TRANSFORMATION INTO 4PL: THE CASE OF LOCAL LOGISTICS SERVICE PROVIDERS IN VIETNAM

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ABSTRACT

For a few decades, a new model of logistics service providers (LSP) has appeared and played the role of integrating all operations of the supply chain. This model is known as a logistics integrator, or fourth party logistics (4PL). 4PL has emerged as an ideal configuration for enterprises around the world to effectively utilize their resources and obtain cost reduction across the supply chain. With increasing competition among enterprises, customers' requirements for complicated services, and global supply chain management, the limitations of inbound services from LSPs have become obstacles to their development. As a result, transformation into 4PL is inevitable for LSPs in the global logistics market. This paper aims to analyze the role, characteristics, and benefits of 4PL. A model for transformation into 4PL for local LSPs in Vietnam is constructed to identify impacting factors. The results point out six factors influencing the transformation process, as well as three important capabilities of 4PL.

Keywords: logistics; fourth party logistics; transformation; logistics service providers; supply chain

DOI: http://dx.doi.org/10.15549/jeecar.v10i2.1018

INTRODUCTION

In the late 1900s and early 2000s, there have been dramatic changes in the logistics field which have been considered to be vital to the improvement of firm productivity. These changes consist of the growth of Third Party Logistics (3PL), the emergence of Fourth Party Logistics (4PL), more complicated partnerships, the increase of multimodal transportation of goods, the decrease of logistics costs, and value chain creation (Li *et al.*, 2003). Markets have, nowadays, become highly competitive and turbulent, and are constantly changing. The logistics industry has undergone a deep transformation for over three decades, due to the pressure of ever-increasing expectations and demands from customers.

Firstly, logistics service providers (LSPs) usually intend to hold up their services and sustainably operate as logistics solution providers. In the long run, however, the tendency of the market creates and motivates more chances for logistics enterprises to run as 4PLS with large projects through integrated and coordinated operations (Lieb, 2005). LSPs have therefore been changing their operations and

strategy to become logistics integrators. Secondly, Bienstock (2002) pointed out that LSPs' strategic thoughts concerning external information flows are useful to help them retain their places and foster relationships with their customers. According to Cherneva *et al.* (2015), the business world is significantly impacted by LSPs' development, making it essential for enterprises, management professionals, and researchers to recognize 4PL's opportunities and challenges. Thirdly, considering LSPs as natural candidates for merging their operations to a 4PL, Visser *et al.* (2004) and Hoek (2006) affirmed that the transformation must be started with comprehensive strategies. Furthermore, grasping the importance of logistics performance, which directly affects customers' evaluation of logistics service providers, is crucial. Finally, supply chain management is considered one of the core elements of successful 4PL. As first mentioned by Oliver and Webber (1982), supply chain management aims to create value for customers through multi-enterprise integration and efficient, cost-effective management of flows.

In this empirical research, the factors influencing the transformation into 4PL of local LSPs in Vietnam are investigated. First, a literature review on various definitions of 4PL and constructs in the model was conducted. Then, the PLS-SEM model is applied to identify the constructs affecting local LSPs' strategic transformation into 4PL. The findings drawn from the study have considerable implications for both academic and practical fields alike.

LITERATURE REVIEW

Fourth Party Logistics (4PL)

4PL has been definied variously by researchers in different studies. The term 4PL itself was introduced and owned by Accenture Consulting Company (Dollet and Diaz, 2011). Their definition of 4PL is stated as "an integrator that assembles the resources, capabilities, and technology of its organization and other organizations to design, build and run comprehensive supply chain solutions." Manufacturers and retailers gain remarkable benefits thanks to 4PL's effective coordination between LSPs and their clients by managing the overall logistics activities. In the late 1990s, Gattorna mentioned the 4PL concept, which was recognized as a combination of various resources, specific capabilities, and technological utilization to assemble and manage comprehensive supply chain solutions. Yao (2010) concluded that 4PL commendably operates an effective, flexible, and reasonable integration of supply chain activities. Papadopoulou *et al.* (2013) discussed 4PL as an LSP that creates increasing evolution within the supply chain and focuses on innovation attributes. Pavlic Skender *et al.* (2013) mentioned 4PL as a joint venture between customers and LSPs.

There have been many other researchers who have focused on 4PL and its transformation to adapt to the new, challenging logistics market demand, including Li *et al.* (2003), Visser *et al.* (2004), Gattorna *et al.* (2004), the Supply Chain Executive Board (2005), Hoek (2006), Vivaldini *et al.* (2008), Win (2008), Ji (2008), and Bajec (2009). 4PL operates with the aim of efficiently utilizing all resources, together with the application of information technology (IT) to simultaneously decrease the firm's backwardness and increase benefits for all connected parties. As such, 4PL creates a competitive advantage in the global logistics market, offering dominant effectiveness in its service provision to clients. Moreover, later studies asserted the importance and preeminent characteristics of 4PL in the role of an effective and flexible integrator throughout the network (Jianming, 2011; Papadopoulou *et al.*, 2013).

Transformation into 4PL

In recent years, logistics has been considered a key element by manufacturing and retailing firms to develop systems within their supply chains (Rafele, 2004). LSPs aim to continually provide logistics services and develop into a solution provider; however, logistics transactions in the market have led to a newer tendency for delivered projects to be larger and more complicated. As a result, LSPs have faced a challenge in their operations (Lieb, 2005). There are even higher expectations on the part of customers for the expertized services LSPs provide as they continue to be more professional in all operations. To keep up with survival and development, strategic logistics solutions should be seriously considered from the point of principles and advantages of all resources (Bienstock, 2002). According to Govindan *et al.* (2016), 4PLs have high capabilities in optimizing

the network and utilizing multi-resources. Moreover, 4PLs effectively implement their role in integrating firms participating in the supply chain, resulting in companies coordinating with 4PL as a strategic partner. Visser *et al.* (2004) analyzed the transformation process into 4PL and suggested that LSPs are well prepared for such transitions. Hoek (2006) highlighted several advantages in the transition from LSP to 4PL, as follows:

- Enhancing added value services and rejecting low profitable operations.
- Enriching relationships with customers and involving efforts in customers' supply chains.
- Serving clients' expectations and demands based on high utilization of information systems, but low dependence on owned physical assets.

METHODOLOGY

Research data

In this section, we use statistical data from a data collection survey of 414 LSPs in the logistics industry in Vietnam, as stated in Table I. To ensure the reliability and validity of the measurement index, the authors use the reliability analyses of Cronbach's Alpha and Average Variance Extracted (AVE) using SmartPLS 4 to eliminate variables uninterpretable to the research concept.

Table I: Category of survey respondents

Field of logistics operations	Quantity (firms)	Percentage (%)
Transportation, forwarding, and warehousing	90	21.74
Transportation and warehousing	81	19.56
Transportation and forwarding	62	14.98
Transportation	60	14.49
Third-Party Logistics providers (3PL)	55	13.29
Forwarding and warehousing	43	10.39
Forwarding	09	2.17
Transportation, forwarding, and shipping agency	09	2.17
Forwarding and shipping agency	05	1.21

Source: Authors' calculations

Sample size

The Structural Equation Model (SEM) is used to analyze the relationships between transformation into 4PL and transportation capability, warehouse operations, information technology (IT) application, human resources, logistics services, transportation infrastructure, logistics outsourcing trends, competition in the logistics market, and policies in the logistics industry. This method requires a large number of samples due to its dependence on sample distribution theory (Raykov and Widaman, 1995). However, Hair *et al.* (1998) affirmed that there are three types of the sample size used in SEM, including small size ≤ 100, medium size 100 – 200, and large size ≥ 200. The sample size of this study is 414, therefore, it meets the sample size requirement for the research.

Research gap

The number of 4PL service providers is constantly increasing around the world. There have been many research studies conducted separately on 4PL's role and model, analysis and comparison between 3PL and 4PL, suggestions for the transition from 3PL to 4PL, and model for conflict resolutions on 4PL development.

For the logistics industry in Vietnam, there has only been research conducted on strategic development into 3PL for local private logistics companies in Vietnam. Other studies have mainly focused on the potential and prospects of the logistics industry in Vietnam, including studies on the supply chain and logistics of Vietnam in the context of international economic integration, assessing the National logistics system of Vietnam, sustainable development of logistics in Vietnam in the 2020-2025 period, human resource management of logistics in

Vietnam, and using the optimization algorithm to evaluate and predict the business performance of logistics companies. Nevertheless, there has not been any research on the transformation from LSP to 4PL, especially in the context of local LSPs in Vietnam.

Research hypotheses

H1: High transportation capability fosters local LSPs' strategic transformation into 4PL in Vietnam.

One of the key elements of logistics service is the transportation capability of LSPs. Park (2011) pointed out that the main elements of competitiveness between companies include human resources, transportation capability, finance, database, and assets. Transportation planning provides the opportunity for firms to maximize cost-effectiveness when it efficiently integrates collaborative partners (Mason *et al.*, 2007). Logistics operations could provide high-quality services when LSPs have advanced transportation systems. Due to the remarkable significance of transportation, the evaluation of the efficiency of transportation modes have been conducted by many scholars, including Smith and Nash (2014), Mandic *et al.*, (2014), Chakhtoura and Pojani (2016), Rodseth (2017), and Cui and Li (2017a, 2017b, 2017c).

H2: Effective warehouse operations have a positive influence on local LSPs' strategic transformation into 4PL in Vietnam.

Warehouse operations are vital in logistics services since warehouse processes perform activities in the supply chain, including material storage, material division, packaging, gathering, and allocating. The study of Kłodawski *et al.* (2017) showed a literature review on various stochastic models for analyzing warehouse operations and relevant warehouse strategies through research conducted by Le-Duc and Koster (2005). Kłodawski *et al.* (2017) pointed out that continuous and proper warehouse operations are very important for significantly impacting the whole supply chain.

H3: The absolute level of advanced IT application has a positive impact on local LSPs strategic transformation into 4PL in Vietnam.

Scholars (Sabherwal and Jeyaraj, 2015; Chaysin *et al.*, 2016) have also highlighted the role and usefulness of IT applications in distribution, especially where they aim at cost-effectiveness, service quality, and small stock. Studies executed by many scholars, including Pinna *et al.* (2010), Evangelista *et al.* (2012), Ghobakhloo and Hong (2014), and Wong *et al.* (2016), pointed out the enhancement of logistics performance based on IT utilization. According to Sauvage (2003), IT investment would lead large LSPs to achieve superior advantages and become leaders in the global logistics market.

H4: High-qualified human resources create a positive influence on local LSPs' strategic transformation into 4PL in Vietnam.

A skilled workforce is essential for running a stable and complicated logistics system. Benefits gained from human resource performance including recruiting, training, and assessment, all of which help firms improve the effectiveness of the whole supply chain and enhance competitive advantages (Hall *et al.*, 2013). Okeudo (2012), through data collected from LSPs, concluded that LSPs will improve their performance if there is an increase in investment in human resources. Kam *et al.* (2010) studied the relationship between human performance and logistics capabilities and pointed out that benefits and performance management mechanisms increase the commitment and capabilities to LSPs.

H5: Advanced logistics services have a positive impact on local LSPs' strategic transformation into 4PL in Vietnam.

Mangan *et al.* (2008) stated that "Logistics involves getting, in the right way, the right product, in the right quantity and right quality, in the right place at the right time, for the right customer at the right cost." In line with this concept, logistics services consist of five main components: IT, stock, transportation, warehousing, and packaging. These activities start with suppliers and end with customers. Logistics services are designed by LSPs to ensure that clients are served with the lowest costs and highest efficiency (Badenhorst-Weiss & Waugh, 2014). Offers in logistics services that are delivered by LSPs have improved to the point of advanced service provision with complex value-added transport and warehousing activities (Selviaridis and Spring, 2007).

H6: Good transportation infrastructure fosters local LSPs' strategic transformation into 4PL in Vietnam.

Fechner (2011) stated that transportation infrastructure, consisting of land, harbor, and

airway systems, as well as information and communication technology (ICT), have high significance in the logistics service industry. The linear logistics infrastructure of nodes in transportation effectively supports LSPs in providing logistics activities, including packaging, warehousing, delivery, and transshipment. Logistics performance, cost-effectiveness, and quality assurance would be enhanced when there is a well-invested transportation system, creating a remarkable advantage for LSPs not only in operation efficiency, but also in their position in the logistics network.

H7: The growth of the logistics outsourcing trend creates a positive impact on local LSPs' strategic transformation into 4PL in Vietnam.

The growth of logistics outsourcing has affirmed a powerful trend in the global market. Solakiv *et al.* (2013) pointed out that financial savings, resourcefulness, and comprehensive operations are core factors for companies in using logistics outsourcing. Outsourcing is considered one of the vital strategies for an enterprise's business to take advantage of outside resources for non-core activities and to focus on strategic functions for long-term development. Other scholars have stated that logistics outsourcing creates chances for enterprises to achieve their aims, such as cost-effectiveness, production enhancement, resourcefulness, and business growth (Aimi, 2007; Bardhan et al., 2006; Lau and Zhang, 2006).

H8: The increase of competition in the logistics market causes a positive influence on local LSPs' strategic transformation into 4PL in Vietnam.

Recently, LSPs, under the requirements of economic globalization, have focused on enhancing their capabilities in order to gain their clients' satisfaction. The survival and growth of LSPs depend on the successful utilization of their capabilities and core resources (Lu & C.S, 2007). As a result, the establishment of a development strategy has been recognized to be significant to LSPs in an increasingly competitive market. According to the 2017 report on logistics in Vietnam, issued by The Ministry of Industry and Trade of the Socialist Republic of Vietnam, competition in the global logistics market has become more fierce. Large logistics service providers throughout the world hold around 15% of the global logistics market share.

H9: Completed government policies in the logistics industry create positive stimulation to local LSPs' strategic transformation into 4PL in Vietnam.

The mechanism and policies for logistics industry development have a vital significance for LSPs. According to research conducted by Jin (2012) and Liu *et al.* (2013), there are two levels of development policies for the logistics industry, consisting of nation and region. National logistics policies are issued to encourage the development of the macroeconomy, while regional logistics policies mainly focus on the specific characteristics of different regions.

Scales of measurement

In the present study, scales of measurement are established for 10 constructs, with a total of 31 indicators. All indicators are measured on a five-point Likert scale (1 = Very high, 2 = High, 3 = Medium, 4 = Low, 5 = Very low). The specific constructs and indicators are as follows:

Table 2: Research constructs and indicators

Constructs	Indicators
Transportation capability (TRA)	TRA1: Owned means of transportation
	TRA2: Speed of transportation nationally and internationally
	TRA3: Connection of transportation chain and logistics services
Warehouse operations (WOP)	WOP1: Scale of owned warehouse
	WOP2: Technology application
	WOP3: Rate of errors
	WOP4: Cross-docking utilization
Advanced IT application (ITA)	ITA1: Highly qualified IT human resources

Table 2: Continued

Constructs	Indicators
	ITA2: Advanced IT infrastructure
	ITA3: Strong partnering relationship between IT and logistics service management
Human resources (HMR)	HMR1: Specialized competence
	HMR2: Planning and controlling capability
	HMR3: Learning and integrating competence
Logistics services (LOS)	LOS1: Provision of diversification and strategy customization of logistics services
	LOS2: Provision of value-added services to customers
	LOS3: Logistics service costs
Transportation infrastructure (INF)	INF1: Airport infrastructure
	INF2: Harbour infrastructure
	INF3: Land infrastructure
The growth of logistics outsourcing trend (OUT)	OUT1: Trend of logistics outsourcing
	OUT2: Size of an organization adopting logistics outsourcing
	OUT3: Levels of logistics outsourcing
Competition in the logistics industry (COM)	COM1: Number of rivals who are LSPs in the logistics market
	COM2: Market share of LSPs in the logistics market
	COM3: Types of rivals' logistics service provision: 2PL, 3PL, 4PL
Policies in the logistics industry (POL)	POL1: Policies in the logistics industry
	POL2: Supported policies for LSPs
	POL3: Directions and strategies of government for the development of the logistics industry
Transformation into 4PL (4PL)	4PL1: Value chain creation
	4PL2: Integration of multiple 3PL providers' activities
	4PL3: Management competence in global supply chain

Source: Authors' study

RESULTS AND DISCUSSION

First, the reliability of the research model was assessed. Known as the coefficient determination, the R-Squared formula defines the degree to which the variance in the dependent variable can be explained by independent variables. From the results of bootstrapping, the R-Square of the model is 0.644, and the R-Square Adjusted is 0.636 (as shown in Figure 1). This means that 63,6% of the variation in the dependent variable (4PL) is explained by independent variables (TRA, ITA, HRM, LOS, COM, OUT, WOP, INF, and POL). With this result, the reliability of the research model is demonstrated.

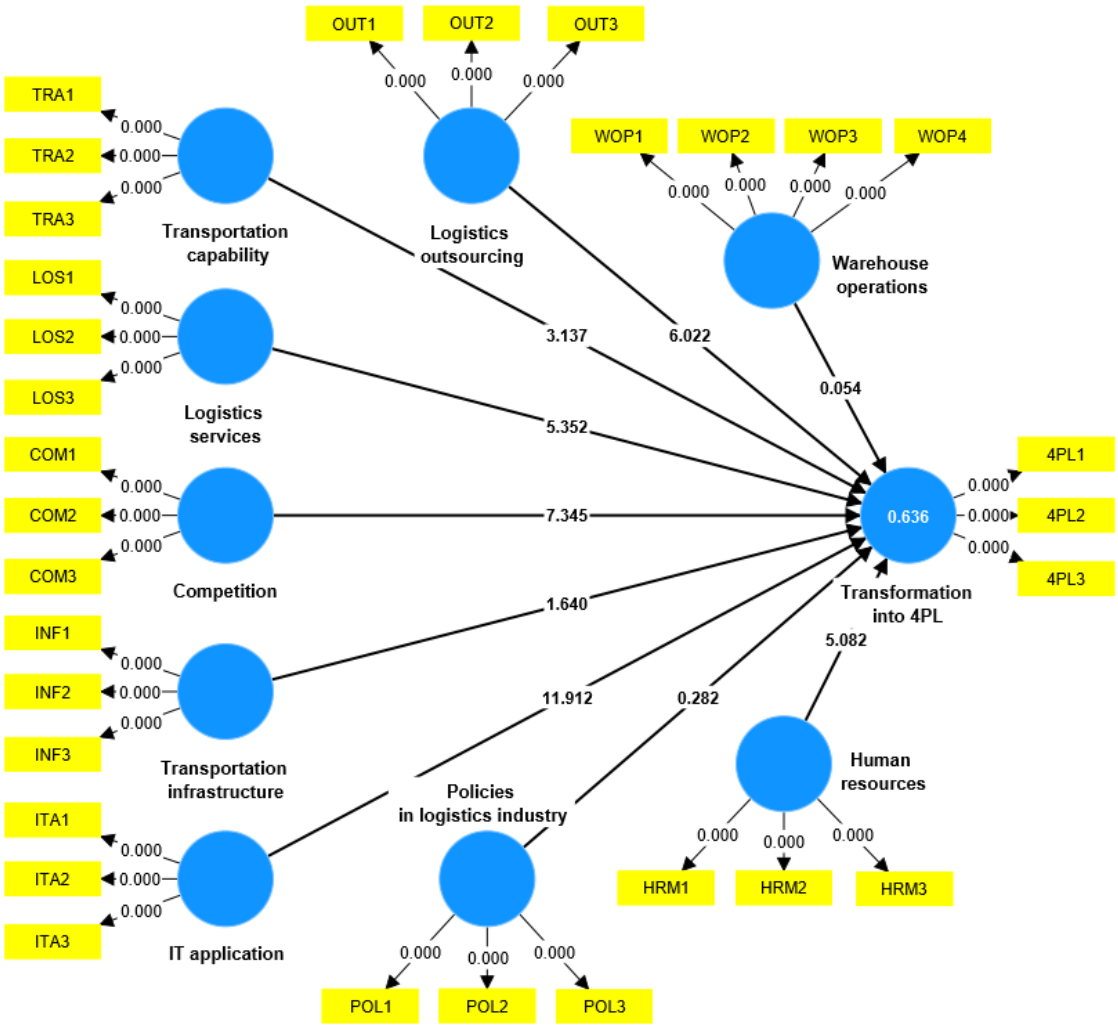

Figure 1: Model of transformation into 4PL

Source: Author's estimations from SmartPLS

Based on the recommendations of PLS-SEM theory and the literature of Hair et al. (2017), the constructs' reliability levels are evaluated using Dijkstra-Henseler's rho, along with Cronbach's alpha, coefficients. As shown in Table III, all values exceed the threshold of 0.5 and indicate strong coefficients of the construct's reliability, as suggested by Bagozzi & Yi (1998) and Hair et al. (2019).

Table 3: Construct Reliability and Validity

Construct	Cronbach's alpha(α)	Dijkstra-Henseler's rho_A	Composite Reliability	Average variance extracted (AVE)
COM	0,886	0,891	0,930	0,816
HRM	0,878	0,887	0,925	0,806
ITA	0,896	0,909	0,936	0,829
OUT	0,713	0,717	0,839	0,634
LOS	0,894	0,912	0,934	0,825
POL	0,872	0,891	0,921	0,795
4PL	0,767	0,768	0,866	0,683
TRA	0,715	0,805	0,847	0,662
INF	0,864	0,875	0,916	0,785
WOP	0,907	0,920	0,935	0,783

Source: Author's estimations from SmartPLS

The Standardized Root Mean Square Residual (SRMR) value was also considered in order to measure the appropriate level of the model for the research context. According to Hu and Bentler (1999), the SRMR value must be lower than 0.08 or 0.1. Moreover, Henseler *et al.* (2014) also affirmed that the SRMR value determines "goodness of fit" in PLS-SEM. This value is measured to avoid model misspecification. Table IV shows the SRMR value of the research model as 0.049, again demonstrating the appropriateness of the model.

Table 4: Standardized Root Mean Square Residual (SRMR)

	Original sample (O)	Sample mean (M)	95%	99%
Saturated Model	0.049	0.034	0.037	0.038
Estimated Model	0.049	0.034	0.037	0.038

Source: Author's estimations from SmartPLS

Regarding indicator loadings of latent constructs, the reliability of indicators must gain outer loadings higher or equal to the threshold of 0.5 to meet the standard of reliability, while composite reliability must be higher or equal to 0.7 (Hulland, 1999). All items in the model are loaded meaningfully and satisfactorily to their corresponding constructs. Values are presented in Table 5.

Convergent Validity is used to evaluate the stability of scales. Fornell and Larcker (1981) pointed out that Average Variance Extracted (AVE) must be higher or equal to 0.5 to indicate satisfactory convergent validity. The constructs in the study have minimum to maximum values from 0.634 to 0.829. Therefore, these values are satisfactory. The details are stated in Table 5.

Table 5: Indicators' Outer Loadings, Constructs' Composite Reliability, and Average Variance Extracted (AVE)

Construct	Indicator	Outer Loadings	Composite Reliability	Average Variance Extracted (AVE)
4PL	4PL1	0.801	0.866	0.683
	4PL2	0.833		
	4PL3	0.843		
COM	COM1	0.953	0.930	0.816
	COM2	0.871		
	COM3	0.884		
HRM	HMR1	0.950	0.925	0.806
	HMR2	0.861		
	HMR3	0.879		
INF	INF1	0.865	0.916	0.785
	INF2	0.909		
	INF3	0.884		
ITA	ITA1	0.958	0.936	0.829
	ITA2	0.883		
	ITA3	0.889		
LOS	LOS1	0.960	0.934	0.825
	LOS2	0.870		
	LOS3	0.893		
OUT	OUT1	0.799	0.839	0.634
	OUT2	0.826		
	OUT3	0.763		
POL	POL1	0.857	0.921	0.795
	POL2	0.926		
	POL3	0.891		
TRA	TRA1	0.929	0.847	0.662
	TRA2	0.511		
	TRA3	0.928		
WOP	WOP1	0.940	0.935	0.783
	WOP2	0.857		
	WOP3	0.850		
	WOP4	0.890		

Source: Author's estimations from SmartPLS

A Discriminant Validity assessment aims to ensure that a reflective construct has the strongest relationships with its indicators in the PLS path model (Hair et at., 2017), wherein the square root of AVE must be higher than the Latent Variable Correlations. The square roots of the AVE of the research constructs are shown in bold diagonals in Table 6.

Table 6: Discriminant Validity

Construct	COM		HMR	ITA	OUT	LOS	POL	4PL	TRA	INF	WOP
COM	**0.903**										
INF	0.110		**0.886**								
POL	0.124		0.219	**0.892**							
OUT	0.177		0.130	0.111	**0.796**						
LOS	0.074		0.282	0.201	0.114	**0.908**					
ITA	0.152		0.283	0.271	0.206	0.311	**0.911**				
4PL	0.421		0.332	0.275	0.426	0.444	0.600	**0.826**			
TRA	0.184		0.362	0.268	0.206	0.410	0.324	0.460	**0.814**		
HMR	0.233		0.072	0.233	0.242	0.052	0.106	0.340	0.115	**0.898**	
WOP	0.194		0.371	0.249	0.169	0.385	0.262	0.381	0.538	0.204	**0.885**

Source: Author's estimations from SmartPLS

To evaluate whether there are relationships between constructs, the Structural Equation Model is used. When the t-value is higher than 1.96, it means that the significant level is lower than 5% (p-value < 0.05). Outer Weights are criteria showing the relative contribution of each indicator. In the Structural Equation Model (SEM), Outer Weights are often lower than Outer Loadings (Hair et al., 2014). To evaluate whether indicators contribute to the establishment of latent variables, bootstrapping should be used. In this study, the software SmartPLS 4 was used to build a Structural Equation Model with 5,000 bootstrap samples.

After completing the establishment of the research model, implementing the assessment of the model is essential. There are various ways to evaluate the reliability of the research model. First, the sample may be divided into two sub-samples, with one used for building the research model and the remaining used to reevaluate the reliability of that research model. The reliability of the model may also be assessed by collecting more samples.

Anderson and Gerbing (1988), however, stated that SEM requires a large number of samples and consumes exorbitant time and costs for researchers. Schumaker and Lomax (2016) then assumed that bootstrapping is appropriate to apply due to its repeated sample method, while the initial samples remain to be major parts. The bootstrapping method uses the obtained sample data from the study to resample it various times to create many simulated samples. The sampling distributions are considered the foundation for confidence intervals and hypothesis testing, with the t-value calculated based on the distributions of created samples.

Table 7: Path Coefficient and Construct Relationships

Effect	Bootstrapping results					Empirical remarks
	Original Coefficient	Mean value	Standard deviation	t-value	p-value	
COM -> 4PL	0,244	0,245	0,033	7,345	0,000	**Supported**
HRM -> 4PL	0,165	0,165	0,032	5,082	0,000	**Supported**
ITA -> 4PL	0,384	0,383	0,032	11,912	0,000	**Supported**
OUT -> 4PL	0,208	0,209	0,035	6,022	0,000	**Supported**
LOS -> 4PL	0,208	0,208	0,039	5,352	0,000	**Supported**
TRA -> 4PL	0,127	0,127	0,040	3,137	0,002	**Supported**
POL -> 4PL	-0,009	-0,008	0,031	0,282	0,778	Not supported
INF -> 4PL	0,056	0,056	0,034	1,640	0,101	Not supported
WOP -> 4PL	-0,002	-0,002	0,038	0,054	0,957	Not supported

After establishing the evaluation of the model, structural equation modeling is used to test the hypotheses. The evidence from the analysis seen in Table VII shows that six constructs have positive effects on transformation into 4PL (4PL), including competition in the logistics industry (COM), human resources (HRM), IT application (ITA), logistics outsourcing (OUT), logistics services (LOS), and transportation capability (TRA). ITA has the strongest impact, while TRA has the weaknest influence on 4PL. On the other hand, policies in logistics industry (POL), transportation infrastructure (INF), and warehouse operations (WOP) negatively impact transformation into 4PL (4PL) due to their p-values, equal to 0,778; 0,101; and 0,957; respectively. From these results, hypotheses 1, 3, 4, 5, 7, and 8 are supported and hypotheses 2, 6, and 9 are not supported. After eliminating WOP, POL, and INF from the model, structural equation modeling is assessed again to affirm the results of the research. Although previous studies have demonstrated the importance and role of warehouse operations, transportation infrastructure, and policies in the logistics industry to the transformation into 4PL, they are not significant in the context of local LSPs in Vietnam. Finally, the findings explain the influence of determinants, including ITA, LOS, OUT, TRA, HRM, and COM, on transformation into 4PL.

CONCLUSION AND IMPLICATIONS

4PL has become more and more important to manufacturing and trading firms around the world due to its dominant benefits. It provides more advanced services than traditional logistics providers through the integration of resources (Remko and Ian, 2001; Xiu *et al.*, 2003; Feng and Juan, 2005). The current study constructed a model for transformation into 4PL for local LSPs in Vietnam, with nine independent variables. The results of the research show positive relationships and effects of identified constructs including ITA, HRM, COM, OUT, LOS, and TRA. These factors play a vital role in the process of development and growth of LSPs, and the logistics industry as a whole. The factor WOP is not significant in the model due to 4PL's attributes, previously stated as integrating the resources of network partners to provide strategic services. For POL and INF, these are core elements in the government's dominant strategies for dramatic and sustainable development in the logistics industry. Therefore, local LSPs in Vietnam are granted favorable policies and infrastructure for their growth. Moreover, three key indicators of transformation into 4PL evaluated in the research highlight the superiority of logistics service provision (Gattorna, 1998; Hoek, 2006). Overall, the results of hypothesis testing with standardized path coefficients and p-values are appropriate. The transformation is substantial and inevitable for LSPs to adapt to global economic growth and the rapid development of e-commerce in Industry 4.0 (Visser *et al.*, 2004; Hoek, 2006).

In order to facilitate LSPs to successfully transform into 4PL, this study suggests that LSPs in Vietnam identify appropriate strategies based on key elements of 4PL. The results of the analysis in the research model show that 4PL's capabilities are identified, including value chain creation, integration of multiple 3PL providers' activities, and management of global supply chain. LSPs should be aware of the importance of these capabilities so as to maintain their positions in the logistics market in Vietnam, as well as to expand their operations to the global market. Strategies for enhancing the effectiveness of these capabilities are significant in qualifying logistic services and gaining customers' satisfaction.

Research implications

This study will be helpful for Vietnamese LSPs' managers and practitioners to enhance their capabilities for strategic transformation into 4PL. Through the utility of their resources and the integration of those of others, LSPs can gain a competitive advantage in the ever-growing global logistics market. The logistics industry in Vietnam has high potential for growth and benefit thanks to its favorable strategic position in the Asian region. If local logistics enterprises optimize their logistics services, they will create value for their clients with effective costs. In this case, local LSPs perform their role by combining process, technology, and management to provide breakthrough solutions and maximum benefits to customers (Gattorna J., 1998; Mukhopadhyay, 2006).

Based on this study's findings, there are six constructs that impact local Vietnamese LSPs' strategic transformation into 4PL, including transportation capability, IT application, human

resources, logistics services, logistics outsourcing trends, and competition in the logistics industry. Specifically, the study suggests that these factors play a key role in the establishment of LSPs' development processes and should be recognized for sustainable competitive advantage. The changes in the logistics service market throughout the world currently influences the scale and role of LSPs in providing operations and coordination. Information technology application, which has the strongest influence, acts as a significant tool for ensuring the provider network when combined with driving forces (Amblar, 2016).

LIMITATIONS AND FURTHER RESEARCH

The research points out determinants impacting local Vietnamese LSPs' transformation into 4PL, based on data collected from a survey of 414 LSPs in Vietnam. The respondents consisted of a variety of combinations of 3PL agencies: forwarding and shipping ; forwarding; transportation, forwarding, and warehousing; forwarding and warehousing; transportation and forwarding; transportation and warehousing; transportation; and transportation, forwarding, and shipping. The data focused only on enterprises that performed their operations in the logistics industry. Further empirical research should consider the scale of local LSPs, which might affect how constructs impact transformation into 4PL. Such factors may act significant differently with regard to their effect on LSPs at variant sizes. As such, the type of operations and size of LSPs should be noted when selecting respondents for a survey to collect data for the model.

Another limitation of this study is that the findings only explain 63.6% of the variation of transformation into 4PL. The six constructs that have direct and positive impacts, including ITA, LOS, OUT, COM, TRA, and HRM could interpret up to 63.6% of the research. In reality, there may be other factors influencing local LSPs' transformation into 4PL, but were not assessed in this study due to the limitation of respondents. Further research should enlarge the survey scale to more widely perform the assessment.

ACKNOWLEDGEMENT

The authors are thankful to the Internal Grant Agency of FaME UTB in Zlín no. IGA/FaME/2022/006 – *Economic research in the context of the Southeast Asia* for financial support to carry out this research.

REFERENCES

Aimi, G. (2007). Logistics outsourcing: what it takes to succeed. *Supply Chain Management Review*, 11(8), 13.

Anderson J. C., Gerbing, D. W. (1998). Structural Equation Modeling in Practice: A Review and Recommended Two-Step Approach. *Psychological Bulletin*, 103(3), 411-423. https://doi.org/10.1037/0033-2909.103.3.411

Badenhorst-Weiss, J. A., & Waugh, B. J. (2014). Business environmental factors affecting South Africa's supply chains and economic growth and development. *Problems and Perspectives in Management*, 12(4), 238-291.

Bagozzi RP, Edwards JR. (1998). A General Approach for Representing Constructs in Organizational Research. *Organizational Research Methods*, 1(1), 45-87. https://doi.org/10.1177/109442819800100104

Bajec, P. (2012). Evolution of Traditional Outsourcing into Innovative Intelligent Outsourcing-Smartsourcing. *Promet-Traffic & Transportation*, 21(2), 93-101. https://doi.org/10.7307/ptt.v21i2.215

Bardhan, I., Whitaker, J., & Mithas, S. (2006). Information technology, production process outsourcing, and manufacturing plant performance. *Journal of Management Information Systems*, 23(2), 13-40. https://doi.org/10.2753/mis0742-1222230202

Bienstock C. (2002). Understanding Buyer Information Acquisition for the Purchase of Logistics Services. *International Journal of Physical Distribution & Logistics Management*, 32(8), 636-648. https://doi.org/10.1108/09600030210444890

Chakhtoura, C., Pojani, D. (2016). Indicator-based evaluation of sustainable transport plans: A framework for Paris and other large cities.

Transport Policy, 50, 15-28. https://doi.org/10.1016/j.tranpol.2016.05.014

Chaysin, P., Daengdej, J., Tangjitprom, N. (2016). Survey on available methods to evaluate IT investment. *Electronic Journal of Information System Evaluation*, 19(1), 71-82.

Cherneva, D., Voigir, K.-I. (2015). Outsourcing to 4PLs – Opportunities, Challenges, Future Outlook. *Innovations and Strategies for Logistics and Supply Chains: Technologies, Business Models and Risk Management. Proceedings of the Hamburg International Conference of Logistics (HICL), Vol. 20* (pp. 231-255). Berlin: epubli GmbH.

Cui, Q., Li, Y. (2017a). Airline efficiency measures under CNG2020 strategy: an application of a dynamic by-production model. *Transport Research Part A: Policy and Practice*, 106, 130–143. https://doi.org/10.1016/j.tra.2017.09.006

Cui, Q., Li, Y. (2017b). Airline efficiency measures using a dynamic epsilon-based measure model. *Transport Research Part A: Policy and Practice*. 100, 121–134. https://doi.org/10.1016/j.tra.2017.04.013

Cui, Q., Li, Y. (2017c). Will airline efficiency be affected by "Carbon Neutral Growth from 2020" strategy? Evidences from 29 international airlines. *Journal of Cleaner Production*, 164, 1289–1300. https://doi.org/10.1016/j.jclepro.2017.07.059

Dollet J. N., Diaz A. (2011). Supply chain orchestration for the luxury alcoholic beverage sector. IUP Journal of Supply Chain Management, 8(3).

Evangelista, P., Mogre, R., Perego, A., Raspagliesi, A., & Sweeney, E. (2012). A survey based analysis of IT adoption and 3PLs' performance. *Supply Chain Management: An International Journal*, 17(2), 172-186. https://doi.org/10.1108/13598541211212906

Fechner, I. (2011). Location conditionings of logistics centers as central units of national logistics network. *Logistics and Transport*, 12, pp. 23-32.

Fornell C., Larcker D.F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marking Research*, 18(1), 39–50. https://doi.org/10.1177/002224378101800104

Gattorna, J., Ogulin, R., & Selen, W. (2004, June). An empirical investigation of 3rd-and 4th-party logistics provider practices in Australia. *In 3rd ANZAM Operations Management Symposium*, (pp. 17-18).

Ghobakhloo, M., & Hong, T. S. (2014). IT investments and business performance improvement: the mediating role of lean manufacturing implementation. *International Journal of Production Research*, 52(18), 5367-5384. https://doi.org/10.1080/00207543.2014.906761

Govindan, K., Khodaverdi, R. and Vafadarnikjoo, A. (2016). A grey DEMATEL approach to develop third-party logistics provider selection criteria. *Industrial Management & Data Systems*, 116(4), 690-722. https://doi.org/10.1108/imds-05-2015-0180

Hair, J.F., Anderson, R.E., Tatham, R.L. and Black, C.B. (1995), Multivariate Data Analysis with Readings. *New York NY: PrenticeHall*.

Hair, J. F., Hult, G. T. M., Ringle, C. M., and Sarstedt, M. (2013). A Primer on Partial Least Squares Structural Equation Modeling (PLS-SEM). *European Journal of Tourism Research*, 6(2), 211-213. https://doi.org/10.54055/ejtr.v6i2.134

Hair, J.F., Hult, G.T.M., Ringle, C.M. (2017). Mirror, mirror on the wall: a comparative evaluation of composite-based structural equation modeling methods. *Journal of the Academy of Marketing Science*, 45, 616–632. https://doi.org/10.1007/s11747-017-0517-x

Hair, J.F., Risher, J.J., Sarstedt, M. and Ringle, C.M. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2-24. https://doi.org/10.1108/ebr-11-2018-0203

Hall, M., Hall, C., Rigsbee, C. (2013). Strategic human resource management and supply chain orientation. *Human Resource Management Review*, 23(4), 366–377. https://doi.org/10.1016/j.hrmr.2012.07.002

Henseler, J., Dijkstra, T. K., Sarstedt, M., Ringle, C. M., Diamantopoulos, A., Straub, D. W., ... & Calantone, R. J. (2014). Common beliefs and reality about PLS: Comments on Rönkkö and

Evermann (2013). *Organizational Research Methods*, 17(2), 182-209. https://doi.org/10.1177/1094428114526928

Hoek, R. I. (2006). Forward. *International Journal of Physical Distribution and Logistics Management*, 36(6). https://doi.org/10.1108/ijpdlm.2006.00536faa.001

Hu, L.T. and Bentler, P.M. (1999). Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives. *Structural Equation Modeling*, 6(1), 1-55. https://doi.org/10.1080/10705519909540118

Hulland J. (1999). Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies. *Strategic Management Journal*, 20, 195-224. https://doi.org/10.1002/(sici)1097-0266(199902)20:2<195::aid-smj13>3.0.co;2-7

Ji, G. (2008). Closed-loop Supply Chain Systems Constructed by 4PL and Performance Evaluation by Using Exergoeconomics*. *Journal of Systems Science & Information*, 6(2).

Jianming, Y. (2011). Optimization of Supply Chain Resource Integration under 4PL by Introducing Integration Risk [J]. *Chinese Journal of Management*, 8.

Jin, T., Tian, Y. (2012). Optimizing reliability and service parts logistics for a time-varying installed base. *European Journal of Operational Research*, 218 (1), 152-162. https://doi.org/10.1016/j.ejor.2011.10.026

Kam, B. H., Tsahuridu, E. E., & Ding, M. J. (2010). Does Human Resource Managment Contribute to the Development of Logistics and Supply Chain Capabilities? An Empirical Study of Logistics Service Providers in China. Research & Practice in Human Resource Management, 18(2).

Kłodawski, M., Lewczuk, K., Jacyna-Gołda, I., & Żak, J. (2017). Decision making strategies for warehouse operations. *Archives of Transport*, 41. https://doi.org/10.5604/01.3001.0009.7384

Lau, K.H., Zhang, J. (2006). Drivers and obstacles of outsourcing practices in China. International Journal of Physical Distribution and Logistics Management, 36(10), 776–792. https://doi.org/10.1108/09600030610714599

Le-Duc, T. & de Koster, M.B.M. (2005). Travel distance estimation and storage zone optimization in a 2-block class-based storage strategy warehouse. *International Journal of Production Research*, 43 (17), 3561-3581. https://doi.org/10.1080/00207540500142894

Li, S., Shue, L. (2003). A study of logistics informediary in air cargo tracking. *Industrial Management and Data Systems*, 103(1), 5-13. https://doi.org/10.1108/02635570310456841

Lieb, R. C. (2005). The 3 PL industry: where it's been, where it's going. *Supply Chain Management Review*, v. 6, no. 6 (Sept. 2005), p. 20-27: ill.

Liu, Z., Li, Y., Dai, W., & Zhang, R. (2013). Current situation and countermeasures of port logistics park information construction. *Journal of Industrial Engineering and Management*, 6(1), 227-236. https://doi.org/10.3926/jiem.676

Lu, C. S. (2007). Evaluating key resources and capabilities for liner shipping services. *Transport Reviews*, 27(3), 285-310. https://doi.org/10.1080/01441640600984015

Mandic, D., Jovanovic, P., Bugarinovic, M. (2014). Two-phase model for multi-criteria project ranking: Serbian Railways case study. *Transport Policy*, 36, 88-104. https://doi.org/10.1016/j.tranpol.2014.08.002

Mangan, J., Lalwani, C. (2016). *Global logistics and supply chain management*. John Weley and Sons.

Mason, R., Lalwani, C. and Boughton, R. (2007). Combining vertical and horizontal collaboration for transport optimisation. *Supply Chain Management*, 12(3), 187-199. https://doi.org/10.1108/13598540710742509

Okeudo, G. N. (2012). The Role of Strategic Human Resources Management in the Performance of Logistic Service Provider Firms: A Case Study of Owerri. *International*

Journal of Asian Social Science, 2(6), 858-868. https://archive.aessweb.com/index.php/5007/article/view/2264

Oliver, C. (1990). Determinants of interorganizational relationships: integration and future directions. *The Academy of Management Review*, 15(2), 241–265. https://doi.org/10.5465/amr.1990.4308156

Papadopoulou, E.-M. (2013). Logistics Service Providers: Collaboration with IFFs, 3PL, or 4PL Providers?. *Outsourcing Management for Supply Chain Operations and Logistics Services* (pp. 52-77), IGI Global. https://doi.org/10.4018/978-1-4666-2008-7.ch004

Park, H. (2011). Efficiency analysis of total logistics provider. *Journal of Korea Port Economic Association*, 27(2), 261–273.

Pinna, R., Carrus, P. P., & Pettinao, D. (2010). Supply Chain Coordination and IT: the role of third party logistics providers. *Management of the Interconnected World*, 299-306. https://doi.org/10.1007/978-3-7908-2404-9_35

Rafele, C. (2004). Logistic service measurement: a reference framework. *Journal of Manufacturing Technology Management*, 15 (3), 280-290. https://doi.org/10.1108/17410380410523506

Raykov, T. & Widaman, F. K. (1995). Issues in applied structural equation modeling research, Structural Equation Modeling. *A Multidisciplinary Journal*, 2(4), 289-318. https://doi.org/10.1080/10705519509540017

Rodseth, J. (2017). From concept to reality: Unmanned merchant ship research in Norway. *2017 IEEE Underwater Technology (UT)*, 1-10. https://doi.org/10.1109/ut.2017.7890328

Sabherwal, R., Jeyaraj, A. (2015). Information technology impacts on firm performance. *Management Information Systems Research Center, University of Minnesota*, 39(4), 809-836. https://doi.org/10.25300/misq/2015/39.4.4

Sauvage, T. (2003). The relationship between technology and logistics third-party providers. *International Journal of Physical Distribution & Logistics Management*, 33(3), 236-253. https://doi.org/10.1108/09600030310471989

Schumacker, E., & Lomax, G. (2012). A Beginner's Guide to Structural Equation Modelling. 4th ed. https://doi.org/10.4324/9780203851319

Selviaridis, K., & Spring, M. (2007). Third party logistics: a literature review and research agenda. *The International Journal of Logistics Management*, 18(1), 125-150. https://doi.org/10.1108/09574090710748207

Smith, A. and C. Nash (2014). Rail Efficiency: Cost Research and its Implications for Policy. *International Transport Forum Discussion Papers*, No. 2014/22, OECD Publishing, Paris. https://doi.org/10.1787/5jrw1kq13qq2-en

Solakivi, T., Töyli, J., & Ojala, L. (2013). Logistics outsourcing, its motives and the level of logistics costs in manufacturing and trading companies operating in Finland. *Production Planning & Control*, 24(4-5), 388-398. https://doi.org/10.1080/09537287.2011.648490

Supply Chain Executive Board. Structuring and Managing 4PL Relationships [online]. ©2005 [viewed 03 August 2020]. Available at www.sceb.executiveboard.com.

Visser, E.; Konrad, K.; Salden, R. (2004). Developing Fourth-Party Services: Empirical Evidence on the Relevance of Dynamic Transaction-Cost Theory for Analyzing a Logistic System Innovation. *44th European Regional Science Association - ERSA 2004 Congress, University of Porto, Porto, Portugal, August* (pp. 25-28).

Vivaldini, M., Pires, S., & de Souza, F. B. (2008). Collaboration and Competition between 4PL and 3PL: a study of a fast-food supply chain. *Journal of Operations and Supply Chain Management*, 1(2), 17-29. https://doi.org/10.12660/joscmv1n2p17-29

Win, A. (2008). The Value a 4PL Provider Can Contribute to an Organisation. *International Journal of Physical Distribution & Logistics Management*, 38(9), 674-684. https://doi.org/10.1108/09600030810925962

Wong, W. P., Soh, K. L., & Goh, M. (2016). Innovation and productivity: insights from Malaysia's logistics industry. *International*

Journal of Logistics Research and Applications, 19(4), 318-331. https://doi.org/10.1080/13675567.2015.1077942

Yao, J. (2010). Decision Optimization Analysis on Supply Chain Resource Integration in Fourth Party Logistics. *Journal of Manufacturing System*, 29(4), 121-129. https://doi.org/10.1016/j.jmsy.2010.12.002

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