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Do Technological and Organizational Innovation Have Significant Influences on the Logistics Performance?

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ABSTRACT: *Logistics service providers (LSPs) need to engage with the innovation to achieve performance and keep their competitive advantage. LSPs are required to develop innovation in logistics activities to face challenges in the market. Logistics innovation can be considered as any type of associated service in logistics service. The purpose of this paper is to investigate the technological and organizational innovation as factors to measure the logistics performance of LSPs. Partial least square structural equation modeling (PLS-SEM) was conducted to examine relationship with logistics performance using SmartPLS 3 software. Technological innovation was found insignificant effect on logistics performance. The result of this study also indicated that organizational innovation has insignificant effects on logistics performance.*
Keywords: *technological, organization, innovation, logistics performance, logistics service providers*

I. INTRODUCTION

As firm provides logistics services in the dynamic market, logistics service providers (LSPs) have to develop and implement the logistics innovation in order to improve growth and profitability as well as to remain as a market leader. Innovation has become the most important driver of firm competitiveness in advanced economies. In the various industries, many empirical researches have addressed the importance of innovation capability as a driver for competitive advantage and superior performance (Chiou, Chan, Lettice, & Chung, 2011; Goksoy, Vayvay, & Ergeneli, 2013; Jenssen, 2003; Lee & Song, 2015; Sakchutchawan, Hong, Callaway, & Kunnathur, 2011; Shi & Au-Yeung, 2014). LSPs need to constantly innovate as logistics service industry is no longer an emerging market. Although, most shippers in the manufacturing and retailing industry havereached close to the maximum level of outsourcing for their logistics services, LSPs have still opportunity to create new certain market through strategies. For example, offering value-added services, which can be created by implementing innovation. Without innovation, services that offered by LSPs to the customers become outdated and not able to compete with their rivals.

In order to keep a distance, LSP has to build core capability to avoid immitation of their competitors. Therefore, it is imperative for LSP to integrate innovation capabilities into their logistics service activities particularly in the current dynamic marketplace (Ho & Chang, 2015). Logistics firms need to engage in the innovation to keep their competitive advantage and this require them to improve their innovation capability in order to remain in the market(Lin, 2006a; 2006b; Lin, 2007). In today competitive business environment, innovation is considered a fundamental component of a successful business as it allows companies to sustain in the market place and at the same time reduce pressures from competitors. Innovation in service firms has different features from manufacturing (Johne & Storey, 1998) as it often involves small incremental changes in both processes and procedures. These phenomena is supported by Langley et al. (2006), which indicated that in the future logistics industry, service offering and innovation capabilities are key challenges in order to deliver better logistics performance and remain competitiveness. Therefore, measuring the logistics performance of LSPs, this study attempts to examine the technological and organizational innovation as core components of logistics innovation.

II. LITERATURE REVIEW

Innovation capability is recognized to be the core capability of organizations to maintain holistic value-creating dynamics in which the opportunities of change are exploited and new ideas generated, translated and implemented in practice (Kim & Park, 2010; Yam, Lo, Tang, & Lau, 2011). Thereason is clearly espoused, innovation can be a key driver of sustained business growth which is the management of innovation is a central concern for firms(Igartua, Garrigos, & Hervas-Oliver, 2010). Innovation means for changing an organization, whether as a response to change that occurs in its internal or external environment or as a pre-emptive move taken to influence an environment (Hult, Hurley, & Knight, 2004). Hurley and Hult (1998) defined firm innovation from a collective perspective, that is, openness to new ideas as an aspect of a firm’s culture. With regards to innovation in logistics service, it is referring to any logistics related service from the basic to the complex that is seen as new and helpful to a particular focal audience which audience could be internal where innovations improve operational efficiency or external where innovations better serve customers (Flint, Larson, Gammelgaard, & Mentzer, 2005). LSPs should pay more attention to innovation in logistics service and the innovation in logistics can be implemented through technology, knowledge and relationship network (Chapman, Soosay, & Kandampully, 2003). Technological effort is the key variable and means of differentiation between LSPs (Sauvage, 2003). However, firms would not only focus technological innovation but they would also give attention on non-technological innovation concerning services, people and organization in order to survive in business environment (Vaccaro, Jansen, Van Den Bosch, & Volberda, 2012).

2.1 Technological Innovation

Technology is one of the main sources of performance for a company (Patel & Pavitt, 1997). It would help companies to have better profitability by implementing technological innovation. Technological innovation is also an important source of growth and a key determination of competitive advantage for many organizations (Azubuike, 2013). In general technological innovation can be classified into four categories namely data acquisition technologies, information, communication and technologies, warehousing technologies, and transportation technologies (Lin & Ho, 2007). Data acquisition technologies are the backbone of information technology. In manufacturing automation, data acquisition technology is the backbone in all phases of manufacturing, i.e. information detection, testing, supervision, equipment fault diagnosis, and management. Indeed, it may be said that data acquisition technology is the foundation of manufacturing and computer integrated manufacturing system (Hu, Du, & Yang, 2003). The bar code system and radio frequency identification system (RFID) are acquisition technologies that can facilitate logistics data collection and exchange. These kind of technologies play an important role in supporting logistics and supply chain processes because of their abilities to identify, trace and track information throughout the supply chain. Technological innovation has great potential for logistics, supply chain management and quick response systems (Zhu, Mukhopadhyay, & Kurata, 2012).

Information, communication and technologies (data communication technologies) are second category in technoloical innovation as identified by Lin (2006b) and Lin and Ho (2007). Many logistics managers see the information technology as a major source of improved productivity and competitiveness. The information technologies that are commonly used in logistics industry include electronic data interchange (EDI), the Internet, value added network (VAN), point of sales (POS), electronic ordering system (EOS), logistics information system, computer telephony integration, and enterprise information portals. EDI is identified as inter-company computer-to-computer exchange of business documents in standard formats. Most logistics firms have adopted this technology since the company often have to deal with a large number of goods and related information, they focus frequently on how to effectively process data collection and exchange(Lin & Lin, 2014; Vieira, Coelho, & Luna, 2013).

Next category in technological innovation is warehousing technologies as listed by Lin (2006b) and Lin and Ho (2007). Warehousing plays an important role in a logistical system. The design of a warehouse management system (WMS) should address physical facility characteristics and product movement. The warehousing technologies that are commonly used in logistics industry include automated storage and retrieval system (AS/RS), automatic sorting system, computer-aided picking system, and thermostat warehouse. Previous researchers concured that WMS is considered to be the tools necessary for supporting the warehouse and delivery processes in the logistics industry (Choy et al., 2014; Vijayaraman & Osyk, 2006).Transportation technologies are other category in technological innovation and one of the most visible elements of logistics operations which was identified by Lin (2006b) and Lin and Ho (2007). The transportation technologies that are commonly used in logistics industry include transportation information system (TMS), global positioning system (GPS), geographical information system (GIS), radio-frequency communication system, and transportation data recorder. The transportation information system and geographical information system can help logistics managers planning, managing and controlling transportation issues. The global positioning system, and radio-frequency communication system can track and guide drivers during the transportation of products. With regards to usage of transportation technologies such as TMS, GPS and GIS, many researchers (Marchet, Perego, & Perotti, 2009; Vieira et al., 2013) agreed that these technologies help LSPs to improve their logistics performance.

2.2 Organizational Innovation

Organizational innovation refers to an approach or method used by organizations to adapt the change conditions within their internal or external environment, competition, technology advances, by introducing newer products, techniques, and/or processes (Razavi & Attarnezhad, 2013).Wang and Ahmed (2004) defined organizational innovativeness as an organization's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behaviour and process. Indeed, innovation relates to the firm's capacity to engage and industrial managers can devise solutions to business problems and challenges, which provide the basis for the survival and success of the firm (Hult et al., 2004). Innovation in workplace organization involves the implementation of new methods for distributing responsibilities and decision-making among employees for the division of work, as well as new concepts for the structuring of activities (Camisón & Villar-López, 2014). Therefore, leaders in LSP firm should better understand the concept of organizational innovation. This will assist them to revise current plan in order to accommodate the changing environment in which they operate and increase competitiveness.

Crossan and Apaydin (2010) investigated a multi-dimensional framework of organizational innovation and proposed that organizational innovation able to promote the capability of company to be competitive in the marketplace. They also emphasized innovation capability, one of the most important determinants of firm performance. In addition, organizational innovation is an acknowledged by the logistics industry as the driver to growth, profitability, and competitive advantage in this sector especially for third party logistics (Langley, 2013). Several studies on the importance of organizational innovation for competitiveness have been conducted. These studies analyzed the impact of organizational innovations on business performance (Camisón & Villar-López, 2014; Dadfar, Dahlgaard, Brege, & Alamirhoor, 2013; Sapprasert & Clausen, 2012). One of the outcomes from the studies by those researchers were organizational innovations are presented an immediate source of competitive advantage since they themselves had a significant impact on business performance. Other researches have also agreed that organizational innovation represents one of the most important and sustainable sources of competitive advantage for firms because of its context-specific nature (Birkinshaw, Hamel, & Mol, 2008).

2.3 Logistics Performance

Performance analysis is the measurement and comparison of actual levels of achievement of specific objectives. It is used to measure the efficiency of resource allocation and the outcome of corporate objectives (Yang, 2012). In this paper, performance is measured based on the dimensions of logistics performance, which is more focus on the operational performance of LSP. Mentzer and Konrad (1991) defined logistics performance as effectiveness and efficiency in performing logistics activities. Logistics performance is associated with efficient and reliable operations, which imply overall cost efficiency and long-term customer relationships. Furthermore, high service performance enhances the bargaining power of LSPs to improve their competitive positions (Toyli, Hakkinen, Ojala, & Naula, 2008). In today's dynamic marketplace, the logistics performance of LSP is crucial as the effect of logistics performance is not only on the logistics providers but it also for their customers. In other words, if the logistics performance is fall under negative impact, stakeholders in the same supply chain may suffer with negative impacts caused by the inefficient of logistics performance (Wilding & Juriado, 2004).

Thai (2013) and Mentzer, Flint, and Kent (1999) highlighted that logistics performance as one of the important factors driving the choice of a third-party logistics providers. Therefore, logistics performance measurement plays a vital role in today's business management. Various indicators and attributes of logistics performance have been discussed in terms of different aspects or purposes. As suggested by Aramyan, Oude Lansink, van der Vorst, and van Kooten (2007) there are four categories or clusters of indicators namely efficiency (seeks to measure how resources are used), flexibility (the ability of the respond to changes in the environment and exceptional customer orders), responsiveness (what the customer wants in the shortest amount of time) and quality (represents the particular characteristics of the product supply chain). Other scholars such as Fugate, Mentzer, and Stank (2010)proposed logistics efficiency, logistics effectiveness and logistics differentiation as dimensions for logistics performance. They used logistics performance as a second-order formative construct. In their study, results indicated that logistics performance positively impacts organizational performance.

2.4 Effect of technological and organizational innovation on logistics performance

Innovation capability has been regarded as a firm's critical organizational capability to deploy resources in new ways to create value, and has been found to have a positive effect on the firms' performance. Firms need to be continuously responsive to the market demand in order to stay competitive. The reason is the expansion of liberalisation in trade and services have forced firms to consider the global market demand in their competitive strategic planning. Various research have shown that innovation considered as a source of additional revenues to the firms, help to save cost (Dilk, Gleich, Wald, & Motwani, 2008; Grawe, Chen, & Daugherty, 2009) or or improve the quality of existing process (Khazanchi, Lewis, & Boyer, 2007). According to scholars (Flint et al., 2005; Ho & Chang, 2015; Yang, Marlow, & Lu, 2009) innovation and performance in logistics industry have direct relationship. Since logistics service offerings and quality services are relatively easily imitated by competitors (Slater, 1996), the LSPs have to be more innovative in delivering services to the customers. By integrating the innovation capabilities into their logistics services activities, LSPs can create high service quality and provide better value to its customers and differentiate their performance (Panayides, 2006; Richey, Genchev, & Daugherty, 2005). Thus, innovation capability has been seen as a crucial factor in performance (Alegre & Chiva, 2008). Consequently, when LSPs engage in innovation activities such as frequently trying new ideas, seeking out new process, developing new services and trying to be more creative in their methods of operations, logistics service capability is more conducive to enhance performance in logistics firms (Yang, 2012).

A study by Camisón and Villar-López (2014) on the relationship between organizational innovation and technological innovation capabilities, at the same time they analyzed their effect on firm performance using a RBV theoretical framework. The survey of 144 Spanish industrial firms and modelling of a system analyzed using structural equations using partial least squares. The results confirm that organizational innovation favours the development of technological innovation capabilities and that both organizational innovation and technological capabilities for products and processes can lead to superior firm performance. Based on the preceding review of the literature on innovation capability, this study hypothesizes that:

H1: Technological innovation has a positive relationship on logistics performance of LSP firm.

H2: Organizational innovation has a positive relationship on logistics performance of LSP firm.

III. METHODOLOGY

In order to empirically test the proposed research model, a quantitative technique was performed using the cross-sectional data collection approach. For the purpose of this study, LSP firms from the Malaysia Logistics Directory 2013/2014 were selected to statistically test and examine logistics innovation towards logistics performance. Accordingly, self-administered questionnaires were used to collect the primary data from the target population. The research questionnaires were categorized into two sections. The first part of the questionnaires captured the information pertaining to the demographic profile of the respondents. In addition, the second section captured the information regarding the research construct relationships.

After pre-test and the pilot test, the study proceeded with the main data collection, in which 600 self-administered questionnaires were distributed among LSP firms in Malaysia of which 134 questionnaires were collected. Off data 134 questionnaires collected, only 126 were valid for further data analysis after a few steps of screening process that included missing data and straight lining screening. Therefore, a total of 126 self-administered questionnaires were used to conduct the statistical analysis for measurement and structural model using the partial least squares (PLS) path modeling approach; a structural equation modeling (SEM) technique.

IV. RESULT

4.1 Assessment of measurement model

Outer loadings, composite reliability (CR), average variance extracted (AVE = convergent validity) and discriminant validity were assessed to reflectively examine the measurement models (Hair, Hult, Ringle, & Sarstedt, 2014). As depicts in Table 1, all the outer loadings of the constructs are well above the minimum threshold value of 0.70 except for logistics performance, which there is three outer loading below 0.70. However, according to Hair et al. (2014), items with their item loading moderately between 0.5 to 0.7 can be retained as long as the AVE for latent variable are above 0.5. As shown by the CR values, all the reflective constructs have high levels of internal consistency reliability. Furthermore, the AVE values (convergent validity) are well above the minimum threshold level of 0.50 thereby demonstrating convergent validity for all constructs.

To assess discriminant validity, the Fornell and Larcker (1981) criterion was evaluated. As shows in Table 2, the off-diagonal values are the correlations between the latent constructs. The shared values between the constructs are square correlations.

Table 1: Construct Validity

Construct	Items	Outer Loading	AVE[a]	CR[b]
Technological Innovation	TI1	0.811	0.581	0.847
	TI2	0.733		
	TI3	0.780		
	TI4	0.722		
Organizational Innovation	OI1	0.818	0.623	0.868
	OI2	0.744		
	OI3	0.734		
	OI4	0.855		
Logistics Performance	LP1	0.746	0.551	0.917
	LP2	0.795		
	LP3	0.751		
	LP4	0.761		
	LP5	0.681		
	LP6	0.682		
	LP7	0.811		
	LP8	0.686		
	LP9	0.756		

[a]*Average variance extracted (AVE)=(summation of the square of the factor loadings)/{(summation of the square of the factor loadings)+(summation of the error variances)}.*

[b]*Composite reliability (CR) = (square of the summation of the factor loadings)/{(square of the summation of the factor loadings)+(square of the summation of the error variances)}.*

Table 2: Discriminant Validity-Fornell Larcker Criterion

Research Constructs	Technological Innovation	Organizational Innovation	Logistics Performance
Technological Innovation	**0.762**		
Organizational Innovation	0.607	**0.789**	
Logistics Performance	0.602	0.653	**0.746**

Note: Diagonals represent the square root of the AVE while the off-diagonals represent the correlations

4.2 Assessment of structural model

As discussed above, once the measurement model has been confirmed as reliable and valid, then, the next step is to evaluate the structural model results, which, in turn, involves examining the model's predictive capabilities and the relationships between the constructs (Hair et al., 2014). Assessing the significance and relevance of the structural model relationships was conducted by applying the PLS–SEM algorithm, which estimates the structural model relationships (the path coefficients) to demonstrate the hypothesized relationships between the constructs. In addition to assessment of the size of the path coefficients, their significance was obtained using the bootstrapping option. Table 3 shows the results of the hypothesis testing and structural relationships. It interesting to note the technological innovation (1.221) and organizational innovation (1.260) was not significant at 5% significant level.

Table 3: Result of Hypothesis Testing

Hypothesis	Relationship	Beta Value (□)	t-value	Decision
H1	TI → LP	0.062	1.221^{ns}	Not Supported
H2	OI → LP	0.074	1.260^{ns}	Not Supported

*Note: Significant level = ** p<0.01; * p<0.05; ns not significant; TI=Technological Innovation; OI=Organizational Innovation; LP=Logistics Performance*

The next step of structural model evaluation criteria analysis is the determination of R^2. The R^2 provides the percentage of variation in dependent variable explained by the independent variables (Keil et al., 2000). Another assessment of structural model is predictive relevance Q^2, which is predictive capability of the model by reproducing the observed values by the model itself and its estimating parameters (Hair et al., 2014; Lowry & Gaskin, 2014). The R^2 value for logistics performance was 0.670, which indicated that 67.0% of the variance could be explained by technological and organizational innovation. The R^2 value of 0.670 is categorized as substantial (Chin, 1998). On the other hand, by performing blindfolding procedures, the Q^2 value for logistics performance was 0.358, which considerably above zero. As the Q2 value was higher than the cut-off value set by Hair et al. (2014), the cross-validated redundancy measures show that the structural model for this study has predictive relevance.

V. DISCUSSION AND CONCLUSION

The study used PLS techniques facilitate the hypotheses testing. Besides assessing the overall research model, this study also evaluates the goodness of measure, which is assessed by looking at the validity and reliability of the measures carried out by using the PLS approach. Both of the tests have fulfilled convergent and discriminant validity required. This paper contributes to the existing literature by exploring the composition of the logistics innovation construct and investigating its impact on logistics performance. The constructs of logistics innovation weretechnological and organizational. This study shows that technological innovation has insignificant effect on logistics performance. The result contradicted and not consistent with the study by Azubuike (2013), whose concurred that source of growth and a key determinant of performance and competitive advantage in many organization should include technological innovation.Yang et al. (2009)whose identified technological innovation was one of the factors for port operators to achieve and maintain a competitive advantage, and De Martino, Errichiello, Marasco, and Morvillo (2013)emphasized that logistics players have to keep the pace with technological innovation in order to maintain and improve their market position. However, as the result shows insignificant, we failed to reject null hypothesis. This result is supported the study by Yang et al. (2009). The study was conducted in Hong Kong on technological or ICT in logistics and the result viewed that the implmentation of technological or ICT could not be on important factor to achieve logistics performance.

The result of second hypothesis is also not supported. Organizational innovation could not influencethe logistics performance of LSP firm in Malaysia. It shows that the result contradicted against the previous studies.Lee and Song (2015) emphasized that organizational would be one of key organizational objectives the firms should achieve in order to realize long-term based strategic competitiveness. Crossan and Apaydin (2010)found that organizational innovation able to promote the capability of company to achieve performance and to be competitive in the marketplace. Other scholars like Lin, Ho, and Chiang (2009) also disclosed that organizational support for innovation can give employees motivation and support to adopt new logistics technologies. Based on the above result, it is high probability most respondents are not yet ready to implement the innovation in logistics business. According to Weiner (2009), if a firm would like to make changes, firm members' beliefs, attitudes and intention to change need to be considered. Other than above mentioned factors, perception towards change, vision to change, mutual respect and trust, change initiatives, management support, acceptance, and how the organization manage the changes also need to be taken into consideration (Ab Talib & Abdul Hamid, 2014; Susanto, 2008). It seems that LSPs have less priority on seeking innovative ideas from employees, not much improving in quality system of logistics handling and remain the service route without exploring new opportunities.

The structural of the Malaysian LSPs, which is characterized by a substantial number of small and medium enterprises conducting logistics business with little encouragement on the innovation, may be a conceivable reason for conflicting result. In this study, we found that most LSPs are early adopters of technological innovation and still have a long way to go towards implementing a fully advanced logistics technology system. The use of sophisticated and advanced logistics technology such as WMS and VAN is still beyond the means of some LSP in Malaysia. The use of cutting-edge technologies such as RFID is also still scarce and reported from previous study indicated that the implementation level of RFID technology is low in most of the logistics companies (Ali, Jaafar, & Mohamad, 2008; Choy et al., 2014; Zailani, Fernando, & Zakaria, 2010). In conclusion, this study shows that at the present time, both technological and organizational innovation do not influenced on logistics performance of LSPs in Malaysia.

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