ASEAN Entrepreneurship Journal (AEJ)

Measuring Third-Party Logistics Service Providers' Innovation Capabilities, Logistics Service Quality, and Sustainable Business Performance: A Confirmatory Factor Analysis Approach

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Abstract

Most businesses rely on third-party logistics service providers (3PLs) to manage the logistics of delivering products to clients and maintaining the supply chain. Further investigation is required to ascertain the impact of innovation capability and logistics service quality on business performance. The relationship between the capabilities of 3PL service providers and business performance has yet to be adequately studied, both in Malaysia and internationally. In this study, the link between the sustainable business performance of Malaysian providers of 3PL services and the innovation capabilities and logistics service quality are investigated by conducting a literature review and developing a questionnaire to solicit the opinions of industry experts. The above capabilities comprise marketing, technology, management, process, and service innovation. The psychometric qualities of questionnaire items assessing the quality of logistical service, innovation capabilities, and sustainable business performance are evaluated to accomplish this task. A total of 500 questionnaires were distributed to selected Malaysian 3PL service providers. IBM SPSS AMOS 26 was used to analyse the data obtained from 152 usable questionnaires. A hypothesised model of the relationship between innovation capabilities, logistics service capabilities, and sustainable business performance was revised using the first-order CFA method. It was found that the CFA measurement model that had been revised was well-fitting to the results based on the goodness-of-fit indicator. The results of this study show how innovation capabilities and logistics service quality play a significant role in enhancing Malaysian 3PL service providers to sustain their business performance. Focus on this study is needed to ensure that the Malaysian government, firms, and 3PL service providers are prepared to formulate the direction of the logistics industry to meet the needs of society and the economy through innovation.

Keywords: Confirmatory factor analysis, Innovativeness, Services, Third-party logistics

1.0. INTRODUCTION

The growth of creativity and innovation capability are among the most critical factors to be considered in today's rapidly changing market. These factors will help a firm expand its business activities while retaining its competitive advantages, allowing it to shape specific management efforts and increase the efficiency of other business processes (Farida & Setiawan, 2022). As part of the knowledge-based capabilities, the process of creativity and innovation development can help firms build efficiencies and apply new technologies that can leverage the needs and demands of existing and future markets. Many factors contribute to the growth of innovation performance, including the existence of high organisational knowledge, skills, and motivation. These factors are believed to be the main contributors to innovation-oriented business activities to meet market needs and organisational objectives (Somwethee et al., 2023). Furthermore, firms must improve their strategic orientation by concentrating on consumer needs to have superior customer value and cultivate an innovation-competent business community (Abozar et al., 2023; Farida & Setiawan, 2022).

The success of a firm is often attributed to innovation, which is widely recognised to be a significant competitive edge. A diverse set of innovations needs to be cultivated to capitalise on potential opportunities to develop new strategies by concentrating on critical needs (Teece, 2018). Firms' innovation capabilities can vary because those capabilities are difficult to replicate or imitate. Essentially, each firm can specialise in specific technologies or related skills, leading to a variety of innovation activities. Given that innovation is widely regarded as a condition that leads to the sustainability and success of a firm, numerous research works have been performed to analyse the factors that influence it (for example, Liao et al., 2007; Radas & Boi, 2009; Bahta et al., 2020; Shafi, 2020).

Third-party logistic (3PL) service providers are incredibly important in today's business world. They serve as a bridge between international trade and global growth. Nonetheless, several 3PL participants have battled to stay financially viable in recent years (Wallenburg & Knemeyer, 2022). Third-party logistics providers' services have a substantial influence, as more than 90 per cent of enterprises have been able to lower logistical costs while increasing logistics efficiency (Langley & Capgemini, 2017). Furthermore, suppliers of 3PL services in underdeveloped countries have experienced a variety of hurdles and difficulties, including a scarcity of labour management, fuel expenses, regulatory compliance, and the inability to deliver bespoke services (De Farias & Akabane, 2011). However, given the intense rivalry for services, the problem of innovation among 3PL suppliers is essential (Wagner & Sutter, 2012). Malaysia's logistics business contributed RM 23.2 billion, or 8.8 per cent, to the country's gross domestic product (GDP), which was around RM 15.7 billion in deficit in 2005. This was followed by RM 21.170 billion (in 2010), RM 22.297 billion (in 2011), and then a precipitous decrease to RM 12.619 billion in September 2018 (World Bank, 2016; DOSM, 2019). According to the 3PL sector's present state, adopting new technologies may help a business thrive, even more so in a highly competitive market.

Many logistics and transportation-based firms are currently working to improve their capabilities by developing operational excellence strategies. Logistics and transportation firms are encouraged to develop their logistics activities to remain competitive for years to come. As part of the initiatives to ensure the sustainable competitiveness of firms, it plays a key role in IR 4.0, which is also known as the fourth industrial revolution, where it speeds up the growth of innovation capabilities through numerous fields (Lasi et al., 2014; Frank et al., 2019).

Malaysia was ranked 35th in the world on the Logistics Performance Index in 2015, compared to Singapore, which was ranked seventh (World Bank, 2016). Nonetheless, Malaysia's logistics industry has begun to mature and show indications of growth since early 2010, notably in the Klang Valley's main ports. Malaysia is now in a strong position to become one of the region's leading integrated logistics services hubs.

This aligns with the objective of the 12th Malaysia Plan (12MP) from 2021 to 2025 to prioritise the logistics and supply chain sectors, where it can aid regional enterprises in enhancing their competitive edge through the optimisation of operations, reliability, and effectiveness (EPU, 2021; Vatumalae et al., 2023). However, the majority of Malaysian 3PL service providers continue to place a premium on conventional services like customs clearance, warehouse storage, and shipping. The organisation exhibits several deficiencies, namely inadequate inventory management, inadequate infrastructure, and a dearth of collaborative endeavours. In general, regulatory compliance is considered a secondary concern (Abdullah et al., 2016; Ong et al., 2020; Vatumalae et al., 2023). Given the rapid growth of the third-party logistics (3PL) industry in Malaysia, it is critical to underscore the significance of innovation as a means to surmount challenges and enhance productivity and quality.

Malaysian service providers have been building linkages and establishing an all-encompassing logistics network since the emergence of multimodal logistics. Nonetheless, there is a lack of study in the current body of literature that particularly investigates the extent to which Malaysian firms use third-party logistics (3PL) service providers. Furthermore, there is a scarcity of research on the relationship between innovation capabilities, logistics service quality, and business performance. The assessment of 3PL service providers' competencies concerning business success received little attention (Grawe et al., 2015; Yuen et al., 2019). Malaysian and worldwide perspectives on the issue have not been properly researched and studied in practice. The objective of this research is to conduct a complete CFA

review to close the current gap, notably in the context of Malaysia.

The first-order confirmatory factor analysis (CFA) technique is used in this study to evaluate a sample of 3PL service providers in Malaysia. The objective is to assess the psychometric features of a questionnaire aimed to create and validate scales for five dimensions of innovation capability. Furthermore, the questionnaire seeks to measure sustainable business performance and logistics service quality, encompassing an assessment of innovation capabilities in marketing, technology, management, process, and service. Therefore, this paper will examine the literature on the Resource-based View (RBV) and explore the connection between innovation capabilities, logistics service quality, and sustainable business performance. The methodology section will detail the sampling techniques and instrument development. Following that, the paper will conduct confirmatory factor analyses, and the results will be subsequently discussed.

2.0. LITERATURE REVIEW

Innovation is the process of successful barriers implementing useful new ideas within a business. Nowadays, innovation provides a competitive edge, particularly when it is accompanied by strong mainstream capabilities in accuracy, reliability, speed, and versatility (Zailani, et al., 2023). Top innovators would be adept at managing multiple skills while steadily delivering unique and top-notch products quicker, cheaper, and more frequently than their competitors, enabling them to dominate their industries' futures (Sukri et al., 2023, Nor et al., 2023). There are various conceptualisation forms of innovation in organisational research. Damanpour (1991) used a conceptualisation that included administrative and technological innovation, progressive and gradual innovation, and process and product innovation, and according to Thongpravati (2022), innovation can be applied to goods, systems, and facilities in an organisational sense and it can be evaluated by either incremental, radical, or breakthrough degrees. It also occurs at various levels.

The creation of new technologies and goods has long been associated with innovation. Innovation can be used to build new pricing strategies, distribution networks, business models, management techniques, and service products (Thongpravati, 2022; Yang & Lin, 2020).

Innovation is not limited to services and goods only. There is a growing recognition that innovation has the power to enhance and change the steps in a value chain (Yang & Lin, 2020). Businesses must be more aggressive in resolving today's globalisation issues. According to scholars, the most significant aspect that helps firms achieve high levels of competitiveness is their ability to innovate (Saunila, 2016; 2017). The capacity of a business to innovate in terms of implementing new systems, goods, or concepts within the organisation is referred to as innovation capability (Rajapathirana & Hui, 2018). More so for providers of third-party (3PL) services, who must formulate strategies to best competitors due to the competitive market caused by globalisation, technological advancements, and fluctuating logistics demand. As a result, innovation is the best way to compete and improve the corporate climate to induce greater potential opportunities (Sukri et al., 2023; Zailani, et al., 2023).

2.1. Resource-based View (RBV)

According to the resource-based view (RBV) theory, innovation capability was established to design and deploy valuable capital and skills that can lead to the achievement and maintenance of firms' competitive advantages (Wernerfelt, 1984; Olavarrieta & Ellinger, 1997; Mohamed et al., 2014). However, this theory is deemed unable to be used in facing the market challenges nowadays due to the inflexible nature of the theory itself. This RBV theory is dynamic and takes a long process to develop the required resources (Barney, 1991; Wibbens, 2023). Besides, the RBV theory can be applied to explain firms' ability to leverage their resources, including developing capabilities, materials, work processes, and structures (Barney, 1991; Al-Sharif et al., 2023).

Logistics service providers have grown in recent years as a result of organisational growth, mergers, acquisitions, and partnerships. These are some of the measures that may be taken to acquire resources for expansion. RBV has been utilised in logistics-related research to investigate the impact of logistics operations on business performance (Coşkun & Erturgut, 2022).

For logistics service providers seeking a competitive advantage, the theory provides a key theoretical grounding. Existing research has offered empirical data demonstrating a relationship between innovation capabilities, logistics service quality, and business

performance. Organisations that have a distinct capability to effectively use and develop resources can improve their overall performance and competitiveness. The importance of having a variety of strategic resources is extremely important in maintaining a competitive edge (Ismail et al., 2011; Wong & Wong, 2011). As a result of the heterogeneous distribution of resources across numerous 3PL service providers, freight operators, freight forwarders, and 3PL clients, RBV theory may be seen as the relevant theory to explain competitive advantage in the 3PL services market.

2.2. The Relationship between Innovation Capability, Logistics Service Quality, and Sustainable Business Performance

Malaysia's logistics industry has grown in recent years, aided by strong growth drivers such as enhanced logistics infrastructure, higher freight volumes, and structural growth in e-commerce (Yean & Yi, 2023). While the present market environment is fragmented, with a large number of competitors throughout the value chain, market consolidation is projected, with the creation of two broad groups of logistics providers – notably big integrated logistics businesses are able to capitalise on their size and reach, and players concentrating on specialist market segments – and this will contribute to Malaysia's poor logistics performance, which may be connected to the country's high logistical costs (Wong et al., 2015; Makmor et al, 2019). This constraint has pushed logistics firms to strike a balance between lowering costs and delivering service of high quality to ensure that they stay competent in the management of the dynamic domestic and foreign supply chain (Tukamuhabwa et al., 2023).

Hence, it is recommended that third-party logistics (3PL) service providers offer customised logistics services based on the specific requirements of their clients. They may improve their competitiveness by employing these logistics services. This can help 3PL service companies improve efficiency to increase client loyalty and reduce competition. As a result, developing a more beneficial market can help the country's economic success (Meiduté-Kavaliausjeiné et al., 2014; Makmor et al., 2019). This viewpoint is consistent with the findings of several researchers (for example, Bienstock et al., 2008; Dang et al., 2019), who discovered that logistics service excellence contributes to a firm's competitive advantage in a variety of ways, including information quality, systematic procedures, punctuality, order

tracking, customer support, and physical delivery. This position is backed by Lin et al. (2023) research, which discovered that the quality of service has a significant influence on consumer satisfaction and loyalty to logistics organisations. This can act as a catalyst to increase market participation and business effectiveness (Liu et al., 2018).

Changes in the quality of logistics services have a favourable impact on business efficiency and client satisfaction (Fernandes et al., 2018). As a result, taking into account the quality of a logistics provider will assist businesses in differentiating not just their products, but also their customer reputation. However, the satisfaction of clients via logistics services was only achieved by ten per cent of all firms (Lin et al., 2023). The majority of firms were unaware of the significance of the quality of logistics service concerning improving the operations of businesses. This served as a reminder to logistics managers about the value of improving logistic service efficiency in today's business climate.

Improvement of business performance is a priority shared by all firms, including 3PL service providers. Performance refers to the attribute and calibre of the actions of an organisation when carrying out its employment and functions in making money (Sink, 1991). According to Venkatraman and Ramanujam (1986), Darroch, (2005), Bagorogozaand and de Waal (2010), and Bakar and Ahmad (2010), there are two categories of performance, namely financial and non-financial. The capabilities of a firm to perform regularly with efficiency, ability to deliver on time, and flexibility represent non-financial performance, which is also referred to as operational performance (Charles & Ochieng, 2023).

According to Ali et al., (2023) and Sharma et al. (2021), a company's ability should be versatile, regularly updated, and capable of meeting customer needs. Brunello and Wruuck (2021) suggest that firms need to continuously enhance their skills. Management-driven innovation can improve business performance (Wang et al., 2023), and sustainable business performance is connected to innovation (Sukri et al., 2023). However, factors like intangibility, perishability, inseparability, variability, and sustainability complicate determining how innovation affects business performance, especially for 3PL service providers. Firms that have the highest long-term performance are both client-focused and highly inventive (Canh et al., 2019). Sustainable performance

Table 1a: Instrument Development for Innovation Capability

Question	Source
We emphasise innovative and creative capabilities when recruiting staff.	Liao et al. (2007)
We adopt new leadership approaches to guide all staff toward task completion.	
We adopt a new performance assessment method to achieve the goal.	
We adopt a new staff welfare system that can effectively provide incentives to our staff.	
We implement new process technology in management.	Lin et al.(2010)
We obtain patents for process technology in management.	
We establish a consistent marketing program involving brand awareness campaigns to generate leads and sales from a more sophisticated and larger customer base.	Robinson(2013)
We import innovative warranty, guarantee, and maintenance systems to enhance client satisfaction.	Lin et al. (2010); Said et al. (2016)
We import innovative claim-clearing procedures and methods to enhance client satisfaction.	
We import innovative before-sale or after-sale service methods to enhance clients' satisfaction.	
We adopt innovative order management and follow-up systems.	
We are willing to take the risk of pursuing very new service ideas.	Chen (2011)
We offer world-class proprietary freight management software to eliminate the inefficiencies of the manual freight shipment process.	Robinson (2013); Moretto and Rice (2012); Rao et al. (1999)
We enhance our logistics service by improving the tracking system.	Coltman etal. (2011); Vivaldini et al. (2012)
We differentiate our business services by creating an integrated network that allows us to deliver goods within 48 hours.	Moretto andRice (2012)
We are active in R&D activities to enhance the traceability and exportability of our services.	Liao et al.(2007)
We provide qualified logistics management services.	van Dammeand van Amstel(1996)
We implement innovative pricing methods in the markets.	Said et al.(2016)
We implement innovative distribution methods in markets.	
We employ innovative promotion methods in markets.	Lin et al.(2010)
We continuously expand potential demand in markets.	

should be addressed when making strategic decisions in the 3PL industry (Gardas et al., 2019). The sustainable business performance of 3PL service providers may be divided into three categories: environmental, economic, and social performance, which are all closely related to 3PL's sustainable efforts (Nitisaroj & Liangrokapart, 2020).

The current study investigates and evaluates the capabilities of innovation in five areas: service, management, marketing, technology, and process, as well as the quality of logistical services. Furthermore, techniques for measuring the sustainable business performance of 3PL service providers must be developed. As a result, the current study took a subjective approach to evaluating ten items of sustainable business performance. These reasons include an increase in transportation and facility orders, improved service

quality in terms of customer satisfaction, and increased revenue from services given.

3.0. METHODOLOGY

Prior to employing IBM SPSS AMOS 26 for structural equation modelling (SEM) analysis, a comprehensive examination was conducted on the gathered data. The rationale for choosing AMOS-SEM as the analytical technique was its efficacy in examining intricate associations among variables, specifically in relation to latent variables and the evaluation of model sufficiency (Rahlin et al., 2022). Consequently, it was a feasible option for evaluating the suitability of the Confirmatory Factor Analysis (CFA) model that was proposed. To ascertain the quality of the data, pre-analysis tests were conducted, encompassing the resolution of missing values and outliers, as well as an assessment of

Question	Source
We provide reliable performance to our clients.	
We are highly responsive to time, especially regarding delivery speed.	Panayides (2006; 2007)
We are very proactive and take responsibility for client service recovery.	
We can meet unanticipated client needs, such as special pickups.	
We can handle significant changes in volume, such as delivery through multi-modal transport services (by air, ocean, land).	Coltman et al. (2011)
We can ensure the security of supply chain systems through low-risk management.	
We demonstrate concern through understanding, dedication, sincerity, sensitivity, and attentiveness toward clients' needs.	Panayides (2007)
We encourage clients to express their opinions about services provided for improvement.	Asubonteng et al. (1996)

the data's normality. Subsequently, statistical validity assessments, including convergent validity, construct validity, and reliability, were implemented to enhance the robustness and credibility of the analysis.

3.1. Sampling Technique

Using a simple random selection technique, a sample was drawn from the Federation of Malaysian Freight Forwarders' 2016/2017 Directory, which included 1161 3PL service providers. To conduct this research, we chose one respondent from each 3PL service provider who held a senior management position or above. A sample size of 500 individuals was selected randomly from the survey population and provided with questionnaires. Out of the 160 questionnaires that were returned, 152 of them were deemed eligible for use. The response rate of 30.4 per cent is regarded as strong in comparison to other mail-survey studies, especially considering the challenge of contacting top-level managers, particularly in the Malaysian setting (Sohail et al., 2006; Zailani et al., 2017).

3.2. Instrument

In this study, the innovation capabilities constructs were examined through the lens of five factors: management innovation (assessed by seven items), service innovation (five items), technology innovation (five items), marketing innovation (four items), and process innovation (four items). Additionally, logistics service quality was evaluated using eight items, as outlined in Table 1. Both constructs were rated on a five-point Likert scale, ranging from 1 to 5, where 1 indicates "strongly disagree", and 5 indicates "strongly agree". Meanwhile, sustainable business performance was

assessed with 11 items on a similar scale, with 1 indicating "very poor" and 5 indicating "excellent".

Following a review of the literature on studies examining innovative capabilities, logistics service quality, and sustainable business performance, some items that were believed to be relevant and practical for the characteristics of 3PL service providers were found. Items that were unrelated to the research were excluded. The gathered items were then organised into three main dimensions, as indicated in Table 1a – 1c.

4.0. DATA ANALYSIS

Before doing the structural equation modelling (SEM) study with IBM SPSS AMOS 26, a meticulous screening and analysis of all collected data were performed. This procedure was carried out to find and fix any missing values or large outliers, as well as to establish the data's normalcy. Several statistical tests and analyses were utilised to examine the goodness-of-fit of the hypothesised CFA model, including convergent validity, construct validity, and reliability.

The data for this study was analysed in three stages. To begin, the Mahalanobis distance squared (D2) was used to check the presence of outliers, while skewness and kurtosis tests were used to establish the data's normality. Several frequently used fit indices were used to evaluate the model's goodness-of-fit. Following that, all 44 items were created, and the model's fitness was evaluated and re-specified. The CFA approach was used to assess the initial measurement model of sustainable business performance, quality of logistics service, and innovation

Question	Source
We received an increased number of orders for transportation services.	Vij & Bedi (2016)
We achieved improved service quality in terms of client satisfaction.	
We attained increased revenue from provided services.	
We achieved fast delivery for clients' orders.	Coltman et al. (2011)
We flexibly adjust operations to meet unforeseen client needs.	Chin et al. (2007)
Our organisational management reports more customisability, range, and flexibility.	Coltman et al. (2011)
We achieve more proactive innovation in service, process, marketing, and management.	
We offer higher-quality services compared to competitors.	Li et al. (2006)
We provide more effective handling of clients' service support for any requests and questions.	Chin et al. (2007)
We assist clients in solving their logistics-related problems.	

capabilities, which comprised innovation in marketing, technology, management, process, and service. This approach was adopted because this research sought to examine whether there is a particular construct trait underlying the measures and the items that form an instrument that measures a single common thing.

4.1. Assessment of Reliability and Validity of the Instruments

The scale's reliability was assessed using Cronbach's alpha coefficient for internal consistency. The Cronbach's alpha values corresponding to sustainable business performance (0.961), quality of logistics service (0.916), and innovation capabilities (0.957) are shown in Table 2 where they exceed the acceptable value recommended by Hair et al. (2016) with regards to exploratory research, which implies that the constructs are reliable. To further validate the instrument, construct validation was performed using IBM SPSS AMOS 26 software to analyse the data. Furthermore, the instrument's face validity was confirmed as the questionnaire was designed by adapting a similar conceptual framework to that in past studies, and it was therefore deemed to serve its intended purpose.

4.2. Confirmatory Factor Analysis

The confirmatory factor analysis (CFA) approach was employed in the study to test the construct validity of the questionnaire items. CFA is a strategy for evaluating variables that are precisely measured and have fewer components (Hair et al., 2016). According to Shultz and Whitney (2005), CFA is a powerful method for researchers to evaluate the link between latent

components and observable data and test hypotheses. The researcher uses theoretical knowledge, empirical testing, or a mix of both to statistically examine the hypotheses. Confirmatory factor analysis (CFA) may be used in the confirmatory testing of measurement theory, where the structural components of the theoretical model are represented systematically and logically in the measurement theory (Hair et al., 2016). In other words, CFA can help a researcher validate or refute a prior notion.

The CFA findings for each first-order concept were examined several times to ensure the model's unidimensionality. The innovation capabilities construct in this study has five factors, each with four to seven items. On the other hand, the sustainable business performance and quality of logistics service constructs have eleven and eight items, respectively. The reliability, dimensionality, and validity of the measurement model are discussed through the CFA process as one of the structural model's validation criteria.

The structural model is validated using indices representing the goodness-of-fit. These indices represent how well the model matches the data. There is currently

Table 2:		
Construct	**Cronbach's Alpha**	**Number of Items**
Sustainable Business Performance	0.961	10
Quality of Logistics Service	0.916	8
Innovation Capabilities	0.957	26

Goodness-of-fit Indices	Descriptions
Chi-square (χ^2)	A test to determine the statistical significance that is dependent on the sample size. The recommended value ranges between 2.0 and 5.0 (Wheaton et al., 1977; Tabachnick & Fidell, 2019).
Root Mean Square of Error Approximation (RMSEA)	Evaluate how fitting the model is with the covariance matrix of the population. It is generally accepted that a value lower than 0.08 represents a good fit. Mediocre fit refers to any value that falls within the range from 0.08 to 0.10. Any value above 0.10 denotes a poor fit (MacCallum et al., 1996; Byrne, 2010; Hair et al., 2016).
Goodness-of-Fit Index (GFI)	To create a fit statistic that has a lesser dependency on the sample size. The value of GFI ranges between 0 and 1, whereby the higher the value is, the better the fit is. A good fit is typically indicated by any value above 0.90 (Hair et al., 2016)
Comparative Fit Index (CFI)	Allows the comparison between the current model fit and the null model. The value of CFI ranges from 0 to 1, whereby a value higher than 0.90 is deemed to be a good-fitting model (Bentler & Bonett, 1980; Byrne, 2010).

no consensus among researchers about which fitness indices should be published (Awang, 2012). According to previous studies, at least three fitness indices should be used, where every model fitness type should have a minimum of one index (Hair et al., 2010; Awang, 2012). There are three categories of fitness indices, namely parsimonious fit, incremental fit, and absolute fit. The best-fit model amongst various models is specified by the parsimonious fit. On the other hand, the incremental fit indicates how fitting the predicted model is when it is compared to a different baseline model. In contrast, the absolute fit measures the accuracy of the observed data reproduced by the researcher's model (Hair et al, 2016; Byrne, 2010). Considering the above, Table 3 shows the indices representing the goodness-of-fit that were used for this research.

5.0. DISCUSSION

The purpose of this study was to report the findings of a systematic first-order CFA that was undertaken to create and validate scales for five components of innovation capabilities, as well as two additional constructs, namely sustainable business performance and logistics service quality. The model was evaluated using standardised regression weights, squared multiple correlations, Cronbach's alpha, construct validity, and convergent validity.

Out of the 152 responses gathered from Malaysian 3PL service providers, the initial 44-item model was revised by removing some of the items that did not meet the recommended statistical values. Then, the model was re-specified and analysed repeatedly until the necessary level was attained. The re-specified model fit indices of 36 items for all the constructs are shown in Table 4. The results confirm the unidimensionality of the model and the convergent validity of each construct. The re-specified model fits the sample data, since $\chi2/df$, GFI, CFI, and RMSEA are all within the recommended statistical values (Byrne, 2010). Only 36 of the 44 initial items could be utilised in subsequent analyses because their standardised regression weights were statistically significant ($\lambda \geq .70$).

It can be observed from Table 5 that every variable's regression weight has high factorial validity ($\lambda \geq .50$), where the loading onto the respective factor ranges between .608 and .989. The majority of indicators are statistically significant ($\lambda \geq .70$); after rounding to two decimal places, Z5, A6, B4, B5, C1, C2, E1, and E2 are deemed to have a .70 factor loading. These findings indicate that no construct is jeopardised by the presence of additional indicators. Additionally, they demonstrate that the factor loading, and critical ratio values do not pose a threat to the model fit, since the majority of loadings are within the required range and all critical ratio values are greater than 1.96 (p <.001) (Byrne, 2010). Also, the squared multiple correlation values for the 36 items show that most of the indicators have good item reliability ($r2 \geq .50$), including items A5, A6, B4, B5, C1, C2, E1, and E2 (after rounding to two decimal places). The constructs' convergent validity can be confirmed, as shown by the extracted values for average variance and composite reliability for each construct. This result indicates that these seven constructs are significant variables. Hence, the analysis of this measurement model demonstrates a good fit. Therefore, these seven constructs are relevant for assessing the quality of logistics service and innovation capabilities of Malaysian providers of 3PL services to discover methods to improve their business performance sustainability.

Table 4 Re-specified Goodness-of-fit Indices for First-order Confirmatory Factor Analysis of Each Construct

Goodness-of-Fit Indices	Recommended Statistical Value	MI	SI	TI	MKI	PI	LSQ	SBP
χ^2/df	≤ 3.00	1.260	1.305	1.387	1.783	1.755	1.475	1.741
GFI	≥ 0.90	0.981	0.981	0.986	0.992	0.992	0.985	0.960
CFI	≥ 0.90	0.997	0.998	0.996	0.978	0.978	0.997	0.991
RMSEA	≤ 0.10	0.044	0.045	0.051	0.872	0.983	0.056	0.070

Note: MI = Management Innovation, SI = Service Innovation, TI = Technology Innovation, MKI = Marketing Innovation, PI = Process Innovation, LSQ = Logistics Service Quality, SBP = Sustainable Business Performance

The CFA analysis for validity, reliability, and factor loading revealed that there were no problems. After the indicators were re-specified and tested again, they all met the requirement of the fitness indices. As indicated in Table 2 and Table 3, all the fit indices were more than adequate, hence, it can be concluded that the re-specified CFA models were appropriate for the subject under study. In other words, the results indicated that the models fit the data after taking into consideration the modification indices and several rules of thumb in the CFA approach. Thus, the finding shows that the fitness indices assessment (RMSEA, GFI, CFI, χ^2/df) for the measurement models accepts the model fit. Also, the loadings ranged between .608 and .989, which indicated that the models fitted very well and therefore provided an adequate fit to the Malaysian 3PL service provider data. The models were finally retained as the first-order measurement constructs for further analyses.

The values of the extracted average variance and composite reliability for each construct supported the constructs' convergent validity. Therefore, the items were considered adequate for use in this study, as their purpose was to clarify the role of the quality of logistics services and innovation capabilities in improving the sustainable business performance of the Malaysian providers of 3PL services, to thereby achieve competitive advantage.

6.0. CONCLUSIONS AND RECOMMENDATION

The purpose of this research is to look at the link between Malaysian third-party logistics service providers' (3PL) innovation capabilities, logistics service quality, and sustainable business performance. It intends to close a huge research gap in this field. The widespread reliance on third-party logistics providers (3PL) in modern business operations emphasises the critical need to understand the factors that influence their success.

The study took a thorough approach, which included a detailed examination of existing literature, the development of a focused questionnaire, and a rigorous evaluation of the psychometric features associated with logistics service quality, innovation capability, and sustainable business performance. A Confirmatory Factor Analysis (CFA) assessment model was determined to be a satisfactory match after assessing 152 valid responses in IBM SPSS AMOS 26. The study's findings emphasise the critical necessity of innovation capabilities and logistics service quality in increasing Malaysian 3PL service providers' sustainable business performance. This not only improves scholarly arguments but also has practical implications for industry participants. Malaysian firms, government agencies, and third-party logistics (3PL) service providers can use this data to affect the logistics industry's trajectory. By prioritising innovation in marketing, technology, management, process, and service sectors, the industry may more successfully respond to changing societal and economic demands.

The study highlights the importance of innovation in maintaining the business performance of 3PL. It recommends a collaborative approach to foster an atmosphere that promotes innovation. This requires collaborations between the government, corporations, and service providers to develop strategic plans for the logistics industry. By engaging in such a partnership, Malaysia may establish itself as a leader in a constantly changing logistics environment, guaranteeing long-term sustainability and flexibility to meet the needs of a fast-growing global economy.

6.1. Limitation of the Study

Construct	Item	Standardised Regression Weight (λ)	Squared Multiple Correlation (r^2)	Composite Reliability (≥ 0.6)	Average Variance Extracted (≥ 0.5)
Management Innovation	A1	0.851	0.725	0.914	0.644
	A2	0.822	0.675		
	A3	0.989	0.977		
	A4	0.832	0.692		
	A5	0.659	0.409		
	A6	0.651	0.485		
Service Innovation	B1	0.869	0.755	0.902	0.652
	B2	0.938	0.880		
	B3	0.842	0.709		
	B4	0.695	0.483		
	B5	0.658	0.453		
Technology Innovation	C1	0.662	0.468	0.881	0.602
	C2	0.658	0.470		
	C3	0.824	0.679		
	C4	0.906	0.822		
	C5	0.837	0.700		
Marketing Innovation	D1	0.951	0.905	0.933	0.777
	D2	0.967	0.934		
	D3	0.825	0.681		
	D4	0.768	0.590		
Process Innovation	E1	0.647	0.468	0.839	0.570
	E2	0.648	0.473		
	E3	0.791	0.626		
	E4	0.907	0.823		
Logistics Service Quality	F1	0.855	0.732	0.926	0.714
	F2	0.922	0.849		
	F3	0.864	0.747		
	F4	0.778	0.605		
	F5	0.798	0.637		
Sustainable Business Performance	G4	0.816	0.666	0.949	0.727
	G6	0.717	0.515		
	G7	0.759	0.576		
	G8	0.892	0.795		
	G9	0.913	0.834		
	G10	0.929	0.863		
	G11	0.916	0.839		

Table 5 Results of Each Construct After Modification following the Confirmatory Factor Analysis Assessment

Every study has its own set of limitations. Extrapolation to other variables should be performed with caution since this study focuses on Malaysian 3PL service providers. The single survey design and subjective judgement were the base of the assessment of sustainable business performance in this study (Flynn et al., 2018). To attain a better understanding of the factors that influence the performance of 3PL service providers, future studies should incorporate more relevant and significant constructs into the present model. Furthermore, given the paucity of logistics literature in Malaysia, the current study's model is applicable or adaptable for prospective empirical studies in various relevant research areas, particularly for research related to Malaysia.

The statistical analysis of the data generated from Malaysian 3PL service providers was thoroughly examined in the study. The demographic and sampling criteria would limit the results' generalisability. This study was done on 3PL service providers in Malaysia and does not apply to the whole worldwide population of 3PL service providers. Furthermore, the researcher discovered that the outcomes of the study differed depending on sampling criteria such as sample size and unit of analysis. This is consistent with the findings of Hair et al. (2016), who proved that the model works with a wide variety of sample sizes. However, it should be emphasised that the investigation did not examine discriminant validity.

The outcomes of this study indicate the relevance of sustainable business performance, logistics service quality, and innovation capabilities for Malaysian providers of 3PL services. This study gives practical information on how to develop and deploy linked aspects of innovation capability and logistics service quality to help and enable 3PL service providers' plans for sustaining business performance in the Industry 4.0 era.

6.2. Recommendation for Future Studies

It is worth noting that the researcher discovered that the study's results varied based on sampling factors such as sample size and unit of analysis. However, it should be noted that the investigation did not assess discriminant validity. Consequently, future research should do a discriminant validity study to assess the suitability of the sample. Subsequent research should also integrate more variables to ensure a more comprehensive investigation.

One variable that could be critical in assessing the effect of the quality of logistics services and innovation capabilities on the sustainable business performance of the providers of 3PL services is relationship orientation. Future studies can employ additional specific and relevant theories to describe the substantial literature and to test hypotheses. Furthermore, the measurement may be empirically evaluated in various businesses and regions. This would assist in improving the measuring of instrument's validity and reliability.

If Malaysia wants to adopt 3PL operations aggressively, policymakers must create and closely oversee the advancement of new capabilities and the upgrading of logistics service quality among Malaysian 3PL service providers. 3PL service providers should include social, environmental, and economic aspects in their operations to encourage the long-term success of Malaysian 3PL. Finally, this study's results can expand the body of knowledge through the offering of a potential map of existing 3PL studies with all current variables, as well as possibilities for future research, to strategic management researchers, government and logistics practitioners.

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