2015; Roslan et al., 2015; Roy & Sengupta, 2018). Also, the study of logistics outsourcing and logistics service providers (LSP) in Malaysia is also limited (Zailani et al., 2015). Scholars unanimously agree that innovation is a crucial instrument for any enterprise to achieve enhanced performance (Adamides & Karacapilidis, 2020; Asian, 2019; Gustafsson et al., 2020; Islam, 2022; Kim & Chai, 2017; Leitão, 2019; Mohd Idris, 2020; Santoro et al., 2018; Wong & Ngai, 2019; Zulkiffli et al., 2019). Asia has become the fastest-growing economic region in the world and the largest economy among all continents, prioritizes accelerating innovation capabilities across industries, aligning with a key goal of the fourth industrial revolution (Frank et al., 2019). Additionally, an inconvenient truth is that most logistics studies have overlooked the role of innovation in determining performance. Even in studies on service performance, innovation has frequently been neglected by previous research (Cichosz et al., 2020; Gustafsson et al., 2020; Kucukaltan et al., 2022; Islam, 2022; Rahman et al., 2022). Hence, the objectives of the study are to determine the association between logistics service flexibility on Logistics performance and to evaluate the mediation effect of innovation between logistics service flexibility and logistics performance.

Literature Review

Resource-Based View

The Resource-Based View (RBV) theory highlights resources and capabilities as core components crucial for attaining superior firm performance. This viewpoint underlines the importance of internal factors, including distinctive assets and competencies, in fostering competitive advantage and enduring prosperity (Barney, 1986, 1991, 2001, 2012; Grant, 1991, 1996; Wernerfelt, 1984, 1995). Through strategic utilization and enhancement of these resources, organizations can elevate their performance levels and secure enduring relevance in the market landscape. It is asserted that a firm can enhance its performance by effectively managing and controlling its capacity to accumulate resources and capabilities with qualities of worth, uniqueness, distinctiveness, and non-replaceability, thus establishing a sustainable competitive advantage (Barney, 1991).

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Logistics Flexibility Capability

Within the context of business flexibility encompasses a firm's capability to tailor its products or services to meet customer specifications, drawing upon factors such as ownership, experiential learning, skills, and procedural knowledge (Cingöz & Akdoğan, 2013; Fawcett et al., 1996). Logistics Flexibility Capability (LFC) plays a crucial role in the delivery of logistics services, especially when factoring in variations in climate, routine demands, and diverse locations of customers. Additionally, numerous empirical studies substantiate the correlation between LFC and logistics performance (Mohd Zawawi et al., 2016; Pisitkasem, 2022). Thence, the following hypothesis is proposed:

H1: There is a positive correlation between LFC and the logistics performance of LSP.

Innovation

Innovation has emerged as a crucial characteristic for businesses to improve service performance, encompassing heightened production flexibility, enhanced customer service, shortened cycle times, and cost reduction (Bakan & Sekkeli, 2017; Hwang et al., 2015). Several analyses have indicated that innovations contribute to firms by generating additional revenue to lower costs (Sakchutchawan et al., 2011), improve the output of the firm process (Khazanchi et al., 2007), and competitive advantage (Ho & Chang, 2015; Mao et al., 2016). Also, scholars have consistently concurred that there exists a direct correlation between technologies in logistics and performance (Ho & Chang, 2015). In situations where firms possess flexibility, those with stronger innovation capabilities are inclined to optimize their existing resources by engaging in entrepreneurial activities and embracing risk (Marcus, 1988; Strebel, 1987). This is support by Grawe et al. (2011) that synthesising resources and capabilities with innovativeness is advantageous for enhancing the flexibility of logistics operations. Hence, these hypotheses are propositioned:

H2: LFC has a positive relationship with innovation of LSP

H3: Innovation is positively related with logistics performance

Innovation Mediation

The amalgamation of resources and capabilities with innovativeness proves advantageous for enhancing the LFC of logistics operations. Therefore, it is imperative for firms to cultivate flexibility, enabling them to consistently adapt and remain versatile to effectively confront to unpredictable environment's variations. In a study by Yang (2012), it was found that innovation moderate the relationship of LFC on logistics performance. Richey et al. (2005) in their study found that innovation functions as intermediary factor influencing the relationship between resources and the performance of a reverse logistics firm. Zhou & Wu (2010) in their study found a positive correlation between flexibility and technological capability, suggesting that an enhancement in these aspects would subsequently lead to improved innovation. Accordingly, the following hypothesis is formulated:

H4: Innovation mediates the relationship between LFC and logistics performance

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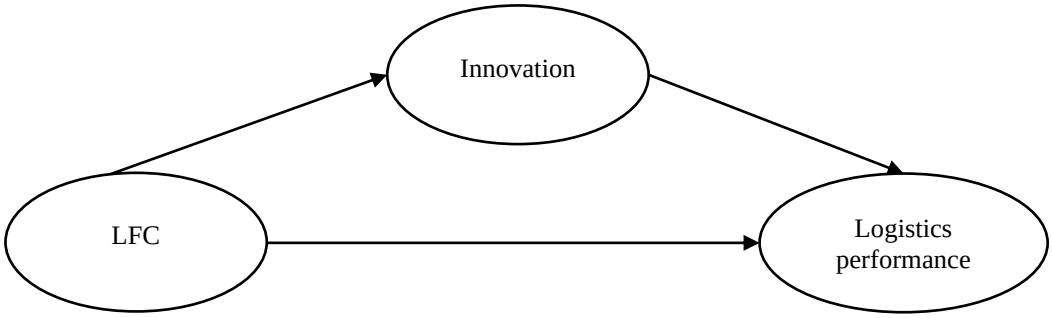

Figure 1: Research Framework

Research Methodology

Sampling and Data Collection

The primary focus of this study centres on logistics service providers (LSPs) in Malaysia. The collection of data was done via an online questionnaire thru Google Forms survey. The survey targeted individuals responsible for each selected LSP, drawn from the Federation of Malaysian Freight Forwarders Malaysia 2021/2022, which comprises three associations. Therefore, the utilization of stratified random sampling in this study is justified. Out of the 600 questionnaire forms distributed, only 127 were considered usable. The response rate is 23%.

Data Analysis

Measurement Model

To assess the measurement model, the research needs to evaluate the alignment between indicators and the constructs they represent. This evaluation involves convergent validity assessments: (1) Composite Reliability (CR) (value>0.7); (2) Cronbach's Alpha (value>0.7); (3) Average variance extracted (AVE)(value>0.5). Next, is the assessment of discriminant validity thru Heterotrait-Monotrait ratio (HTMT) (Value<0.85) (Ab Hamid et al., 2017; Hair et al., 2022). The result of measurement model is depicted in **Table 1**. It was evidenced that all the indicators of convergent validity, including CR, Cronbach's alpha, and AVE surpass the minimum threshold requirement. In **Table 2**, all the HTMT ratio values were below 0.85, thus confirming the test. Consequently, the measurement model analysis for this study is deemed successful.

Table 1: Convergent Validity

variables and items		Loadings
LSP performance (CR=0.900; Cronbach's α=0.899; AVE=0.522)		
LP1	Our company is excellent in adjusting to changing customer preferences compared to our competitors	0.699
LP2	Our company is better at dealing with changes in competitors' strategies	0.767
LP3	Our company is better at creating new products than our competitors	0.739
LP4	Our delivery services consistently on time	0.779
LP5	Our company can manage a high volume of daily shipments	0.719

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LP6	Our company can accommodate a high loading capacity per shipment.	0.747
LP7	Our company offers reasonable shipping cost	0.733
LP8	Our company offers reasonable distribution cost	0.700
LP9	Our overall logistics performance is better than the industry standard.	0.760
LP10	In general, our logistics performance is exceptional	0.839
LP11	We are competent in completing our logistics responsibilities	0.842
Innovation (Cronbach's α=0.902; CR=0.908; AVE=0.600)		
I1	Our company employs data acquisition technologies like RFID and barcodes for product handling	0.813
I2	Our company manages logistics activities through data communication technologies.	0.801
I3	Our company utilizes automated storage and retrieval systems	0.818
I4	Our company employs GPS	0.808
I5	Our company consistently improves its operating systems.	0.835
I6	Our company enforces a quality management system for logistics operations	0.779
I7	Management actively promotes innovative ideas within our company.	0.744
I8	Our company possesses clearly defined innovation strategies	0.757
Logistics Flexibility Capability (CR=0.811; Cronbach's α=0.811; AVE=0.522)		
LFC1	Our company can address non-routine customer requests	0.722
LFC2	Our company provides flexible operational procedures and systems	0.700
LFC3	Our company can efficiently handle delayed customer orders.	0.726
LFC4	Our company utilizes flexible delivery management systems.	0.759
LFC5	Our company can effectively handle unexpected situations.	0.715
LFC6	Our company offer reverse logistics operations.	0.729

Table 2: Discriminant Validity (HTMT)

	Innovation	LFC	Logistics Performance
Innovation			
LFC	0.741		
Logistics Performance	0.831	0.787	0.809

Structural Model

The outcomes of the hypothesis testing are demonstrated in **Table 3**, revealing that only one hypothesis (H2) was found to be significant, while the remaining three hypotheses (H1, H3, H4) were deemed insignificant. According to Cohen (1988) criteria, all hypotheses exhibited a small effect size on innovation and logistics performance. Additionally, the variable displayed a Q^2 assessment value exceeding 0, indicating predictive relevance within the study's model. Moreover, based on Shmueli et al. (2019) criteria, the model is assessed to possess moderate predictive power.

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Table 3: Pathways Coefficients and The Testing Of Hypotheses.

Hypothesis	Relationship	Beta	T-value	p-value	Decision
H1	LFC → Logistics Performance	0.103	1.318	>0.05	Rejected
H2	LFC → Innovation	0.330	3.732	0.00	Accepted
H3	Innovation → Logistics Performance	0.144	1.211	>0.05	Rejected
H4	LFC→ Innovation→ Logistics Performance	0.141	0.199	>0.05	Rejected
Predictive Relevance (Q^2)					
0.183					
PLSpredict					
Medium predictive power by following Shmueli et al. (2019) evaluation					

Discussion

First, Logistics Flexibility Capability (LFC) fails to relate with logistics performance (β=0.103, *t*-value=1.318, *p*-value> 0.05). The findings between LFC and performance is not as expected and thus H1 is not significant. The finding is contradicted with previous studies (Chou et al., 2018; Phaxaisithidet & Banchuen, 2020). Still, it cannot be denied that LFC is a crucial capability that would develop logistics performance. In the same study setting which is in Malaysia, Aziz et al. (2017) and Zawawi et al. (2017) found a positive and statistically significant correlation between LFC and logistics performance. During COVID-19 pandemic, global supply chains have faced significant vulnerabilities and disruption such as factory closures, lockdowns, trade conflicts, and geopolitical events which has profoundly impacted the world economy. LSPs were struggling to uphold high service quality amid challenges such as cargo backlogs, difficulty in securing truck drivers, and delayed sailings by ocean carriers. These constraints have posed difficulties for LSPs in maintaining their customary levels of service flexibility, consequently impacting overall logistics performance.

Secondly, the link between innovation and logistics performance was found to be insignificant. This indicates that innovation (β= 0.124, t=1.211, P>0.05) did not establish a significant association with logistics performance. Given that most of the studied population comprises of local or SME logistics service providers (LSPs), it was observed that innovation entails substantial costs and risks, potentially resulting in adverse outcomes such as heightened market risk, increased expenses, and unintended alterations (Banomyong et al., 2008). SMEs frequently abstain from investing in transformative technologies such as ERP and e-HRM due to limited financial resources. For a considerable duration, Malaysia's logistics environment has been constrained by factors such as a lack of openness, sluggish communication, and reliance on manual procedures.

Lastly, innovation fails to mediate the relationship between LFC and logistics performance (β= 0.141, t= 0.199, P>0.05). Since the COVID-19 outbreak in early 2020, Malaysia has experienced numerous waves of infections. In September 2020, the country witnessed a significant surge in COVID-19 cases, prompting the government to implement stringent measures to curb the spread of the virus. These measures included travel restrictions, border closures, and partial lockdowns in specific regions (Garrison, 2023). Despite the Malaysian government's designation of logistics services as essential, LSPs faced various constraints due to the pandemic. For instance, the addition of additional safety measures including requiring

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social separation in warehouses, cleaning and sanitising workspaces, providing protective equipment, and granting employees an endless amount of unpaid time off (Britt, 2021). It can be argued that the regulatory measures implemented during the COVID-19 pandemic in Malaysia did not foster an environment conducive to innovation. This could potentially hinder the acceptance and adoption of new technologies and methodologies. COVID-19 is expected to have long-term ramifications for the transportation and logistics sectors. Throughout the pandemic, LSP businesses were in a critical state and primarily focused on survival, leaving little time for innovation.

Conclusions

The study examined how innovation mediated the link between logistics performance and logistics flexibility capability (LFC) and thus offering valuable insights for LSPs to optimize their logistics services for optimal performance and customer satisfaction. However, the findings revealed that LFC does not significantly impact innovation. Consequently, innovation has no mediating effect on the link between logistical performance and LFC. This unexpected outcome contrasts with previous research emphasizing the importance of innovation as a critical influencing factor and a driver of value-generating capabilities. This study adds to the existing body of knowledge, particularly in the context of the COVID-19 pandemic, highlighting the need for further scholarly inquiry to deepen our understanding of this phenomenon. Unlike previous studies, which primarily focused on specific contexts, it became evident that the economic repercussions of the pandemic were significant. Consequently, LSPs can enhance their preparedness for unforeseen circumstances in the future by strengthening and fortifying their capabilities in logistics services.

The findings emphasize the critical role of LFC in enhancing logistics capability and ultimately improving the competitiveness of the logistics industry. LSP management should prioritize the development of LFC to strengthen their position in the market and meet the dynamic demands of the industry effectively. Particularly in situations where only a limited number of employees are allowed to return to work, this study aids managers and practitioners in effectively allocating resources and optimizing logistics and supply chain decisions. It is recommended that managers focus on variables that contribute to superior performance to maximize their advantage during the pandemic and design future contingency plans to address unforeseen situations. Furthermore, the study highlights the significance of innovation in shaping logistics performance, emphasizing the need for LSPs to explore strategies to enhance their innovation capabilities. Establishing essential capabilities is essential for achieving higher levels of innovation performance. For instance, the government could facilitate collaborative efforts among various logistics players, including local, multinational corporations, and international LSPs, to enhance their capabilities through knowledge exchange and exposure to advanced technologies. Policies incentivizing small and medium-sized LSPs to incorporate innovation into their logistics and supply chain practices could be implemented, such as financial incentives, pilot initiatives, and tax incentives.

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