Tomas Bata University in Zlín
Faculty of Management and Economics

Doctoral Thesis

Strategic Transformation into Fourth Party Logistics: A Methodological Approach for Local Logistics Service Providers in Vietnam

Strategická transformace na logistiku čtvrtého typu: metodický přístup místních poskytovatelů logistických služeb ve Vietnamu

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ABSTRACT

Logistics service is a significant component of the service sector. For a few decades, a new model of logistics service providers (LSP) which has appeared and played the role of integrating all operations of the supply chain is mentioned as 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 the increasing competition among enterprises and customers' requirements in complicated services and global supply chain management, 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.

Currently, many researchers demonstrate research results in related elements of logistics services and supply chain management. 4PL's operations and model are analyzed, assessed, and suggested for sustainable development. The orientation and policies in the logistics services are recommended and issued to strongly support and enhance the contribution of the logistics industry to the growth of the national economy. Moreover, investment strategies in the key areas that are established by the government create a high advantage for LSPs in Vietnam to reach outstanding objectives in both the local and international logistics markets. However, the logistics outsourcing trend in the global market that requires more than professional logistics services but high-value-added solutions through long-term contracts between logistics providers and their clients creates LSPs to face challenges in their positioning and competitive advantage in their service provision.

There is a wide range of practices and initiatives that can be used in development enhancement for LSPs. Logistics service practices vary from diverse service provisions to the efficiency of logistics operations concerning all related parties such as suppliers, manufacturers, and customers. Innovative strategies are currently employed as a key element in implementing comprehensive logistics service provision of LSPs to gain and maintain a competitive advantage. Theory of Inventive Problem-solving (TRIZ) serves as the basis for inventive problem-solving methods and tools in a dialectic and systematic way.

This study analyzes the role, importance, characteristics, and benefits of 4PL in the global logistics market. Then, the model for transformation into 4PL for local LSPs in Vietnam is constructed to identify factors impacting the transformation. The results point out six factors influencing the transformation process and three important capabilities of 4PL. Finally, TRIZ innovation methodology is analytically applied to develop strategies for the transformation based on the defined capabilities of 4PL.

ABSTRAKT

Logistické služby jsou významnou součástí sektoru služeb. Již několik desetiletí existuje nový model poskytovatelů logistických služeb (LSP), který se objevil a hrál roli integrace všech operací dodavatelského řetězce, zmiňován jako logistický integrátor nebo logistika čtvrté strany (4PL).

4PL se ukázala jako ideální konfigurace pro podniky po celém světě, aby efektivně využívaly své zdroje a dosáhly snížení nákladů v celém dodavatelském řetězci. S rostoucí konkurencí mezi podniky a požadavky zákazníků na složité služby a globální řízení dodavatelského řetězce se omezení příchozích služeb od LSP stalo překážkou jejich rozvoje. V důsledku toho je transformace na 4PL pro LSP na globálním logistickém trhu nevyhnutelná.

V současné době mnoho výzkumníků demonstruje výsledky výzkumu souvisejících prvků logistických služeb a řízení dodavatelského řetězce. Provoz a model 4PL jsou analyzovány, hodnoceny a navrhovány pro udržitelný rozvoj. Orientace a zásady v oblasti logistických služeb jsou doporučovány a vydávány za účelem výrazné podpory a posílení příspěvku odvětví logistiky k růstu národního hospodářství. Investiční strategie v klíčových oblastech, které stanoví vláda, navíc vytvářejí velkou výhodu pro LSP ve Vietnamu, aby dosáhli vynikajících cílů na místním i mezinárodním trhu logistiky. Trend outsourcingu logistiky na globálním trhu, který vyžaduje více než profesionální logistické služby, řešení s vysokou přidanou hodnotou prostřednictvím dlouhodobých smluv mezi poskytovateli logistiky a jejich klienty, vytváří LSP, aby čelili výzvám v jejich umístění a konkurenční výhodě při poskytování služeb.

Existuje široká škála postupů a iniciativ, které lze použít při zlepšování vývoje pro LSP. Praktiky logistických služeb se liší od různých poskytování služeb až po efektivitu logistických operací týkajících se všech spřízněných stran, jako jsou dodavatelé, výrobci a zákazníci. Inovativní strategie jsou v současnosti využívány jako klíčový prvek při zavádění komplexních logistických služeb poskytovaných LSP za účelem získání a udržení konkurenční výhody. Teorie invenčního řešení problémů (TRIZ) slouží jako základ pro inovační metody a nástroje řešení problémů dialektickým a systematickým způsobem.

Tato studie analyzuje roli, důležitost, vlastnosti a výhody 4PL na globálním logistickém trhu. Poté je vytvořen model pro transformaci na 4PL pro místní LSP ve Vietnamu, aby se identifikovaly faktory ovlivňující transformaci. Výsledky poukazují na šest faktorů ovlivňujících proces transformace a tři důležité schopnosti 4PL. A konečně, inovační metodologie TRIZ je analyticky aplikována k vývoji strategií pro transformaci na základě definovaných schopností 4PL.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

1PL: First party logistics

2PL: Second party logistics

3PL: Third party logistics

4PL: Fourth party logistics

5PL: Fifth party logistics

AVE: Average Variance Extracted

CILT: Charter of the Institute of Logistics and Transport

CSCMP: Council of Supply Chain Management Professionals

EDI: Electronic data interchange

ICT: Information and communication technologies

IEA: International Ergonomics Association

IoT: Internet of Things

IT: Information Technology

LPI: Logistics Performance Index

LSP: Logistics service provider

NCPDM: National Council of Physical Distribution Management

SCM: Supply Chain Management

SEM: Structural Equation Model

SRMR: Standardized Root Mean Square Residual

TRIZ: Theory of Inventive Problem Solving

USD: United States Dollar

VIRAC: Vietnam Industry Research and Consultancy

VLI: Vietnam Logistics Research and Development Institute

1. INTRODUCTION

1.1 Research problem and motivations for the study

1.1.1 4PL in the world

4PL is known as a modern model of logistics provision where manufacturing firms outsource their supply chain and logistics activities to external logistics service providers (LSPs). 4PL, also called lead logistics provider, commits to providing comprehensive integrated solutions for supply chain management at a higher level for the customers. Nowadays, enterprises push the diversification of products to spread their business to the global market. This fact leads to the demand for more complicated logistics services. As a result, 4PL has become the priority choice of the clients for innovative and integrated logistics services. Thanks to the ability to handle multiple logistics operations at faster speed and cheaper costs, 4PL has emerged as the integrator handling complex resources to optimize and provide valuable services to its clients. To catch up with the higher requirements of the customers, customized logistics solutions have been set up to connect with the management system such as warehouse management, process supervision, customer relationship management to expense and revenue management. This approach helps enterprises minimize the concentration on ineffective activities in the supply chain through the implementation of 4PL's innovative solutions. Hence, companies can achieve benefits and promote growth by gaining cost-effectiveness and focusing on core competency.

In the late 1900s and early 2000s, there were been dramatic changes in logistics systems consisting of privatization, internationalization, rationalization, technology utilization, consolidation, and integration (Transportation Industry Solutions, 2004). Furthermore, other critical changes which have been considered to be vital to the improvement of firm productivity include the rise of Third Party Logistics (3PL) and the emergence of Fourth Party Logistics (4PL) service providers, 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 been undergoing profound changes for over three decades under the pressure of ever-increasing expectations and demands from customers.

Firstly, LSPs usually intend to maintain their services and continue working as logistics solution providers. However, the tendency in the contracts between LSPs and their clients is for greater geographic coverage and more activities, which is a challenge for LSPs. In the long run, the market tends to provide more opportunities for logistics companies dedicated to broader projects aimed at the coordination and integration of activities, such as 4PLs (Lieb, 2005). Therefore, LSPs have been changing their operations and strategy to become logistics integrators. They develop customized services for their customers by mobilizing

resources, connecting different partners, and controlling information flows through applying information and communication technologies (ICT).

Secondly, Langley and Allen (2005) concluded that, by incorporating new activities required by the market, LSPs have created a movement that demonstrates the progress and maturity of these operators. However, clients expect to achieve greater skills in service development, relationship improvements, involvement of integration concepts in the supply chain through LSPs and to build expertise and dedicated operations. Likewise, the market demands turn to solutions focusing on logistics coordination. Bienstock (2002) pointed out that LSPs should think strategically in terms of rules and external information resources, to maintain their position and support the relationships with their clients. According to Cherneva *et al.* (2015), the business world is significantly impacted by LSPs' development, then it is essential for enterprises, management people, 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, it is crucial to grasp the importance of logistics performance which affects directly the customers' evaluation of LSPs. Finally, supply chain management is considered one of the core elements of the successful 4PL. Being developed from the first mention by Oliver and Webber (1982), supply chain management is aimed at creating value for customers through multi-enterprise integration and good management of flows with cost-effectiveness.

4PL services are also called supply chain services where service providers associate with supply chain departments in the customer's enterprises. It enables 4PL to work with a hands-on approach to the entire supply chain operations ranging from activities in order, purchasing, warehousing, and distribution to reverse logistics. From the 4PL market size global report issued by Polaris Market Research, the increasing need for a comprehensive supply chain for productivity enhancement in different market segmentations is expected to develop the global 4PL logistics market (See Figure 1 on 4PL market segmentation). The presence of 4PL creates an essential movement towards mostly eliminating bottlenecks in the complicated supply chain. For manufacturing firms, 4PL provides strategic visibility on inventory and enables them to arrange stocks based on the demand of customers in the market. Such strategies then help manufacturers concentrate on generating a better and more innovative product portfolio by controlling the whole supply chain.

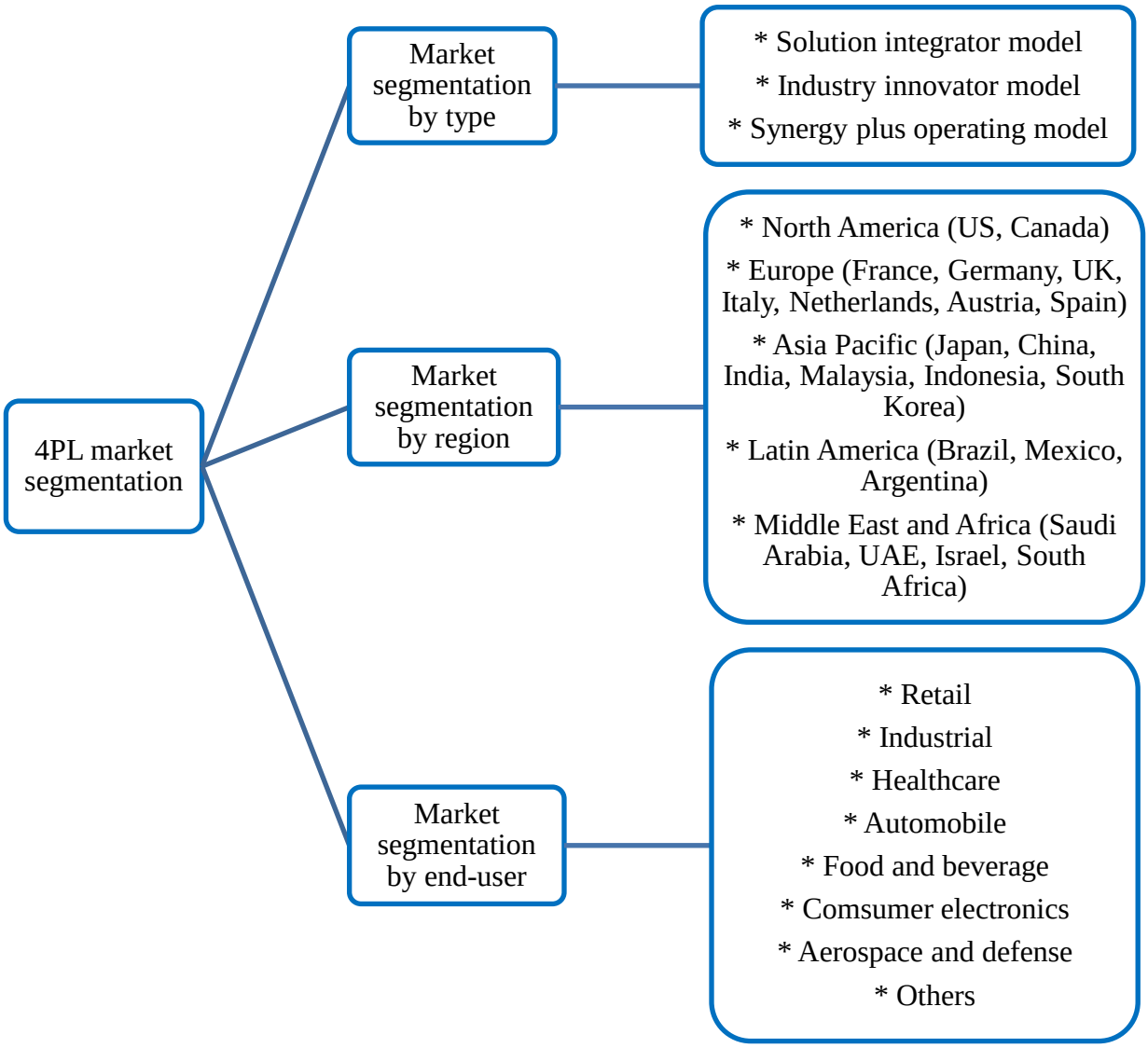


Figure 1.1: 4PL market segmentation

Source: Polaris Market Research

According to the analysis of the global logistics market conducted by Polaris Market Research, the integrated solution segment holds the largest part of the market share. The global 4PL market is expected to reach a compound annual growth rate of 7,1% leading revenue to rise from 49.84 billion USD in 2021 to 89.95 billion USD in 2030. Recently, 4PL services have created tremendous attraction to many industries, especially manufacturing enterprises. In 2021 and 2022, the Asia-Pacific region holds the largest global logistics market share due to the rapid growth of e-commerce in Korea, India, Japan, and China. According to forecasts, this region will continue holding the position of market leader in the coming years until 2030. Meanwhile, North America is expected to have a progressive growth rate in the coming years due to the fast development of logistics firms in this region. In addition, the growing demand for logistics service

outsourcing from many manufacturers is estimated to create high 4PL market growth opportunities.

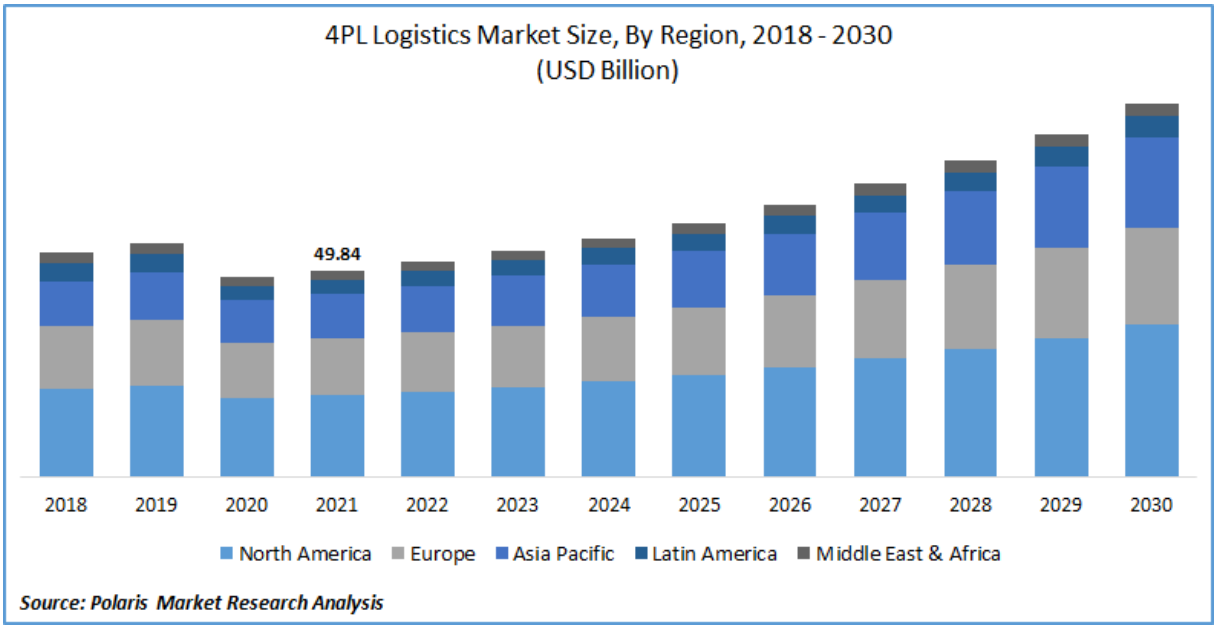


Figure 1.2: 4PL logistics market size in the period of 2018 - 2030

The increase in the demand for the strategic supply chain from 4PL for improving productivity and gaining cost-effectiveness has driven the global 4PL market to grow at a fast speed with the participation of leading 4PL providers in the world as stated in Figure 1.3.

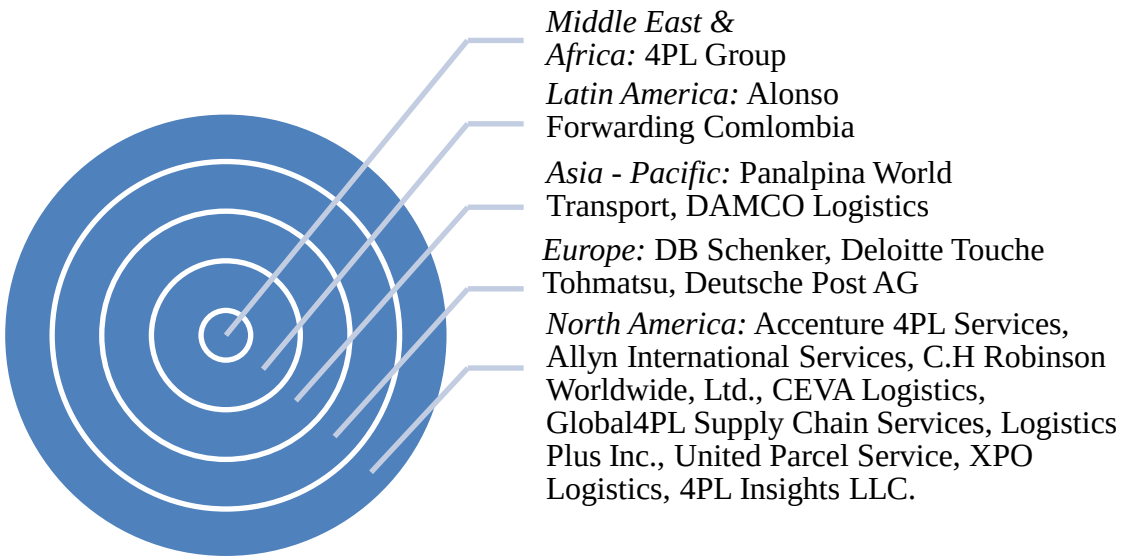


Figure 1.3: Leading 4PL providers in the world

Source: Polaris Market Research

4PL service providers act as integrators of various LSPs to create strategic solutions for the client company. 4PLs manage all operations in the supply chain

to provide their customers valuable services which play a vital role in improving revenues and enhancing competitive advantage for the clients. 4PL services enable manufacturers to have a strategic vision based on the completed supply chain provided under the customization of different clients.

1.1.2 4PL in Vietnam

Being located in the central of Asia - Pacific region, Vietnam is considered a potential market for developing the logistics service industry thanks to dominant advantages such as being on international maritime routes, owning a long coastline with many locations suitable for deep water ports to be built, and opportunities for international economic integration undersigned free trade agreements. In recent years, Vietnam's logistics industry has gained remarkable growth at an average rate of 14-16% annually with a value of USD 40-42 billion. According to Vietnam Industry Research and Consultancy (VIRAC), Vietnam is in the top 10 emerging logistics markets in the world and ranked 4th in Southeast Asia (Agility's annual ranking in 2023). Over the past years, Vietnam's logistics market has made significant progress, the market not only increased in number of LSPs but also enhanced the quality of logistics service. Such development has remarkably contributed to the results of import and export turnover in 2022 to reach the highest level of 732.5 billion USD, up 9.5% compared to 2021. However, there are still many drawbacks in Vietnam's logistics industry that should be improved such as high logistics costs, shortage of the connection between LSPs, weak relationship between LSPs and enterprises, low LSPs' financial potential, slow speed of global logistics penetration, etc. With the outstanding growth and important role of the logistics industry in the country's economy, the policies and investments for the transformation of LSPs are always in special consideration and support.

The development tendency of LSPs derives from the increasing demand for advanced logistics services. Globalization, trends of outsourcing, and the development of information and communication technology (ICT) have created remarkable changes in international business models and global supply chains. The market trends are to bring more chances for logistics enterprises to execute larger projects with the integration of activities as of 4PL's operations (Lieb, 2005). Visser *et al.* (2004) and Hoek (2006) argue that LSPs must have well-defined strategies to begin the transition process into 4PL when considering LSPs as natural candidates to evolve their services into 4PL. LSPs need to pay more attention to inventive approaches which play a key role in the success of LSPs in adapting to the companies' demands for integrated logistics services with high value and cost-effectiveness (Flint *et al*., 2005; Flowers *et al*., 2008; Langley *et al*., 2009; Lin, 2007). Bandyopadhyay and Pathak (2007), Pavlina and Cerne (2010), and Wagner and Sutter (2012) believe that the company's competitive capability is created and maintained by the viewpoint of innovation considered as the effective key.

In Vietnam, figures from the General Statistics Office in 2023 show that more than three thousand LSPs are operating in the Vietnamese market, of which 89 percent are domestic enterprises, 10 percent are joint ventures and the remainder are foreign-invested companies. In terms of market share, local LSPs account for 25% only. The remaining is of foreign logistics corporations which take 5% of the total amount. Foreign logistics companies can provide 3PL and 4PL services while the rate of local 3PLs account for around 15% of these logistics firms and most local LSPs operate as 2PL service providers. Most of them are small firms with little capital and a shortage of premises such as warehouses, ports, information technology, transportation means, etc. As a result, they can only operate in small segments of the logistics industry, i.e. transportation services, forwarding, lease of the warehouse, customs formalities, etc.

Over the years, Vietnam's logistics industry has achieved remarkable progress. Vietnam's logistics performance index (LPI) is ranked 43rd position out of 160 countries in the year 2023. However, logistics costs in Vietnam are still much higher than those in other countries in the world. According to World Bank 2022 data, Vietnam's logistics costs were around 20.9 to 25 percent of the Gross Domestic Product (GDP). This ratio is quite high compared to the average level of the whole world which is around 10.8 percent. The fierce and severe competition of international trade has forced domestic LSPs to create competitive advantage, time saving, cost-effectiveness, risk reduction, and flexibility. Meanwhile, Vietnamese local LSPs have to suffer the pressure of competitors which are foreign logistics corporations. The improvement of competitive ability requires local LSPs to focus on providing high-value-added service solutions such as those of 4PL. Although 3PL can provide a variety of services including warehouse, inspection, packaging, distribution, and customs formalities, 4PL commits to creating comprehensive and integrated logistics solutions to meet the client's growing demands (Li and Lin, 2006; Wang *et al*., 2011). With the increasing competition between logistics enterprises and the expectations of customers for service development, relationship improvements, seamless information flows, and integrated operations, LSPs should think strategically about the retention of their positions and relationships with customers. The limitations of LSPs' offered services have strongly promoted the inevitable transformation into 4PL. Therefore, when considering the evolvement of LSPs' services into 4PL, Visser *et al.* (2004) and Hoek (2006) argue that they must have well-defined strategies to begin the transition process.

1.2 Research gap

The number of 4PL service providers is constantly increasing around the world. There are many types of research separately conducted on 4PL's role and model such as the studies of Saglietto *et al*. (2007); Buyukozkan *et al*. (2009); Skender *et al*. (2017); Balanagalakshmi (2018); Christopher S. Tanga and Lucas P. Veelenturf (2019). Other studies conducted on analyzing and comparing 3PL and

4PL consisting of those of Balanagalakshmi (2018) and Vivaldini *et al*. (2008), establishing suggestions for the transition from 3PL to 4PL with the typical study of Kao *et al*. (2019), and recommending model for conflict resolutions on 4PL development through the research of Kuang *et al*. (2017).

Moreover, there are other research works on related elements to logistics services and supply chain management in 4PL consisting of various services of logistics and customer satisfaction (Huang, 2014), the role of transportation in 4PL (Dircksen and Magnin, 2017; Mehmann and Teuteberg, 2018; Tseng *et al*., 2005), strategies for warehouse operations (Klodawski *et al*., 2017), IT competence (ITC), information and communication technology (ICT), and IoT in 4PL enterprises (Schramm et al., 2019; Mehmann and Teuteberg, 2018; He *et al*., 2013), supply chain resources and monitoring in 4PL (Yao, 2010; Skender *et al*., 2017; Fulconis and Paché, 2018), outsourcing logistics risk management in 4PL (Huang *et al*., 2013).

For the logistics industry in Vietnam, there is one research conducted in strategic development into 3PL for local private logistics companies in Vietnam (Research of Tran Thanh Ha, 2013). Other studies mainly focus on the potential and prospects of the logistics industry in Vietnam including studies by Pham Nguyen My Linh and Nguyen Thi Thu Huong (2020) on The supply chain and logistics of Vietnam in the context of international economic integration; Banomyong *et al*. (2015) on Assessing the National logistics system of Vietnam; Hoang Phuong Nguyen (2020) on Sustainable development of logistics in Vietnam in the period 2020-2025; Hoang Phuong Nguyen (2020) on Human resource management of logistics in Vietnam: status and policy solutions; Hai Nam Vu (2019) on Strategic development in logistics in Vietnam; Le *et al*. (2020) on Using the optimization algorithm to evaluate and predict the business performance of logistics companies – A case study in Vietnam. However, there isn't any research on the transformation from LSP to 4PL, especially in the context of local logistics service providers in Vietnam. Therefore, this study is performed as the first one on this topic with expectations of contributing to the development of the logistics industry in Vietnam and in the academic field as well.

1.3 Research objectives

Based on reviewing literature and observations of Vietnam and the global logistics industry, the author specifies the main goal of the dissertation as to investigate factors affecting the transformation into 4PL of local LSPs in Vietnam. Besides, the supplementary objectives are also established to assess the importance of 4PL in the logistics service industry and global supply chain, and then, to build strategies for the successful transformation. As a result, the thesis is conducted with 3 core and 9 specific objectives as stated in the following parts.

In the development and transformation process of LSPs, LSPs operate under the influence of many factors in both macroeconomic and microeconomic sectors.

Therefore, the assessment of how impact of constructs in each economic sector is essential to the probability of the transformation model. Hence, research objective 1 is determined to affirm whether the research model is significant.

**RO1: To investigate factors affecting the transformation into 4PL of local LSPs in Vietnam.*

In the research model, there are nine constructs including transformation capability, warehouse operations, IT capability, human resources, logistics services, transportation infrastructure, logistics outsourcing trend, competition in the logistics industry, and government policies in the logistics industry influencing the transformation process of local LSPs into 4PL. Therefore, specific objectives for each construct within the main objective RO1 should be established to assess how and which level of each factor impacts the transformation. The details are as follows:

**RO1a: To examine the impact of transportation capability on the transformation into 4PL of local LSPs in Vietnam.*

**RO1b: To identify the relationship between warehouse operations and the transformation into 4PL of local LSPs in Vietnam.*

**RO1c: To measure how IT capability causes influences on the transformation into 4PL of local LSPs in Vietnam.*

**RO1d: To examine the influence of human resources on the transformation into 4PL of local LSPs in Vietnam.*

**RO1e: To measure how logistics services impact the transformation into 4PL of local LSPs in Vietnam.*

**RO1f: To identify the relationship between transportation infrastructure and the transformation into 4PL of local LSPs in Vietnam.*

**RO1g: To measure how the logistics outsourcing trend impacts the transformation into 4PL of local LSPs in Vietnam.*

**RO1h: To examine the influence of competition in the logistics industry on the transformation into 4PL of local LSPs in Vietnam.*

**RO1i: To identify the relationship between government policies in the logistics industry and the transformation into 4PL of local LSPs in Vietnam.*

4PL acts as an integrator for offering a wide range of solutions to help firms achieve the highest productivity. The recent outsourcing trend concentrates on integrated solutions under long-term contracts of 4PL instead of using separate logistics services provided by 2PL and 3PL. The research systemizes theories and empirical studies in 4PL to affirm the position of 4PL in the global logistics market and supply chain.

**RO2: To systemize the theories in the role, importance, and characteristics of 4PL in the logistics service industry and global supply chain.*

To survive under the pressure of competition in the global logistics market where various giant logistics corporations are expanding their operations across nations with worldwide networks, Vietnam's local LSPs must be adaptable and willing to execute changes. With the composition of Vietnam's logistics industry of mostly 2PLs and a small part of 3PLs, transformation into 4PL for maintaining survival and achieving a competitive advantage is an inevitable development in the new era of the global logistics industry. RO3 is established for generating strategic solutions through the application of an innovative approach.

**RO3: To develop strategies for successful transformation into 4PL of local LSPs in Vietnam.*

In summary, this study leads the findings to provide deep insights into the investigation of factors influencing the transformation into 4PL, the systemization of theories and comprehensive concepts of 4PL in the logistics service industry and global supply chain, and innovative strategies for the significant transformation. These objectives could be specified by giving answers to established research questions in the following part.

1.4 Research questions

From the research problem, motivations, and research objectives, research questions (RQ) are set up to strengthen the research basis and clarify the main content of the study by comprehensive answers for the following research questions:

**RQ1: Why should local logistics service providers in Vietnam transform into 4PL?*

This research question analyzes the situation of the logistics market in the world and in Vietnam where there are different levels of logistics enterprises operating under fierce competition. The characteristics of 2PL, 3PL, and 4PL are specified to highlight the differences between these types of LSP. In addition, the logistics outsourcing trend in the world which holds a high value and is anticipated to gain growth prospects in the coming time is carefully assessed on its importance to the whole logistics industry. Enterprises, especially manufacturing firms have recently focused much more on the long-term contracts with 4PL for providing comprehensive strategic solutions for their supply chains. Integrated strategies which are established by 4PL created valuable benefits to their client's organization in cost-effectiveness and competitive advantage.

**RQ2: Which factors impact the transformation into 4PL of local logistics service providers in Vietnam?*

LSPs operate their business under the influence of many macroeconomic and microeconomic factors. The existence of these diversified factors can become

facilitators or obstacles to the development of logistics enterprises. In reality, the level of impact may be different in various situations, and impacting factors can vary in different environments. This research question aims to investigate the influence that LSPs suffer when they execute the transformation process to a higher level of logistics services. Critical factors that are motivators or constraints to the transformation should be determined and examined for their interactions with the changes to evaluate the probability of the transition from LSP into 4PL.

For the purpose of providing specific evaluations on identified macroeconomic factors (transportation infrastructure, logistics outsourcing trend, competition in the logistics industry, and government policies in the logistics industry) and microeconomic factors (transformation capability, warehouse operations, IT capability, human resources, logistics services), it is essential to establish sub-research questions for RQ2. Hence, the following sub-research questions are developed to support the study:

**RQ2a: How does transportation capability impact the transformation into 4PL of local LSPs in Vietnam?*

**RQ2b: How is the relationship between warehouse operations and the transformation into 4PL of local LSPs in Vietnam?*

**RQ2c: How does IT capability cause the effect to the transformation into 4PL of local LSPs in Vietnam?*

**RQ2d: How is the influence of human resources on the transformation into 4PL of local LSPs in Vietnam?*

**RQ2e: How do logistics services impact the transformation into 4PL of local LSPs in Vietnam?*

**RQ2f: How is the relationship between transportation infrastructure and the transformation into 4PL of local LSPs in Vietnam?*

**RQ2g: How does the logistics outsourcing trend impact the transformation into 4PL of local LSPs in Vietnam?*

**RQ2h: How is the influence of competition in the logistics industry on the transformation into 4PL of local LSPs in Vietnam?*

**RQ2i: How is the relationship between government policies in the logistics industry and the transformation into 4PL of local LSPs in Vietnam?*

4PL is an advanced model of LSP due to its valuable benefits delivered to the client. 4PL helps manufacturing firms increase efficiency, improve productivity, and provide opportunities to optimize the supply chain. Being considered an integrator of 3PL's resources, technology, and skills, 4PL creates high benefits such as a powerful data system, professional supply chain, operational efficiencies, and cost reduction. Meanwhile, 2PL and 3PL can only provide separate logistics services under short-term contracts. 4PL integrates itself into

the client organization and becomes an important part of the business operations of the customer's firm. Such differences in service provision demonstrate a high level of 4PL which creates a competitive advantage for 4PL in the global logistics market. It is also the explanation for the necessity of the transformation into 4PL of LSPs. However, the transition process is always complicated and needs a lot of time and effort from logistics firms. RQ3 is designed to provide direction to LSPs to catch up with their changing strategy.

**RQ3: How do local logistics service providers in Vietnam successfully transform into 4PL?*

It is obvious to affirm that local LSPs need to transform themselves to retain their existence and enhance their development through appropriate and practical strategies. This research applies TRIZ innovative approach to develop strategies for the transformation into 4PL for local LSPs in Vietnam.

1.5 Research design

In this study, the author determines three main objectives concerning the systemization of distinguishing concepts of 4PL, the investigation of factors impacting the transformation into 4PL, and the innovative strategies for the advanced transformation of local LSPs in Vietnam with three main research questions. Since this study reviews the distinguished quality of 4PL from the perspective of value provided to the clients and outsourcing trend in integrated logistics solutions in the global logistics market, qualified parts of content matching with these research objectives were selected to conduct the research as follows:

- Part 1: Fundamentals and theoretical background of 4PL.
- Part 2: Research framework, hypotheses, and methodology.
- Part 3: Findings and strategy establishment.

Apart from the acknowledgment and the abstract, this study is carried out in ten chapters. A sketch map with the main parts of the research design is illustrated in Figure 1.4. The given chapters of the study provide all relevant knowledge, theory, data, processes, analyses, evaluation, and solutions for the research problem. In further affirmation of the research design, the process presents all essential stages and expertise content of the research to finally create the completed study for devoting remarkable contributions in the logistics field.

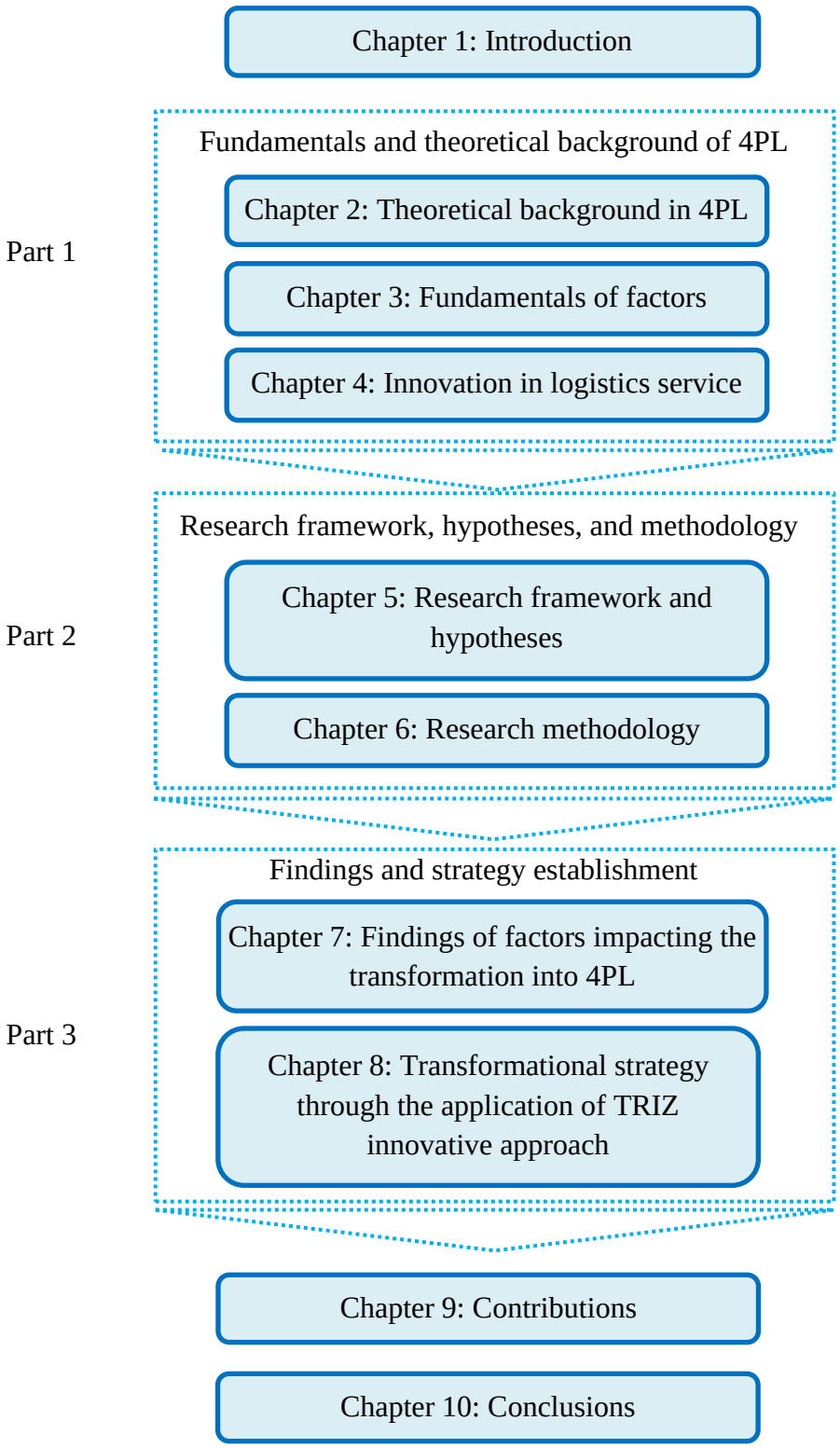


Figure 1.4: Research design

Source: The authors' works

Beginning the study, Chapter 1 introduces a general overview of LSPs, 4PL, and the logistics service industry in both Vietnam and global markets. Theories related to 4PL in this part build a strong foundation for the analyses and evaluation of the research. Then, Part 1 covers 3 chapters for presenting the

theoretical background in 4PL, fundamentals of factors, and innovation of logistics service. In Part 2, the research framework, hypotheses, and research methodology are stated in detail with relevant foundations and analyses for the basis of model testing. The broad collection of data in Part 2 increases the reliability of qualitative and quantitative analyses in the research. The data and information related to the situation of 4PL's operations in the world and Vietnam, and factors influencing the transformation into 4PL are also presented and analyzed significantly. The last part of the study, Part 3, shows the findings of the model from using SmartPLS tool and suggested strategies for the transformation into 4PL by applying TRIZ inventive methodology. The contributions of the study that are evaluated in Chapter 9 for both academic and practical fields demonstrate the significance of the research results in the development of LSPs to a superior type of service provider. At the end of the process, Chapter 10 is designed to summarize and highlight outstanding points of the whole study. In addition, the conclusion focuses on the assessment of the results of research objectives, the answers to research questions, the investigation of hypotheses, the limitations of the research, and suggestions for further studying.

2. THEORETICAL BACKGROUND

2.1 Development fundamentals of 4PL

2.1.1 The competitive advantage of 4PL in the market – A motivation for the development of 4PL

According to the studies of many researchers, 4PL is considered a modern model that creates a sustainable competitive advantage because it provides customer-oriented services. From the increasing demand of retailing and manufacturing companies for integrated logistics services, the development of 4PL becomes stronger and provides more benefits to the clients with collaborative logistics processes, transparent information flows, sharing network of resources in warehousing and transport, and data exchange. 4PL has special features compared to conventional LSPs due to its highly customized services. 4PL presents its ability to implement interdependent activities between partners thanks to the planning and coordination of information flows throughout the global supply chain.

Actually, 4PL implements its key role in strategic alignment because the more the coordination in the supply chain is established, the more the effectiveness of successful performance seems to be likely (Bergeron *et al.*, 2004). Strategic alignment is implemented based on the coordination of business strategy, corporate structure, and strategy selection with the priority of technology application. According to the viewpoint of strategy, the process of constructing sustainable competitive advantage is initiated from strategic alignment. The outstanding benefits of IT enable 4PL to enhance their logistics service provision through professionally controlling the processes of tracking and tracing thanks to

their completed information system. Schramm *et al.* (2019) conducted a comparison of 4PL solutions on today and future differences from semi-structured interviews, the results revealed that an effective IT platform may have a positive impact on 4PL's integrated role of network partners in the supply chain. Moreover, the information sharing amongst 4PL's actor network promotes it to generate more logistics services based on detailed analyses of the data system. Hence, it is an advantage for 4PL compared to other LSPs in the global logistics market due to its value-added services.

In the study on the classification of 4PL, Saglietto (2013) pointed out 4 groups of 4PLs including (1) - 4PLs operating in technical engineering for scaled projects, (2) 4PLs specializing in the simulation illustrated from logistics resolution approaches, (3) 4PLs running as subsidiaries of parent logistics corporations, and (4) virtual 4PLs delivering operations in the combination of other 4PLs in the network. These groups emerged with different common features and enabled the optimization of logistics solutions for the clients. The attribute of 4PL service provision is to deliver strategic contracts and projects on the entire supply chain. As a result, the performance of all groups of 4PL leads to the effectiveness of the integrated logistics system. The specific characteristics and fields of engagement of each group are generalized as follows:

- Group 1: 4PLs concentrate on the establishment and control of technical information systems consisting of compiling and converting documents; storing and managing data flows related to projects; developing information systems of documents, libraries, and software; and managing logistics contracts and projects.

- Group 2: 4PLs' activities are implemented entirely towards the consultation and global integrated logistics model. Specific operations provided by this group focus on three main groups of activity including: (i) creating a model for compositions in the supply chain, and controlling the flows and performance of logistics operations; (ii) making the transformation technology application in logistics operations through improving information flows within the supply chain and utilizing the integrated logistics information system and database; and (iii) providing software outsourcing for bringing added value to the clients.

- Group 3: 4PLs operate as subsidiaries of large logistics corporations. They provide logistics consulting and implementing services to different customers in various fields. These enterprises can perform their activities independently from the parent company and other subsidiaries of the same group. The main activities of 4PLs in this group focus on 4 areas including (i) providing global strategy for the client's supply chain under contract on information system or logistics project; (ii) implementing quality assurance in different stages in the logistics process and ensuring dedicated standards of performance; (iii) enhancing the relationship with partners in the network for creating more added value to the client in transportation services; and (iv) generating suggestions for controlling costs in operations and administration towards improving the effectiveness.

- Group 4: 4PLs in this group are various in scale. They may be large or small logistics firms and operate independently. 4PLs of this category present following features: firstly, they are actual service enterprises with expertise and professional consultation without owning any physical assets but utilizing resources from the partners in the network; secondly, these firms present their role as integrator in assigning staff to take care of activities throughout the process of service provision; thirdly, 4PLs indentify and affirm responsibilities between them and other parties in contracts providing services to the clients; fourthly, 4PLs combine information technology into their performance to generate dedicated logistics solutions; fifthly, these firms show their professionality in managing the transportation activity in all stages of the movement of goods nationally and internationally; sixthly, they optimize the advantage of information system to exactly and effectively supervise the movement situation of goods; seventhly, they can follow and perform well customs formalities and duty completion; eigthly, they have ability to establish the network of subsidiaries for meeting various demands from the clients; ninethly, they are absolutely expertised in different segments in the market from transportation mode, group of customers, type of goods to the route of transportation.

From the analyzed studies of researchers, it is clear to affirm that an LSP becomes more advantageous when running its operations as 4PL thanks to its expertise and prestige. Win (2008) and Frost and Sullivan (2004) pointed out that 4PL can offer the client the most cost-effective solutions and the improvement for the client's logistics system based on 4PL's collaboration with other providers in the network. 4PL establishes a combination between parties to offer diverse services and comprehensive support to the customer. It plays a central role in the network to operate the global supply chain through its knowledge and expertise (Bowersox, 2007; Kutlu, 2007). According to Gavrielatos (2007), 4PL is recognized to be a superior type of LSP due to its ability to be creative to generate new chances for its client. Therefore, manufacturing firms often consider 4PL as the optimal choice for outsourcing their logistics activities.

2.1.2 The correlation between international trade, national economy, and logistics performance – A key stimulation for the development of 4PL

The relationship between a combination of international trade and logistics performance and the role of logistics efficiency in international trade flow is documented by numerous studies by many researchers. According to Mann (2012), international trade is especially emphasized by many countries due to its influence on international competitiveness which is impacted by the capability of logistics management on a global scale. Globalization has created an increase of international competitiveness where logistics service is considered as the core factor in international trade. It is obvious to state that effective logistics service helps to decrease logistics costs and boost the movement in the supply chain (Cheung, 2020). Therefore, the key role of logistics services in globalization is

enhanced through established capabilities in national production and broadened networks in trade and production between nations (De & Saha, 2013).

Christopher (2016) specifically affirmed logistics service as an optimizing chain of activities consisting of purchasing, transferring, and stocking goods under the supply chain. In other words, this process spreads out from the production to consumption stages on an international scale. Therefore, the logistics industry is recognized as the core element of the global economy (Liu *et al.*, 2018). It operates under the relationship with many other industries, therefore, it is assessed to be vital in the sustainable development of the economy. The effectiveness of the logistics service industry is measured through the analyses of trade flows. The logistics industry greatly contributes to the prosperity and competitive advantage of a country (Bensassi *et al.*, 2015). As a result, an efficient global logistics performance should significantly support the growth of international trade. Pointing out the situation of recent studies, Wang *et al.* (2018) mentioned the complicated relationship between logistics performance and international trade, especially the role of logistics efficiency in sustainable development.

Regarding the mutual impact between the economy and the logistics industry, Feng *et al.* (2010) pointed out that the demand for logistics services can be dramatically fostered by economic development. Otherwise, an efficient logistics industry plays an important role in promoting economic growth. Another research that was conducted by Lean *et al.* (2014) indicated the positive influence of economic development on the increase of logistics needs and the growth of the logistics industry. In addition, the correlation between logistics and economic development was analyzed through statistics by Lan *et al.* (2018). In the research, the core elements were suggested to be invested including logistics infrastructure, technological investment, and the ranking of the logistics industry. In investigating the coordinated mechanism between the regional economy and the logistics service industry, Jun (2017) suggested that there should be a connection between modern logistics systems and supported financial sources in the industry.

In recent years, the research on the correlation between international trade, the national economy, and the logistics service industry has been demonstrated through many studies. The results concluded on the unseparated situation of the logistics industry and other industries, the coordinated development of logistics and manufacturing industries, the correlated development between financial and logistics service industries, and the mutual influence of the development of the logistics industry and economic growth. Hence, an effective linkage of the above-mentioned factors would promote their growth and the optimization of developing potential and advantage. However, the economic growth in the next decades can be highly impacted by many factors from the social and demographic environment, and climate change. Therefore, the essentials of more sustainable logistics business types are acquired to be responsive to these challenges and build comprehensive supply chains. This is affirmed as the foundation for the

transformation potentials of LSPs toward providing more value to clients through innovative and integrated strategic solutions (Schaltegger *et al*., 2016).

2.2 Theoretical foundation of transformation into 4PL

2.2.1 Theory of the development of LSPs

Logistics and LSPs are considered core factors in the development of supply chains (Rafele, 2004). LSPs often expect to retain service provision and operate in the role of logistics solution providers. However, the complexity of the client's demands and expectations in professional skills, completed information flow systems, and relationship improvements in logistics services create challenges for LSPs. The market tendency requires logistics enterprises to provide large projects with integrated activities which are usually executed by 4PLs (Lieb, 2005). Due to the requirements of effective logistics solutions, LSPs have to be ready for the transformation into a higher innovative model of logistics provision to keep up with the times and gain a competitive advantage.

The definitions of 4PL are various in different studies by researchers. The term 4PL was introduced and owned by Accenture Consulting Company (Dollet and Diaz, 2011). Their definition of 4PL is stated as "A 4PL is an integrator that assembles the resources, capabilities, and technology of its organization and other organizations to design, build and run comprehensive supply chain solutions". 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 its 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. Manufacturers and retailers gain remarkable benefits thanks to 4PL's effective coordination between LSPs and their clients under the management of the overall logistics activities.

In addition, there are many other researchers 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), Supply Chain Executive Board (2005), Hoek (2006), Vivaldini *et al*. (2008), Win (2008), Ji (2008), Bajec (2009). 4PL operates to efficiently utilize all resources together with the application of IT to simultaneously decrease the firm's backwardness and increase benefits for all connected parties. Therefore, 4PL creates a competitive advantage in the global logistics market and offers dominant effectiveness in service provision to its clients. Besides, 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). According to Win (2008, p. 677), 4PL is described as follows:

"A 4PL is an independent, singularly accountable, non-asset-based integrator of a client's supply and demand chains. The 4PL's role is to implement and manage a value-creating business solution through control of time and place utilities and influence on form and possession utilities within the client organization. Performance and success of the 4PL's intervention are measured as a function of value creation within the client organization".

According to Hosle *et al.* (2017), Fulconis *et al*. (2016), logistics services are classified into five types based on the differences in service range and applied information technology levels including First Party Logistics (1PL), Second Party Logistics (2PL), Third Party Logistics (3PL), Fourth Party Logistics (4PL), and Fifth Party Logistics (5PL). Table 2.1 shows the characteristics of different logistics service providers.

Table 2.1: Classification of logistics service providers

Type	**Characteristics**
1PL (First Party Logistics Provider)	1PL performs all logistics operations for his own cargo.
2PL (Second Party Logistics Provider)	2PL takes on a part of logistics functions such as warehousing, transportation, handling, and freight forwarding. Other companies are involved in getting partial logistics outsourcing.
3PL (Third Party Logistics Provider)	3PL executes all or most of the logistics operations. A range of services is provided by 3PL shifting from a single type to a broader one including advanced supply chain solutions.
4PL (Fourth Party Logistics Provider)	4PL applies information and communication technology (ICT) to provide breakthrough solutions through the coordination of 3PLs and companies developing logistics information technology.
5PL (Fifth Party Logistics Provider)	5PL operates in logistics outsourcing based on modern network technology. 5PL concentrates on strategic management of the supply chain and has no tangible assets.

Source: Hosle *et al.* (2017), Fulconis *et al*. (2016)

Moreover, there are many other studies on 4PL and its transformation to adapt to the new challenging logistics market demand as shown in Table 2.2.

Table 2.2: Literature review on 4PLs

Researchers	Described characteristics of 4PL
Foster and Wild (1999)	4PL has the ability to implement both the provision of the integrated supply chain with various logistics services and the enhancement to 3PL in increasing capabilities of transportation and warehousing.
Magill (2000)	4PL coordinates with its clients to offer integrated logistics services to them in the ways of partnership and enhance logistics operations in the whole supply chain at tactical and strategic levels.
Huang et al. (2001)	4PL integrates operators' logistics services to create various values and improve effectively the integrated supply chain management.
Copacino and Byrnes (2001)	As a leader in logistics service providers, 4PL has to build a superior IT system and capabilities in managing information flow, strategic planning in an integrated supply chain, and efficient implementation of logistics operations.
Marino (2002)	3PL and big transportation enterprises are going to transform into 4PL to become leading logistics consulting firms through the development of their capabilities in IT application and various logistics services.
Li *et al*. (2003)	Optimizing the integration of service providers and both inside and outside resources.
Raja Simhan (2003)	Being considered as the next generation logistics aiming at value enhancement and cost reduction.
Visser *et al*. (2004)	Developing acquired expertise and logistics competence, and providing solutions for its client to improve the supply chain
Gattorna *et al*. (2004)	Managing projects and services, integrating systems and information, utilizing technology, creating constant innovation, planning and optimizing the supply chain.
Supply Chain Executive Board (2005)	Offering logistics services for the supply chain including monitoring LSP and serving great opportunities for cost reductions.

Hoek (2006)	Coordinating operation and administration, building dedicated contracts and strategic coordination of the supply chain, measuring and involving client service and results in the supply chain.
Vivaldini *et al*. (2008)	Integrating deliveries, storage, transportation, claim, and payment management.
Alan Win (2008)	Being an independent, accountable, non-asset-based integrator of supply and demand chains.
Ji (2008)	Implementing model analysis, monitoring and managing transactions, and integrating supply chain activities.
Bajec (2008)	Constructing procurement strategy, delivering customer support, utilizing technology in the supply chain, designing process, and managing distribution.
Hingley et al (2011)	The characteristics of 4PL are the outsourcing of logistics operations to 3PL for higher effectiveness.

Source: The author's study

The 4PL's objective is to minimize individual inefficiencies and, at the same time, maximize the efficiency of the entire actor network by employing IT networking and platforms (Mammitzsch and Francyk, 2012). Bourlakis and Bourlakis (2005) suggested that 4PL is used to reduce high transaction costs in buyer-seller relationships and highlighted the role of IT in reducing and absorbing complexity. Other scholars (Huiskonen and Pirtilla, 2002; Xin and Peng, 2002) identified how 4PL is used by logistics networks to lower logistics costs and enhance efficiency and coordination. Another study analyzed how different logistics resources such as physical resources, human resources, information resources, knowledge resources, and relational resources can be bundled together to assist in achieving sustainable competitive advantage (Wong and Karia, 2010; Somsuk *et al*., 2012; Phusavat *et al*., 2013). Other scholars (e.g. Remko and Ian, 2001; Xiu *et al*., 2003; He *et al*., 2004; Christopher, 2005; Feng and Juan, 2005) highlighted the strategic nature of 4PL and suggested that 4PL ensures supply chain coordination, integration, and competitiveness. Jianming (2010) concluded that the successful operation of 4PL integrates resources of a supply chain reasonably, efficiently, and flexibly. In a later study, Papadopoulou *et al*. (2013) acknowledged the importance of collaboration through 4PL partnership building, proposing thereby a framework that emphasizes the pre-selection phase by 4PL providers when forming global logistics networks.

Whether at the local or global scale, LSPs expand their service proposals with preferred support for the implementation of specialized strategies combining reliable and effective coordinators (Fabbe-Costes & Roussat, 2011; Fulconis & Saglietto, 2015). Being recognized as network organizations, these LSPs become indispensable entities in supply chain management and business-to-business coordination strategies (Håkansson & Persson, 2004; Petrișor & Petrache, 2014; Christopher, 2016). Many advanced LSPs realize that they design innovative logistics services by taking advantage of their possessed management expertise without owning a lot of resources and physical assets. These LSPs are considered the new generation of LSPs and are called 4PL providers. They operate as orchestrators utilizing an extended network of partners and their acquired expertise to serve customized solutions to their clients for obtaining objectives (Mehmann & Teuteberg, 2016). Certainly, information flow management is a vital element in logistics services provided by 4PLs together with the monitoring of partners' performance (Schramm *et al.*, 2017). Appearing to be different from traditional LSPs, the role of 4PLs is to provide solutions to given clients by coordinating supplementary activities of warehousing, packaging, transport, consulting, handling, etc. in the supply chain.

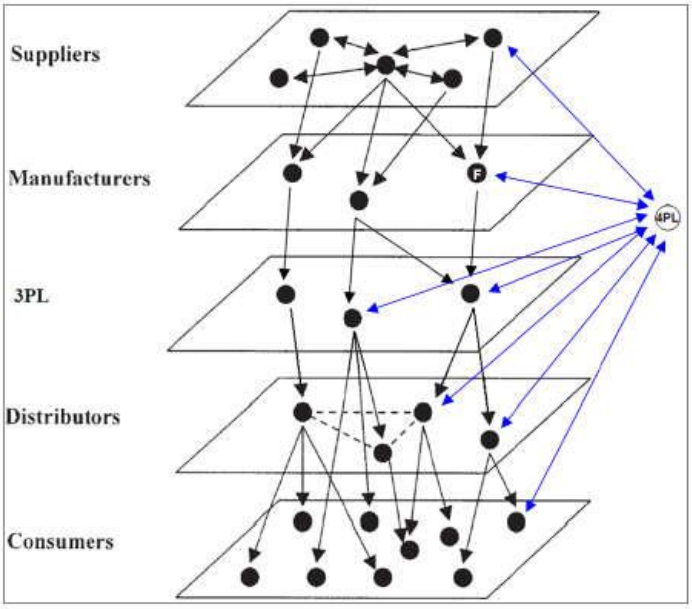


Figure 2.1: Fourth party logistics relationships

Source: Camargo *et al.* (2012)

According to Stefanson (2005), a 4PL can create a network of 3PLs and other service providers under its selection and evaluation. Then, it provides diverse services in strategic management including finance, insurance, payment, customer care, etc. besides logistics services. In the 4PL network, participants create strong relationships between themselves to ensure their performance and responsive ability to uncertainty in the fluctuating choices of customers (Win, 2008). These activities highlight the vital role of 4PL in the network as an

integrator connecting actors. Figure 2.1 exemplifies the relationships between participants in the 4PL network which become the most valuable resource and are utilized to enhance value in the whole supply chain.

2.2.2 Characteristics of 4PL

In recent years, when logistics is considered a key element by many enterprises to develop systems within their supply chains, the increasing application of logistics service outsourcing by manufacturing firms is fostering the development of LSPs. Logistics services are variously provided to the clients depending on the business model of LSPs which operates as 2PL, 3PL, or 4PL. Details are presented in Table 2.3 and Table 2.4.

Table 2.3: Comparison between 2PL, 3PL, and 4PL

Criteria	2PL	3PL	4PL
Service invovelment	Mainly providing separated transportation and warehousing services	Providing a range of logistics services	Settling the whole supply chain operations and solutions
Types of service	Implementing different functional operations based on its own capabilities	Executing all or most of logistics operations	Generating integrated solutions for the supply chain based on a long-term contract
Contact relation with the client	Contract for supplying specific logistics service	Negotiated contract	Dedicated contract and strategic coordination in the supply chain
IT application	Utilizing IT in providing logistics operations and controlling cost reduction	Optimizing IT in service provision for strengthening efficiency and speed	Combining IT and 3PL's resources to enhance efficiency and added value for logistics operations
Owned assets	Possession of assets respective to provided logistics service	High intensity of assets including vehicles, storage equipment	Low level of assets, mainly owning information and communication system

Source: Hoek (2006), Saglietto (2013)

LSPs are most commonly categorized in terms of the services that they provide on the stretch from asset-intensive to IT-intensive operations including basic

services, added value services, and strategic services (De Souza *et al*., 2008). The basic services usually consist of transportation and warehousing that are provided by 2PLs.

Table 2.4: Advantages and disadvantages of 2PL, 3PL, and 4PL

Logistics provider	Main operations	Advantages	Disadvantages
2PL	Contracting with enterprises to move goods from one location to another.	- Offering lower overhead costs for clients than shipping products by themselves. - Giving convenience to customers to choose the mode of transportation. - Being easy for clients to contract and keep track of their goods.	- Don't provide sophisticated level of delivery. - Don't offer long-term solutions, but create transactional relationships. - Can't optimize service operations due to limited scale.
3PL	Offering a wide range of logistics services and acting as a partner of enterprises.	- Faster delivery time with fewer mistakes. - Higher level of satisfaction from the clients. - More professional logistics services thanks to greater scalability than 2PLs.	- Enterprises' business become dependent on 3PLs. - Enterprises less control over their logistics activities. - Costs are higher than shipping companies.
4PL	Managing the whole enterprises' logistics needs, overseeing entire logistics chain, and optimizing resources.	- Providing a clear view of the supply chain based on sophisticated technologies. - Providing strategic solutions for the client's supply chain. - Providing best providers from the network in terms of costs, services, and value. - Significant cost savings due to the optimization of the whole supply chain.	- Offering more services than enterprises' needs. - Being expensive. - Less controlling for clients in choosing the shipping partners. - Being difficult for small LSPs to reach the scale.

Source: De Souza *et al*. (2008)

Langley (2007) notes that LSPs are moving to IT-based services with added value in response to customers' needs. They tend to develop long-term relationships with their clients rather than operating as transactional LSPs. Being considered high-level logistics operations, strategic services are related to the management

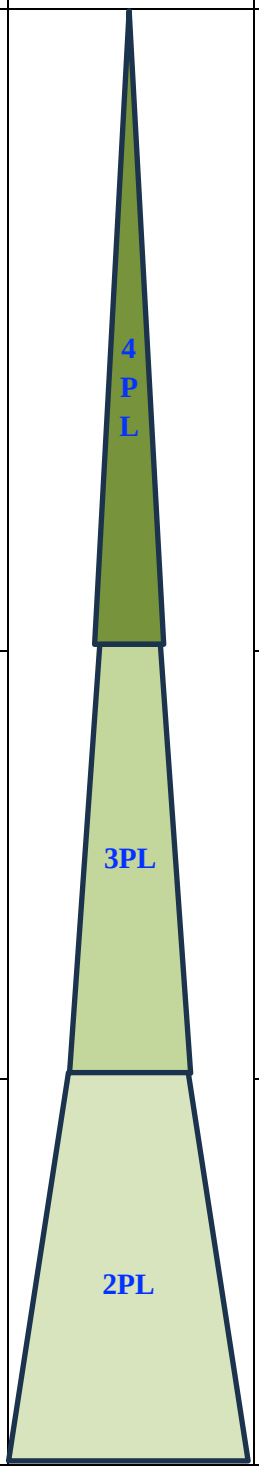
of the whole supply chain. These LSPs are identified as IT-intensive firms. Enterprises that offer strategic services become differentiated from other models and emerge among the LSPs. The customer's choice of models depends on their outsourcing plan and consideration of the advantages and disadvantages of each model as shown in Table 2.4.

The concept of 4PL can be considered a refinement to a superior level of 3PL due to its distinctive ability to "create unique and comprehensive supply chain solutions that can not be supplied or achieved by any single provider" (Li *et al.*, 2003). 4PL provides services to customers through the utilization of technology and its intellectual capability in connecting 3PLs's capacity to supply integrated solutions for the client's supply chain.

4PL works with the central role of contact in the network of many operators to coordinate all integrated parts of the strategic recommendations. "Non-asset" is assessed as the dominant characteristic of 4PL while it still ensures to achievement of the goals of superior services and cost reduction to the client firms. As a result, 4PL has emerged as the ideal consulting firm for the breakthrough supply chain solution through an effective combination of 3PLs' competencies and technology. Frost and Sullivan (2003) affirmed that "*4PL, supply chain outsourcing has undergone a paradigm shift from a cost center to a revenue-generating opportunity. It has leveraged logistics to improve the service level to customers, accelerate the speed of launching new products, and stimulate market penetration"*. Therefore, it is clear to state that 4PL has outstanding competency in designing a supply chain with the alignment of sustainable long-term investment and constant benefits from the time of achieving cost savings.

Being conducted and proved in many scientific works, outsourcing is understood as the business strategy that transfers non-core functions to external suppliers so that enterprises concentrate on critical issues for future growth. The main motives for logistics outsourcing are mainly focused on cost reduction, flexibility, and customer service (Solakivi *et al.*, 2013). The increasing decision to logistics outsourcing indicates that enterprises may gain value which is helpful for them in dealing with challenges in the business environment. The rise of logistics outsourcing and the increased complexity of SCM have led to the evolution and transformation in the logistics service industry towards the development into 4PL. Several scholars suggest concepts and point out characteristics of 4PL in their studies such as Beiderman (2005) mentioning 4PL as "the practice of consulting firms, as non-asset based managers, in overseeing the work of multiple 3PL providers in managing global supply chains"; Manchester (2001) describing 4PL as "outsourced outsourcing"; Schwartz (2003) suggesting 4PL as "extreme outsourcing model' presenting sophisticated, highly coordinated solutions for outsourcing logistics". Table 2.5 highlights the core characteristics of 4PL through a comparison between 2PL, 3PL, and 4PL.

Table 2.5: Key characteristics of logistics service providers

Relationship	Type of service offerings	Type of service provider	Relationship structure	Key characteristics
Partnership and long-term contract	Advanced services		Strategic	- Creation of supreme added value - Provision of strategic solutions for the clients - Best utilization of advanced technology - Significant cost savings - Establishment of an expertised supply chain - Constant improvement and innovation - Limitation of capable LSPs due to requirements on scale
Contractual service provision and short-term contract	Value added services		Tactical	- Faster delivery, fewer mistakes, and higher level of satisfaction - More professional logistics services - Client's dependence on 3PL - Low control of clients on their logistics activities
Commodity transaction	Traditional logistics functions		Transactional	- Lower overhead costs - Convenience in selecting mode of transportation - Simple level of delivery - No long-term solutions or service customization

Source: Gavrielatos K.A. (2007)

2.2.3 Theory of transformation into 4PL

Nowadays, LSPs are facing a lot of challenges in their provision of logistics services due to changes in international trade, e-commerce, and digitalization. The

digital economy requires logistics operators to make the transformation to adapt to the new conditions of the modern era. The innovative technology operating under the global internet network creates new opportunities for LSPs in reaching for positioning and competitiveness in the market. Moreover, the development of business models demonstrates the successful performance of the corporate strategic goals. In the global logistics market, LSPs are forced to offer a wide range of logistics services to meet the clients' expectations in terms of speed, reliability, flexibility with cost-effectiveness (Agatic *et al.*, 2020). A logistics system with digital components in logistics operations creates strategic advantages and dynamic responsiveness.

Regarding the transformation of the business model, a large number of scientific works were conducted by many scholars and contributed significant value to the modern literature. In an empirical study, Von Delft (2019) presented a conceptual innovative business model based on the proposal of the advancement of theories and approaches toward global orientation. Based on the global supply chain, corporate data, and theories in the business model, the research developed a conceptual business model leading the way to gain innovation through specific activities related to global knowledge such as assessment, integration, transformation, and application. In order to obtain global competitiveness by creating innovation in the business model, an enterprise must identify its ability to make unique value and integrate resources. When global connectivity of supply chain partners is executed, these coordinators work as providers of valuable knowledge, reshape the entire supply chain, and create new forms of collaboration (Cano-Kollmann *et al.*, 2016). With the outsourcing trend in the logistics market, enterprises are increasingly aware of the allocation of high-value-added activities such as research and development (R&D) and marketing and building a close connection to the new and more open model (Buckley and Strange, 2015). Besides, many other researchers have studied the importance of global supply chain and business model innovation to the enterprise's success such as Cao and Zhang (2011), Kastalli and Van Looy (2013), Kim and Min (2015), Karimi and Walter (2016), Verwaal (2017).

In the context of changes in the global market, the logistics industry is dramatically influenced by many factors. However, it leads to opportunities for LSPs to promote value creation in logistics operations and to stipulate new management forms of the supply chain (Schaltegger *et al.*, 2016). The supply chain is likely to make a transition remarkably due to the impacts of those changes. Then, integrated solutions mentioning the core elements of business strategies are essential for the management of transformation in the entire supply chain to ensure sustainability (Schaltegger *et al.*, 2016). Hence, LSPs' understanding of their transformation potential will motivate them to develop their business models in an innovative, integrated, and sustainable way.

In line with sustainable business models, LSPs operate the supply chain towards making the alignment of logistics activities provided by different operators more sustainable and creative (Boschian and Paganelli, 2016). According to Gruchmann (2019), business models in the logistics industry are classified based on their offered service range and organizational structure. Common categories consist of LSPs from 1PL to 4PL with different scales and scopes of logistics services from separate operations to integrated solutions for the client's supply chain. 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. As a result, companies have coordinated with 4PL as a strategic partner. Accordingly, when regarding the development of LSPs to 4PL, Visser *et al*. (2004) analyzed the transformation process into 4PL and suggested that LSPs should have good preparation for the transition. 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 chain.
- Serving clients' expectations and demands based on high utilization of information systems but low dependence on owned physical assets.

2.3 Key attributes of 4PL

2.3.1 Value chain creation

Explanations of the term 'value' are popularly varied due to different perspectives. Basic differences are from the points of the manager or customer. The manager wants to create value for his shareholders and customers while customers desire to acquire more benefits for the products or services that they purchase. Walters and Rainbird (2007) considered that 'Value is a term frequently used but infrequently understood and of which numerous interpretations exist'.

According to Porter (1996), companies can be superior to their competitors when they create differences by granting higher value to customers or providing them with cost-effective equal value. Walters and Rainbird (2007) pointed out that the value chain process includes identifying value expectations, creating value, producing value, communicating the value, delivering the value, and servicing the value. Under increasing expectations of the value chain, Bowersox *et al*. (2007) affirmed that 'There was a radical shift from single function to multifunctional outsourcing. Integrated service providers began to market a range of logistics services.

4PL has become an ideal integrator that provides enterprises with multifunctional outsourcing. Moreover, they are turning to 4PL to construct relationships with partners during their supply chain to focus on cost-cutting and dealing with

unexpected matters in supply and demand so that they ultimately have the best results in their operations (Frost and Sullivan, 2005). In order to fulfill the prime role of providing value to customers, 4PL utilizes resources from its own and best value-added providers simultaneously. 4PL's capacity in value creation depends on its ability to choose and combine resources that create extreme value for its clients under specific strategy customization. The benefits of added value that client firms achieve when outsourcing logistics operations to 4PL are mentioned in Figure 2.2.

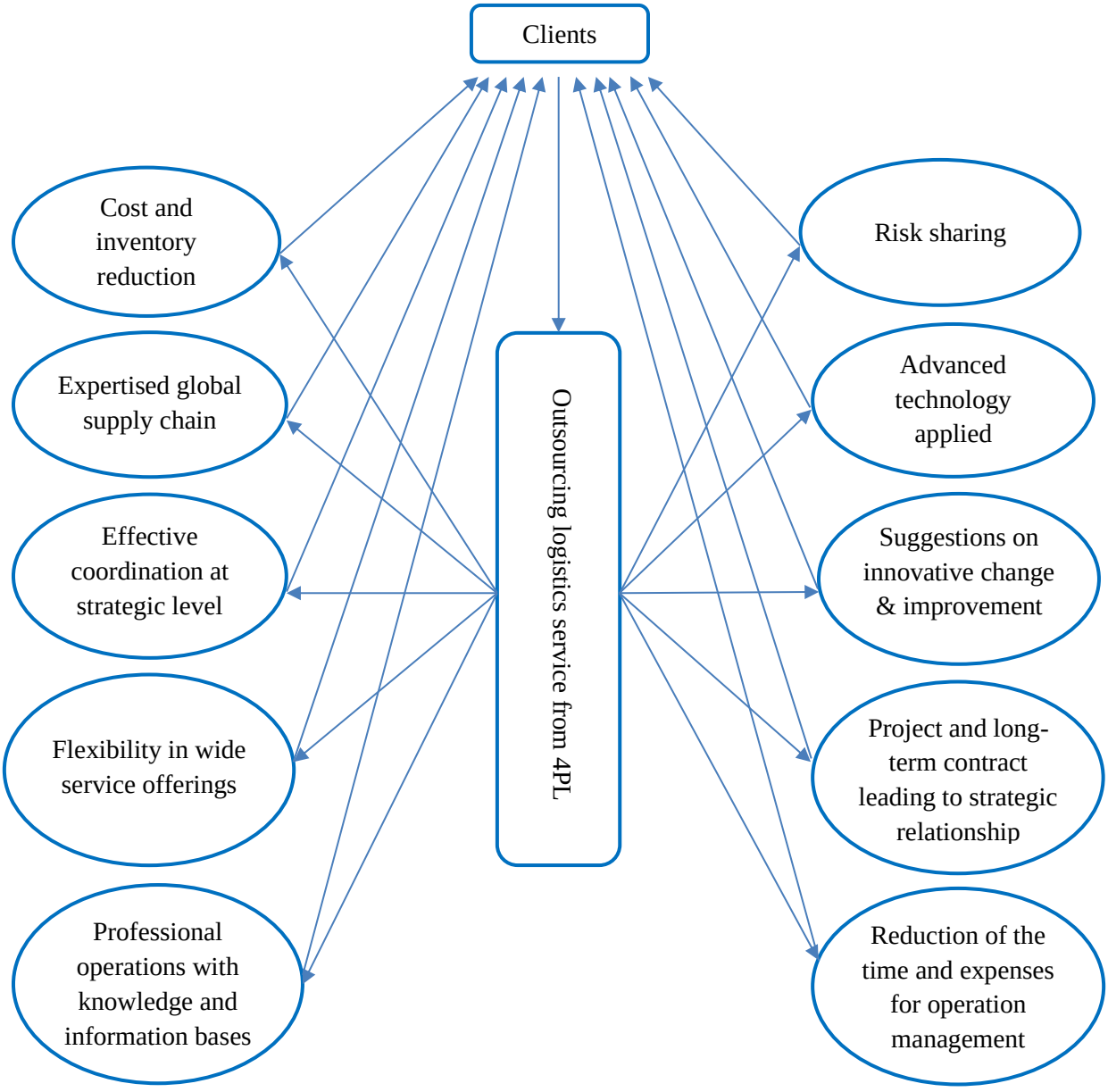


Figure 2.2: Value achieved from outsourcing logistics service from 4PL

Source: Frost and Sullivan, 2005

With the main goal of focusing on the whole supply chain system, 4PL can effectively integrate a variety of fragmented external resources and create value for the clients through customized solutions in six groups of activities including

cost and expense savings; reduction of risk inventory; expertise in global supply chain and operations; flexible service offerings; strategic coordination in the long-term contract; innovation and improvement suggestions with advanced technology application. Thanks to the mentioned outstanding benefits and the fast growth of global purchasing, manufacturing, and trading, 4PL can optimize the allocation of supply chain resources, improve the speed of market response, and increase the efficiency of logistics operations.

2.3.2 Integration of multiple 3PL providers' activities

Langley *et al*. (2005) differentiated logistics models into two-tiered relationship structures with details in relationship attributes and service attributes. For relationship structure, 3PL operates at the tactical level while 4PL's activities are at the strategic level. In terms of relationship attributes, 4PL works with characteristics such as partnership joint venture, value-based, risk sharing, few partners, long-term, common core value, alignment, and trust. Meanwhile, the activities of 3PL are concentrated on the contractual, fixed and variable, transaction-oriented, and short-term. Coyle *et al*. (2003) noted that the trend toward the application of 4PL appears where 3PLs' activities are managed to ensure operations in the supply chain for enterprise customers. Under a strategic role, 4PL works as the integrator to provide benefits to customers by connecting their needs and available resources from the network of 3PLs, IT providers, and consultants. In addition, Frost and Sullivan (2004) affirmed that 4PL, being considered a breakthrough supply chain solution, integrated effectively competencies of 3PLs, superior consulting companies, and IT providers.

2.3.3 Management of global supply chain

The Council of Supply Chain Management (SCM) Professionals (CSCMP) (2004) delivered the definition of supply chain management as 'The planning and management of all activities involved in sourcing and procurement, manufacturing processes, and all logistics management activities, including coordination and collaboration with suppliers, intermediaries, third-party service providers, and customers. Saglietto *et al*. (2007) defined supply chain management as a set of managerial strategies and practices aiming at designing, coordinating, and managing operations in the supply chain. Bechtel and Jayaram (1997), Christopher (1997), Lambert *et al*. (1998), Frohlich and Westbrook (2001), Zailani and Rajagopal (2005) considered the importance of combination in supply chains at both strategic and operational levels and pointed out that it is one of vital parts of logistics operations and supply chain management. Together with the growth of the logistics outsourcing trend, firms broaden their logistics outsourcing from traditional distribution activities such as transportation and warehouse operations to strategic solutions for the whole process of business operations. As a result, 4PLs could work as LSPs and consultants in designing and managing the supply chain (Fulconis *et al*., 2006).

According to Cooper *et al*. (1997), supply chain management is understood as a system of enhancing the integration of activities to create a value-added chain for customers. Wildemann (2001) pointed out the aims of supply chain management as optimization of process cycles, improving the service value, and increasing flexibility of logistics operations through utilizing resources in efficient and cost-effective ways. Rajaguru and Matanda (2013), Kasperek (2013), Win (2008), Yao (2010), and Vinay *et al*. (2009) proved that 4PLs could be able to reach these objectives through strategic planning within the supply chain. Based on the definition of the Consulting group Accenture, the core superiority of 4PL is to make the integration of resources in the supply chain. Customers could be provided customized integration solutions with fast, high-quality, and cost-effective logistics services. In the research, Jianming Yao (2010) set up a systemic integration frame for 4PL used for decision-making in supply chain resource integration. The researcher also discussed dominant factors that are vital to 4PL to reach its prime objectives.

Since the late 20th century, the development of technology in telecommunication and transportation, together with the globalized orientation of countries in the world, has made enterprises look for suppliers and coordinated partners anywhere (Trent and Monczka, 2005). The supply chain now become a global supply chain due to complicated operations and management. The integration of new elements appears in decision-making matters such as working standards, culture, language, ethical standards, management practices, etc. This increasing complexity is integrated into the decision-making processes and strategy building to partners in global networks.

The aforementioned review acknowledges the role, importance, and characteristics of 4PL for the achievement of particular objectives and competitive advantage for manufacturing and retailing firms that are target customers of 4PL service providers. As time goes by, the large number of manufacturing and retailing firms that no longer want to manage their logistics by themselves has kept on increasing. They consider LSP as an important component in the development of their supply chains (Rafele, 2004). The LSP usually intends to maintain its services and continue working as a logistics solution provider. The tendency in the contracts between LSPs and their clients is for greater geographic coverage and more activities. Clients expect to achieve greater skills in service development, relationship improvements, relevance in information, and involvement of integration rules and concepts in the supply chain through the LSP, and to build expertise and dedicated operations.

3. FUNDAMENTALS OF FACTORS IMPACTING THE TRANSFORMATION INTO 4PL

3.1 Transportation capability

In many industries, logistics is very helpful in the optimization of production and distribution processes through effective resource management to increase efficiency and competitive advantage. One of the key elements of logistics service is the transportation capability of LSPs. Transportation operations have a high impact on the effectiveness of product movements. Transportation accounts for a high part of logistics costs due to its operating spread from manufacturing to distribution to the customers in the markets.

Transportation capabilities refer to LSPs' ability to deploy resources in performing transportation to achieve a market advantage. Makadok (2001) emphasized that LSPs can easily duplicate investments in physical resources but superior performance depends on how LSPs leverage their resources. In studying the role of transportation capabilities in international supply chain management, Morash and Clinton (1997) compared the supply chain structures and transportation capabilities of approximately 2,000 firms from four industrialized nations including The United States, Japan, Australia, and Korea. The research results implicate measurement indicators including time compression, reliability, just-in-time delivery, flexibility, standardization, and customization.

Park (2011) pointed out that the main elements of competitiveness between companies include human resources, transportation capability, finance, databases, and assets. Transportation monitoring which is a component of the supply chain focuses on planning and managing material and product flows. Transportation planning provides the opportunity for firms to maximize cost-effectiveness when it efficiently integrates collaborative partners (Mason *et al*., 2007). The 4PL's goal is to effectively utilize resources of the supply chain, which means that 4PL is capable of highly competent transportation control. In order to examine the supply chain in the aspect of building components, Vidalakis et al. (2011) applied a simulation-based approach which consists of involved actors including transportation capability. The concentration of the simulation is to construct better planning for transportation capacity. In this case, the role of transportation capability is of essential significance.

Logistics operations could provide high-quality services when LSPs have advanced transportation systems. According to Chang (1988), the average cost of transportation accounted for 6.5% of market revenue and 44% of logistics costs. Due to the remarkable significance of transportation, the evaluation of the efficiency of transportation models has been conducted by many scholars including Smith and Nash (2014), Mandic *et al*., (2014), Chakhtoura and Pojani (2016), Rodseth (2017), Cui and Li (2017a, 2017b, 2017c).

3.2 Warehouse operations

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. Although warehouse operations vary in different operating conditions of the supply chain based on customer needs, its fundamental characteristic is capacity. Analyses on the design and organization of logistics infrastructure in the supply chain are conducted in detail by Berry (1968), Bozer *et al.* (2005), Jacyna-Gołda (2014), Roberts *et al.* (1972). Later studies which are studied by Frazelle (2008), Gu *et al.* (2010), Jacyna et. al. (2016), Rouwenhors *et al.* (2000), and Żak (2014) presented a review and comparative analyses. The study of Kłodawski *et al*. (2017) showed a literature review on various stochastic models for analyzing warehouse operations and relevant warehouse strategies through studies conducted by Chew *et al.* (1999), Le-Duc *et al.* (2005), Yu *et al.* (2009). In the research, Kłodawski *et al.* (2017) pointed out that continuous and proper warehouse operations are very important impacting significantly the whole supply chain. Therefore, it is necessary to have an effective choice of warehouse strategy for carrying out the tasks in logistics service. The value of warehouse strategies is demonstrated through investments and modernizations to advance the potential of warehouse operations including performance and capacity.

3.3 Information technology application

Information technology is the use of any computers, storage, networking, and other physical devices, infrastructure, and processes to create, process, store, secure, and exchange all forms of electronic data. Scholars (Sabherwal and Jeyaraj, 2015; Chaysin *et al*., 2016) highlight the contribution of IT in helping to restructure the entire distribution setup to achieve higher service levels; and lower inventory and supply chain costs. Investments in IT systems would enhance logistics performance (Devaraj and Kohli, 2000; Lim and Palvia 2001; Bardhan, Mithas, and Lin, 2007; Pinna *et al.*, 2010; Sinkovics *et al.*, 2011; Evangelista *et al.*, 2012; Ghobakhloo and Hong, 2014; Karagöz and Akgün, 2015; Wong *et al.*, 2016). Sauvage (2003) stated that large-size logistics companies would probably invest in information systems more to attain a competitive edge and take the lead in the global supply chain network.

In terms of the impact of IT developments on the integration of LSPs, Jayaram and Tan (2010) concluded that it is essential to have the integration of LSPs into the supply chain, but the integration of IT systems and solutions between coordinating partners has core significance. The product quality and profitability of logistics firms have been improved by better information systems (Stank *et al.*, 1999). Capabilities in logistics services are drivers for superior performance. These include electronic data interchange (EDI) linkage, freight consolidation, warehousing, consulting, and freight bill payment. It emphasizes on physical

equipment and information system that an LSP owns and utilizes to foster communication and execution of logistics operations of its customers. According to Weill *et al.*, (2002), IT developments make it possible for enterprises to react rapidly and cost-effectively to electronics-based challenges. LSPs that have better IT infrastructure are able to react more quickly, as well as to reach better growth rates, better sales, and realize shorter returns on investment.

3.4 Human resources

Human resources refers to a group of individuals who participate together in the contribution to the firm's objectives (Alexander *et al.*, 2013). A skilled workforce is essential for running a stable and complicated logistics system. Benefits gained from human resource performance including recruiting, training, and assessment help firms improve the whole supply chain effectiveness and enhance competitive advantage (Hall *et al.*, 2013). Skilled and talented employees are a valuable asset to companies. Human capital is invested by firms for the purpose of enhancing their competitive ability in the market (Elsdon, 1999).

The International Ergonomics Association (IEA) states the definition of ergonomics as "Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions amongst humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well being and overall system performance" (IEA, 2019). The definition points out that the combination of system and human resources enhances the social and firm objectives.

Logistics services is an industry focusing much on the human factor. Firms are under pressure to ensure that they have enough skilled laborers at all levels through the management chain. Therefore, firms must select the most qualified humans to ensure the achievement of business objectives. Gatewood and Field (1994) assumed that knowledge, skills, and abilities are predictors of success in the job while McDaniel *et al.* (1988) evaluated the role of training and experience. A survey of senior logistics executives which was conducted by Ginter and La Londe (2001) indicated that 95% of the respondents held baccalaureates, 56% graduate degrees, and 22% professional certifications. Other researches were conducted to study the role of human factors in logistics services. Okeudo (2012), through data collected from LSPs, concluded that LSPs will improve their performance if there is an increase in the 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 commitment and capabilities to LSPs. Anastasiou (2012) assumed that practices on human resources positively support the supply chain effectiveness and stimulate innovation.

Logistics operations play an essential role in creating value and competitive advantage for clients. Despite the automation of the logistics system, many

operation processes are performed by humans. Battini *et al.* (2015) argued that planning models would be productive, efficient, and realistic when human factors are considered in designing production and logistics systems. According to Neumann and Dul (2010), new technology application significantly achieves benefits when there are regulations in human factors.

3.5 Logistics services

The word "logistics" has its origin from the ancient Greek word. This term was formerly used in the military. It was responsible for the supply of all necessities and movements of things in the military. Oxford English Dictionary defines logistics as "The branch of military science having to do with procuring, maintaining and transporting material, personnel and facilities". However, the modern concept of logistics mentions it as a cost and time-effective service for mainly the commerce sector. Logistics service includes many activities from goods movement, packaging, warehousing, and procurement to order processing. 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". According to Rushton (2009), logistics mentions the transport of products from supplying materials through the production process to consumers in a cost-effective way. The Charter of the Institute of Logistics and Transport (CILT) (2012) suggests logistics focus on exactly delivering what customers want at the right time, in the right place, and at the right price. The term logistics is defined by CILT (2012) as "The process of designing, managing and improving such supply chains, which might include purchasing, manufacturing, storage and, of course, transport."

Logistics services consist of five key elements warehousing, transport, inventory, packaging, and information processing. Transport and warehousing often play the main parts in most provided logistics services. All industries need logistics services although it is considered to serve mainly the manufacturing industry. Bert *et al.*, (2010) stated that handling, movement, and storage are activities of logistics management in the supply chain, 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 and Waugh, 2014). Considering the importance of logistics, Gattorna (2010) mentions logistics as "supply chains consist of the logistics system of networks".

3.6 Transportation infrastructure

With the recent trend of nationalization and globalization, the importance of logistics services has been growing. Logistics helps to optimize the existing production and distribution processes based on the same resources through management techniques for promoting the efficiency and competitiveness of enterprises. The key element in a logistics chain is the transportation system, which joins the separated activities. Transportation occupies one-third of the

amount in the logistics costs. Transportation systems hugely influence the performance of logistics systems. Transporting is required in the whole production procedure, from manufacturing to delivery to the final consumers and returns. Only good coordination between each component would bring the benefits to a maximum level. According to Grzelakowski (2014), logistics infrastructure which includes various facilities, equipment, technical devices, and means, significantly contributes to the effective performance of the logistics processes. Logistics infrastructure comprises warehousing infrastructure, handling infrastructure, transport infrastructure, transport packaging infrastructure, and IT infrastructure. In other words, transport infrastructure is considered a part of logistics infrastructure and remarkable impact on the potential of the logistics industry. Besides, Bolumole *et al*. (2015) indicated that several countries have upgraded their transportation infrastructure and technology to obtain big market share.

A good transportation system in logistics activities could provide better logistics efficiency, reduce operation costs, and promote service quality. The improvement of transportation systems needs effort from both public and private sectors. A well-operated logistics system could increase both the competitiveness of the government and enterprises. The Transportation system is considered the most important economic activity among the components of business logistics systems. According to the investigation of National Council of Physical Distribution Management (NCPDM) in 1982 (Chang, 1988), the cost of transportation, on average, accounted for 6.5 % of market revenue and 44% of logistics costs. The transport system makes goods and products movable and provides timely and regional efficacy to promote value-added under the least cost principle. Transportation affects the results of logistics activities and, of course, influences production and sales. In the logistics system, transportation costs could be regarded as a restriction of the objective market. The value of transportation varies with different industries. For those products with small volume, low weight, and high value, transportation cost simply occupies a very small part of sales and is less regarded; for those big, heavy, and low-valued products, transportation occupies a very big part of sales and affects profits more, and therefore it is more regarded.

Transportation plays a connective role among the several steps that result in the conversion of resources into useful goods in the name of the ultimate consumer. It is the planning of all these functions and sub-functions into a system of goods movement to minimize cost and maximize service to the customers that constitutes the concept of business logistics. The system, once put in place, must be effectively managed (Fair *et al.*, 1981). These developments reflect factors such as better transportation services and pressures to improve logistics performance. The role that transportation plays in the logistics system is more complex than carrying goods for the proprietors. Through the well-handled

transportation system, goods could be sent to the right place at the right time to satisfy customers' demands. It brings efficacy and also builds a bridge between producers and consumers. Therefore, transportation is the base of efficiency and economy in business logistics and expands other functions of the logistics system. In addition, a good transportation system performing logistics activities brings benefits not only to service quality but also to company competitiveness.

3.7 Logistics outsourcing trend

Logistics outsourcing has remarkably grown all over the world. The increasing application of logistics services by manufacturing firms is fostering the development of LSPs. The main motives for logistics outsourcing are mainly focused on cost reduction, flexibility, and customer service (Solakivi *et al.*, 2013). LSPs demonstrate their important role in quality issues in manufacturing firms (K. Gotzamani *et al.*, 2010). Enterprises coordinate with LSPs for various reasons. The increasing decision to logistics outsourcing indicates that enterprises may gain value which is helpful for them in dealing with challenges in the business environment.

According to Sink and Langley (1997), outsourcing is a business strategy that transfers non-core functions to external suppliers so that enterprises concentrate on critical issues for future growth. Logistics outsourcing means that a part of logistics or all activities of logistics are implemented by logistics service providers. It involves the transferring of an existing process or function to a logistics service provider to provide the service onshore or offshore (Frankfurt, 2005). Gattorna (1998) and Gavrielatos (2007) stated variations on logistics outsourcing as follows:

- Absolute independence (100 % insourced): all logistics functions are conducted in-house.
- 2PL – Transactional logistics outsourcing: Contracting of specialized functions: some logistics functions are outsourced to traditional contractors.
- 3PL – Tactical logistics outsourcing: management of parts of the supply chain outsourced to a 3PL provider.
- 4PL – Strategic logistics outsourcing (100 % outsourced): comprehensive supply chain solutions for clients through integrating 3PL providers, IT, and business process management.

Enterprises have been motivated to logistics outsourcing to reach certain objectives including cost saving (Jiang *et al.*, 2006; Lau and Zhang, 2006; Aimi, 2007), product quality improvement (Bardhan *et al.*, 2006), flexibility improvement (Lau and Zhang, 2006), and market share increase (Skjoett-Larsen, 2000). Logistics outsourcing is the effect of global competition on markets, high focus on core competencies, information and communication technology, and rising customer expectations (Marasco, 2008; Sheffi, 1990). The trend of logistics

outsourcing is increasing in the upcoming time. Langley and Capgemini (2008) stated the rate of logistics outsourcing in regions in the world with 49 % in North America, 61 % in Europe, 57 % in Asia Pacific, and 48 % in Latin America. Another study showed that the growth forecast for logistics outsourcing between 2009 and 2022 was 17 % (Deepen *et al.*, 2008).

Firstly, transactional logistics outsourcing (2PL) is implemented without long-term contracts and bonds between outsourcing enterprises and logistics service providers (Gavrielatos K.A., 2007). 2PL providers supply only a single operation in the logistics chain such as transportation, warehousing, customs formalities, and payment to meet shippers' demands (Frankfurt, 2005). This type hasn't combined single logistics operations into the connected chain. Enterprises of this type include shipping companies, warehousing service companies, customs formalities service companies, and payment service companies.

Secondly, tactical logistics outsourcing (3PL) is executed based on long-term contracts under the integration of an IT system to facilitate free information flow and build a transparent supply chain system (Gavrielatos, 2007). Services that are outsourced to 3PLs have shifted from being a single type of service to a broader range of services, including advanced supply chain solutions (Soinio *et al.*, 2012). The operations of 3PL providers involve the collection of outbound shipments from manufacturers and the consolidation of shipments in their distribution centers. The consolidated shipments are then moved to the customer through alternative transportation routes (Tyan *et al.*, 2003).

Thirdly, the strategic logistics outsourcing (4PL) is the most advanced model. It leads to breakthrough solutions to modern supply chain challenges with the purpose of providing maximum benefits to the customers (Gattorna, 1998). Unlike 3PL, 4PL's service provision combines process, technology, and management (Mukhopadhyay, 2006). In recent years, 4PL service providers have contributed to the sustainable competitiveness of all the collaborating manufacturing companies (Hoffman, 2000). 4PL development highlights the ways companies initiate innovative practices in the coordination of IT management and other resources to make profound changes for better competition. Many scholars suggested that logistics operations should be managed by 4PLs networks with strong cooperation between 3PL firms and companies that are developing the latest logistics information technology (Folinas *et al.*, 2004; Bourlakis and Bourlakis, 2005; Krakovics *et al.*, 2008).

3.8 Competition in logistics market

According to the Report on Logistics in Vietnam 2017 issued by 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 in the world include DB Schenker, Deutsche Post DHL Group, Kuehne + Nagel, DSV, C.H. Robinson, Rhenus, Agility, Allcargo Logistics, APL Logistics, Damco,

FedEx Supply Chain, Gati, UPS, Nippon Express, Imperial Logistics, Ceva Logistics, etc. Amongst these logistics enterprises, Ceva Logistics, Deutsche Post DHL Group, FedEx Supply Chain, and UPS are withholding around 15 % of the global logistics market share. In order to maintain their positions, logistics giants set up strategies for investment in widening their operations as well as applying new technology. With such a tendency of the ever-increasing development of logistics enterprises, competition happens in all segments of the global logistics market.

Amstrong and Associates (2017) affirmed that e-commerce has become the key factor in the development of global logistics in the coming time. In the forecast up to the year 2020, e-commerce will account for 7.2-7.5 % of total revenues of world logistics. Besides, green logistics is an inevitable tendency in the time of environmental pollution and resource exhaustion. In order to catch up with the new trend derived from industry 4.0, large logistics companies in the world have improved their operations by applying automated tools such as Automated Guided Vehicles (AGV), co-pilot, mapping, direction routing, logistics Scandit, the easy stock, web fleet, Cerasis Rater, etc. IoT has nowadays become the key to creating a competitive advantage for logistics enterprises.

Regarding the price of the logistics service, Yao and Zhang (2012) conducted research on the pricing strategy for shipping services to gain a competitive edge for LSPs. In addition, Ha *et al*. (2003) pointed out that an effective delivery speed can become a competitive advantage for LSPs. Since LSPs are facing challenges in gaining profits and market share, they have to make superior operational, tactical, and strategic decisions in shipment, warehouse; resource and transportation planning; and investment and service levels (Ghiani *et al*., 2004; Chen, 2008; SteadieSeifi, 2011; Park and Min, 2017).

3.9 Policies in logistics industry

In the new economic situation, the logistics industry has achieved rapid development and played the role of pillar industry in the national and regional economic development. The mechanism and policies for logistics industry development have a vital significance for LSPs. In recent years, many scholars in the world have paid a lot of attention to the issues of development policies for the logistics industry. From the research level, development policies for the logistics industry can be classified into national and regional levels (Hai *et al.*, 2005; Hens *et al.*, 2011; Masahiro, 2010; Pilar *et al.*, 2004). At the national level, logistics policies are issued to promote the economy at the level of macroeconomics (Magnus and Ruth, 2010). At the regional level, scholars proposed logistics policies under specific regional conditions (Jin, 2012; Liu *et al.*, 2013).

Shuihai *et al.* (2014) conducted analyses of the interactive mechanism between the logistics industry and the regional economy from a macroeconomic view and built a dynamic model of development policies for the logistics industry. In their

research, they simulate the model with 4 policies including Policy I: Change the technology investment efficiency; Policy II: Increasing investment in fixed assets; Policy III: Adjusting industrial structure; and Policy IV: Comprehensive policy. Scholars stated that development policies for the logistics industry have clear significance in promoting the efficiency of LSPs. Besides, from the effect of a single policy, the policy of Technology investment efficiency has a better effect on GDP, logistics demand, and actual logistics cost than other policies. The policy of increasing the investment in fixed assets has the best pull effect on the logistics supply capacity. Finally, from the comprehensive effect of policies, the effect of the comprehensive policy is significantly better than the effect of a single policy.

4. INNOVATION IN LOGISTICS SERVICE

4.1 TRIZ innovative approach

4.1.1 Fundamentals of TRIZ

TRIZ, the Russian acronym for "Theory of Inventive Problem Solving", was developed by Henrich Altshuller in 1946 and has been applied in different industries. It is acknowledged as the unique systematic technology for generating innovative solutions in solving problems through the analyses and application of a series of directions. In TRIZ, a systematic analysis of the problem would be solved, and the selection of suggestions made based on solution alternatives. TRIZ analysis classifies innovative problems and provides corresponding methods for solving problems. Contradictions would be involved in the process of problem settlement. Alsthuller initially constructed a set of tools and methods to identify and resolve problems for engineers. Then, these methods were improved with a theoretical corpus. Until now, TRIZ has provided foundations and assumptions with a framework to build problem-solving methods. TRIZ could introduce breakthrough solutions to enhance the effectiveness of the results.

TRIZ is developed and operated based on three axioms as follows:

- Contradictions: contradictions derive from evolutionary trends, expectations, or chances for the system development. Contradictions should be overcome to ensure the existence of the system.
- The rules of evolution of technical system: evolution of technical system and tendency are examined to evaluate and orient the problem-solving process.
- The specific requirements: making contextualization of evolution and the problem to be solved.

Based on the principles of TRIZ inventive approach, Simon (1977) pointed out four steps in problem-solving: defining the problem, constructing solutions, selecting solutions, and implementing solutions. However, Mann (2009) made some changes in this problem-solving process in which four steps are problem identification, tool selection, solution generation, and solution evaluation.

Meanwhile, four steps in the analytical application of TRIZ are suggested by Waransky (2002) including identifying the problem, determining the parameters for improving and worsening, studying innovative principles, and formulating strategies. According to Mann (2007), TRIZ's systematic innovative process leads a specific problem to a specific solution through two generic steps of problem and solution in the process derived from 39 engineering variables, 40 inventive principles, 76 standard solutions, and TRIZ contradiction matrix.

In the TRIZ inventive approach, 39 engineering variables of the system operate in the dependent relationship although some of them are positive and some are negative to others when proposing the problem-solving approach. Due to their contradictory effects, these 39 engineering variables are classified as improving and worsening parameters in the contradiction matrix. When a problem is identified to be solved, the improving feature is initially pointed out to be changed, then the unexpected side effect from this change is forecasted. Principles among 40 inventive principles are proposed based on the interaction between improving and worsening parameters. Details of 39 engineering variables are presented in Table 4.1.

Table 4.1: TRIZ 39 engineering variables

No.	Name of parameter	No.	Name of parameter
1	Weight of moving object	21	Power
2	Weight of stationary object	22	Loss of energy
3	Length of moving object	23	Loss of substance
4	Length of stationary object	24	Loss of information
5	Area of moving object	25	Loss of time
6	Area of stationary object	26	Quantity of substance/the matter
7	Volume of moving object	27	Reliability
8	Volume of stationary object	28	Measurement accuracy
9	Speed	29	Manufacturing precision
10	Force (Intensity)	30	Object - affected harmful factors
11	Stress of pressure	31	Object - generated harmful factors
12	Shape	32	Ease of manufacture
13	Stability of the object's compostition	33	Ease of operation
14	Strength	34	Ease of prepair
15	Duration of action of moving object	35	Adaptability or versatility
16	Duration of action by stationary object	36	Device complexity
17	Temperature	37	Difficulty of detecting and measuring

18	Illumination intensity	38	Extent of automation
19	Use of energy by moving object	39	Productivity
20	Use of energy by stationary object		

Source: Altshuller, 2002

TRIZ 40 inventive principles are recognized as systematic solutions and potent tools for moving paradigms toward creativity and higher effectiveness. Altshuller first suggested 40 inventive principles for engineers to find creative solutions to problems. Then these inventive principles were applied in the service sector. Innovators selected the highest probabilities that were workable to resolve the problems. The table of contradictions provides which inventive principles to be used in certain circumstances. Each intersecting cell in the contradiction matrix presents a contradiction created by two separated parameters, i.e. improving and worsening parameters. Each cell in the contradiction matrix refers to inventive principles out of TRIZ 40 inventive principles as shown in Table 4.2.

Table 4.2: TRIZ 40 inventive principles

No.	Name of parameter	No.	Name of parameter
1	Segmentation	21	Skipping
2	Taking out/Separation	22	Blessing in disguise
3	Local Quality	23	Feedback
4	Asymmetry	24	Intermediary
5	Merging	25	Self-service
6	Universality	26	Copying
7	Nested Doll'	27	Cheap short-living objects
8	Anti-Weight	28	Mechanics substitution
9	Preliminary Anti-action	29	Pneumatics and hydraulics
10	Preliminary Antion	30	Flexible shells and thin firms
11	Beforehand Cushioning	31	Porous materials
12	Equipotentiality	32	Colour changes
13	The other way around'	33	Homogeneity
14	Curvature	34	Discarding and recovering
15	Dynamization	35	Parameter changes
16	Partial or excessive actions	36	Phase transitions
17	Another dimension	37	Thermal expansion
18	Mechanical vibration	38	Strong oxidants
19	Periodic action	39	Inert atmosphere
20	Continuity of useful action	40	Composite materials

Source: Altshuller, 2002

Based on the studies of thousands of patents, Altshuller created a set of 76 standard solutions upon developing and transforming the operating system

towards eliminating contradictions. After some improvements, the number of standard solutions was affirmed at 76 and classified into 5 classes as mentioned in Table 4.3.

Table 4.3: TRIZ 76 standard solutions

No.	Category	No. of standard solutions
1	Improving the system with no or little change	13
2	Improving the system by changing the system	23
3	System transitions	6
4	Detection and measurement	17
5	Strategies for simplification and improvement	17

Source: Altshuller, 2002

4.1.2 TRIZ contradiction matrix

According to Ilevbare *et al*. (2013) and Kim et al. (2009), TRIZ was constructed based on patent analysis and developing trends of technical systems. In the beginning, TRIZ was intentionally developed to solve technical problems. However, Nadhmi and Azizah (2014a, b, 2015) pointed out that TRIZ has been also applied in non-technical fields such as business, management, finance, and marketing. Due to fast-changing market situations, the application of new methods for generating creative solutions is significant to enable enterprises to face complicated problems. TRIZ is considered the most structured method for innovative enhancement thanks to its covering of different aspects of the system.

In TRIZ methodology, problem-solving is directed from the contradiction matrix where 40 inventive principles are presented for the direction of problem-solving depending on specified characteristics. The matrix is constructed with 39 engineering variables arranged in vertical and horizontal directions forming a 39 x 39 matrix as shown in Table 4.4. From the analysis of the problem, improving parameters are identified, and then, worsening ones will be also simultaneously determined. In the interface of the matrix, the intersection of column and row of engineering variables indicates the conflict between these parameters. Suggestions for inventive principles to be applied are introduced in the matrix to eliminate the contradiction. For defined problems, relevant suggested solutions are introduced in the matrix. However, which suggestions are selected to implement depending on the state of the problems and the circumstances. Due to the remarkable differences between technical and service fields, several given recommendations in the matrix may not be appropriate for all cases in these two fields in reality. As a result, the considerations and investigations of the best choices are primely important in establishing strategies for innovation based on TRIZ methodology. The identification of improving and worsening features is

considered the vital foundation in the process of TRIZ implementation. A typical example of TRIZ application in a service area is illustrated in Figure 4.1.

Table 4.4: Partial contradiction matrix

Improving feature ↓ / Worsening feature →		Weight of moving object	Weight of stationary object	Length of moving object	Length of sationary object	Area of moving object	Area of stationary object	Volume of moving object	Volume of stationary object	Speed	Force (Intensity)	Stress of pressure	Shape	Stability of the object's compostition
		1	2	3	4	5	6	7	8	9	10	11	12	13
1	Weight of moving object	+		15, 8, 29, 34	15, 17, 28, 12	29, 17, 38, 34	17, 28, 1, 29	29, 2, 40, 28	40, 35, 2, 4, 7	2, 8, 15, 38	8, 10, 18, 37	10, 36, 37, 40	10, 14, 35, 40	1, 35, 19, 39
2	Weight of stationary object		+		10, 1, 29, 35		35, 30, 13, 2		5, 35, 14, 2		8, 10, 19, 35	13, 29, 10, 18	13, 10, 29, 14	26, 39, 1, 40
3	Length of moving object	8, 15, 29, 34		+		15, 17, 4		7, 17, 4, 35		13, 4, 8	17, 10, 4	1, 8, 35	1, 8, 10, 29	1, 8, 15, 34
4	Length of sationary object		35, 28, 40, 29		+		17, 7, 10, 40		35, 8, 2, 14		28, 10	1, 14, 35	13, 14, 15, 7	39, 37, 35
5	Area of moving object	2, 17, 29, 4		14, 15, 18, 4		+		7, 14, 17, 4		29, 30, 4, 34	19, 30, 35, 2	10, 15, 36, 28	5, 34, 29, 4	11, 2, 13, 39
6	Area of stationary object		30, 2, 14, 18		26, 7, 9, 39		+				1, 18, 35, 36	10, 15, 36, 37		2, 38
7	Volume of moving object	2, 26, 29, 40		1, 7, 4, 35		1, 7, 4, 17		+		29, 4, 38, 34	15, 35, 36, 37	6, 35, 36, 37	1, 15, 29, 4	28, 10, 1, 39
8	Volume of stationary object		35, 10, 19, 14	19, 14	35, 8, 2, 14				+		2, 18, 37	24, 35	7, 2, 35	34, 28, 35, 40
9	Speed	2, 28, 13, 38		13, 14, 8		29, 30, 34		7, 29, 34		+	13, 28, 15, 19	6, 18, 38, 40	35, 15, 18, 34	28, 33, 1, 18
10	Force (Intensity)	8, 1, 37, 18	18, 13, 1, 28	17, 19, 9, 36	28, 10	19, 10, 15	1, 18, 36, 37	15, 9, 12, 37	2, 36, 18, 37	13, 28, 15, 12	+	18, 21, 11	10, 35, 40, 34	35, 10, 21
11	Stress of pressure	10, 36, 37, 40	13, 29, 10, 18	35, 10, 36	35, 1, 14, 16	10, 15, 36, 28	10, 15, 36, 37	6, 35, 10	35, 24	6, 35, 36	36, 35, 21	+	35, 4, 15, 10	35, 33, 2, 40
12	Shape	8, 10, 29, 40	15, 10, 26, 3	29, 34, 5, 4	13, 14, 10, 7	5, 34, 4, 10		14, 4, 15, 22	7, 2, 35	35, 15, 34, 18	35, 10, 37, 40	34, 15, 10, 14	+	33, 1, 18, 4
13	Stability of the object's compostition	21, 35, 2, 39	26, 39, 1, 40	13, 15, 1, 28	37	2, 11, 13	39	28, 10, 19, 39	34, 28, 35, 40	33, 15, 28, 18	10, 35, 21, 16	2, 35, 40	22, 1, 18, 4	+

Source: Altshuller, 2002

In TRIZ process, several basic concepts are selected to implement. The details are as follows:

- Ideality concept: according to Ilevbare *et al*. (2013), this concept was established by Altshuller to define the direction of innovation of technical systems. The ratio between useful and harmful features of a specific technical system presents the level of ideality. Then, sources for both positive and negative impacts on the system are identified to improve and enhance the ideality.
- Functionality concept: this concept leads to the identification of elements of the system that are not effective through the analysis. This method is applied to supervise the performance of all functions based on the system's requirements.
- Contradiction concept: in this concept, contradiction is divided into two types including physical and technical contradictions. With physical contradiction, two contradictory requirements are proposed for the same parameter of a system. Principles of separation can be used as solutions for eliminating the contradiction (Srinivasan and Kraslawski, 2006; Orloff, 2006). For technical contradiction, a worsening influence appears when an improving parameter is applied to solve problems in the system. The contradiction matrix is used to generate solutions for removing problems.

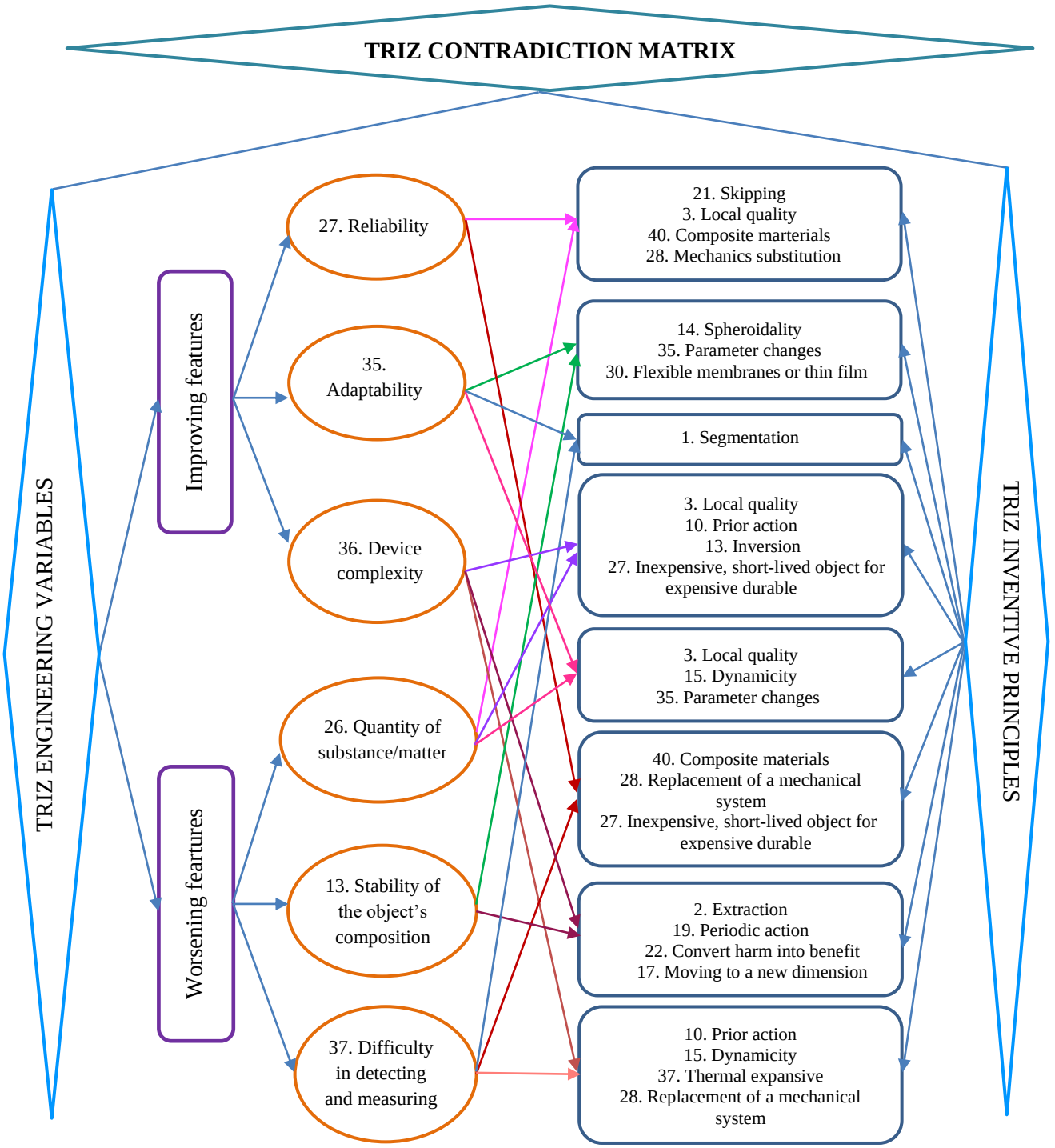


Figure 4.1: Model of TRIZ contradiction matrix

Source: Altshuller, 2002

The model of TRIZ contradiction matrix is constructed to generate recommendations for solving existing problems that appear in both engineering and service areas. In this study, this model is applied as an effective tool for developing strategies for LSPs to transform into 4PL. Improving and worsening features are investigated based on 4PL's characteristics that LSPs need to achieve.

Then, the profound consideration of available alternatives from the contradiction matrix is implemented to select the most appropriate inventive principles for promoting suggested solutions. Details of the implementation process and strategy development are presented in chapter 4.3 and chapter 8.

4.1.3 Benefits of the application of TRIZ innovative approach

Nowadays, the rapid change in a competitive world has required enterprises to be more productive and efficient. Many managers and inventors apply the TRIZ approach to enhance their competitive advantage by procreating new products and services or eliminating contradictory states. The most dominant strength of TRIZ methodology is its removal of contradictions for developing inventive solutions. In TRIZ application, contradictions are methodologically settled by creative recommendations based on three fundamental principles including the goal of ideal design, contradictions serving problem-solving, and innovative process to be established systematically (Ismail Ekmekci *et al*., 2019).

According to Altshuller's description, TRIZ is a structure that contains inventive methods and a comprehensive philosophy of resources, excellence, and contradictions. The philosophy of TRIZ includes follows:

- Generating innovative solutions for problems and making differentiated product development.
- Creating inventive principles that are appropriate in all areas of technology.
- Eliminating contradictions.
- Utilizing effectively and efficiently resources.

TRIZ methodology has successfully substituted the unsystematic method of finding solutions thanks to the well-structured and superior inventive process in problem-solving itself. From analyzing thousands of worldwide patents and categorizing them to identify problem-solving processes, researchers stated that the same problems were often repeatedly solved using one of 40 fundamental inventive principles. After comparing generic TRIZ problems and respective generic TRIZ solutions from databases in scientific effects and patent research, solutions can be created for the specific problem. TRIZ has become a reliable process for leading to systematic innovation and avoiding inefficient ways of problem-solving. Details of TRIZ inventive structure are shown in Figure 4.2.

In the process of investigating chosen patents, Altshuller realized that TRIZ theory is effective and useful thanks to the following elements:

- Systematic operations
- The direction of optimized solutions within a broad scope
- Repetition and reliability
- Provision of innovative information
- Generation of inventive knowledge

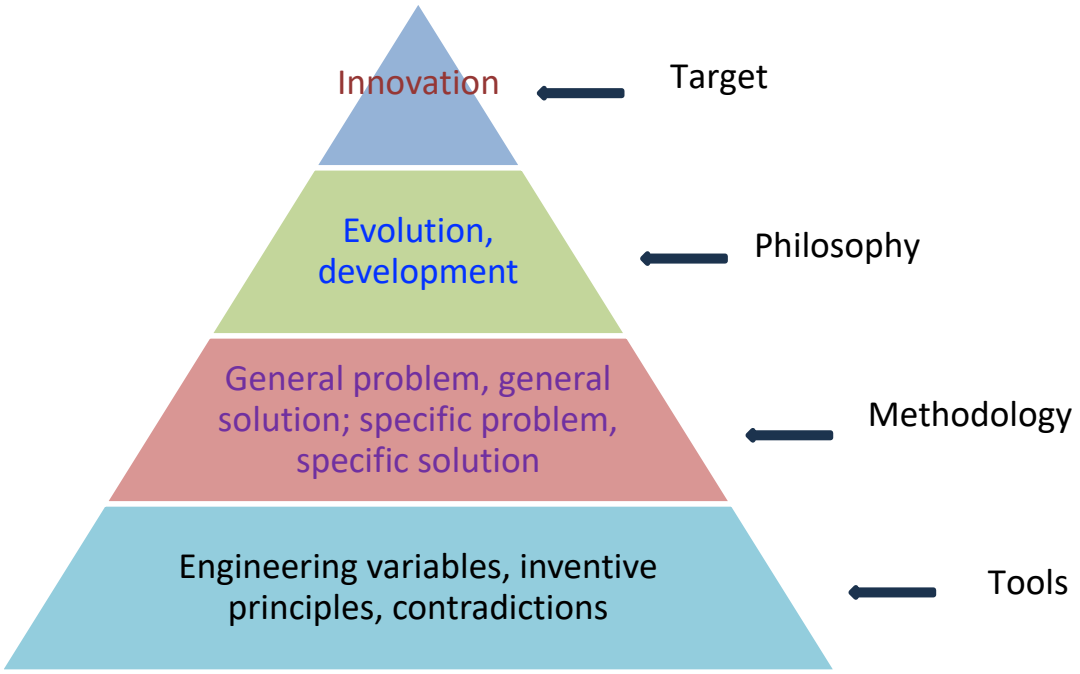


Figure 4.2: Structure of TRIZ inventive approach

Source: Ismail Ekmekci *et al.*, 2019

TRIZ creates significant benefits in making contradictions be solved methodologically by applying inventive recommendations based on three fundamental principles:

- The goal of the TRIZ application is to find the ideal solution.
- Identified problems are solved by contradictions.
- Innovation can be implemented in a systematic process.

4.2 Relevance of TRIZ to services

As mentioned above, the TRIZ approach has not been recently applied only to technical problems but has also been extended to any type of problem (Ilevbare *et al.*, 2013). The extension of TRIZ to non-technical problems is also based on three basic axioms of TRIZ. Other researchers have studies concerning the further development involving the application of TRIZ methods in non-technical areas (Zlotin *et al.*, 2000), technology and innovation management (Sheu and Lee, 2011), supply chain (Stratton and Warburton, 2003; 2006), knowledge management (Vezzetti *et al.*, 2011), and in open innovation (Bianchi *et al.*, 2010). Ben Moussa *et al.* (2017) pointed out twenty-one studies applying TRIZ in the supply chain. These authors propose a specific matrix to associate contradictions with TRIZ inventive principles.

TRIZ methodology is processed based on the unified principles of identifying contradictions and finding out solutions. Knowledge-based tools are utilized to eliminate contradictions and create inventive resolutions. In the area of technology, contradictions are easier to define due to their tangible appearance.

However, inventive principles could be applied to identify and eliminate contradictions to generate innovative solutions in the service area through proven experiments. From the study of the similarities between services and TRIZ through innovated patterns, critical methods of service remodeling could be classified into preservice, self-service, direct service, physical service, and bundled service (Berry and Lampo, 2000). Finally, the research pointed out that it is possible to forecast innovations in services.

4.3 TRIZ implementation in developing strategy for the transformation into 4PL

Being adapting to solve different kinds of problems, TRIZ methodology mentions contradictions as the core concept for creating inventive solutions. Altshuller's matrix, the so-called TRIZ matrix, includes 39 parameters involved in most contradictions. After the first step of defining the problem, the improving and worsening parameters are identified to derive solutions based on 40 inventive principles for solving contradictions. There are various methods for solving contradictions by applying the TRIZ matrix. Waransky's algorithm which is mentioned as one of the effective ways for constructing development strategies for enterprises consists of 4 stages in the process as follows:

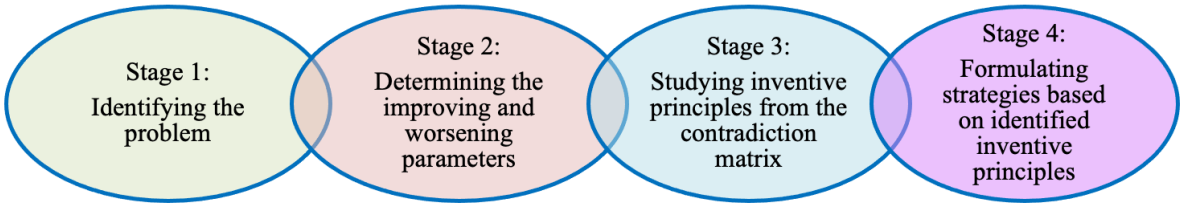


Figure 4.3: Process of TRIZ implementation

Source: Waransky, 2002

The core goals of the process are to affirm the effective application of TRIZ in the service field and to develop strategies for local LSPs in Vietnam to transform into 4PL through the implementation of TRIZ inventive methodology on the identified capabilities of 4PL under the research of Porter (1996), Walters and Rainbird (2007), Frost and Sullivan (2014), Fulconis et al. (2006), Rajaguru and Matanda (2013), and Diem *et al.* (2023). Three main capabilities of 4PL including value chain creation, integration of multiple 3PL providers' activities, and management of global supply chain are considered as problems in which local LSPs must identify contradictions and determine relevant innovative solutions. To assess the attainment of the mentioned goals, the results of the implementation will present the answers to the following questions:

- How is TRIZ inventive methodology applied in logistics service provision?
- How are strategic solutions for the transformation into 4PL of local LSPs in Vietnam developed by applying TRIZ inventive methodology?

In order to facilitate LSPs to successfully transform into 4PL, the study would suggest 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 to maintain their positions in the logistics market in Vietnam as well as 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. In the global logistics market where the fierce competition is dramatically increasing, innovation becomes vital to local LSPs to be superior to their rivals. Based on this foundation, the author adopts the TRIZ matrix to identify innovative recommendations for the three above-mentioned important attributes of 4PL including value chain creation, integration of multiple 3PL providers' activities, and management of the global supply chain.

5. RESEARCH FRAMEWORK AND HYPOTHESES

5.1 Formulation of research model

Based on the reality of the development of logistics enterprises in Vietnam and the growth of the logistics service industry in the world; the systematic synthesis of elements influencing the logistics operations and development; the identified research objectives concerning the investigation of factors affecting the transformation into 4PL of local LSPs in Vietnam; research questions regarding why local LSPs should transform into 4PL, which factors affect the process of transformation, and how local LSPs in Vietnam transform into 4PL; and research hypotheses relating to 9 independent constructs to be examined in the model, the author suggests the comprehensive research model for investigating determinants influencing the strategic transformation into 4PL of local LSPs in Vietnam.

The model consists of two groups of factors in microeconomic and macroeconomic sectors. In the first group, there are five microeconomic constructs including transportation capability, warehouse operations, IT application, human resources, and logistics services to be investigated in their impact on the transformation into 4PL. The second group includes four factors in the macroeconomic sector consisting of transportation infrastructure, logistics outsourcing trend, policies in logistics industry, and competition in logistics market which will be assessed specifically for affirming their role in the transformation process. The research model is illustrated in Figure 5.1.

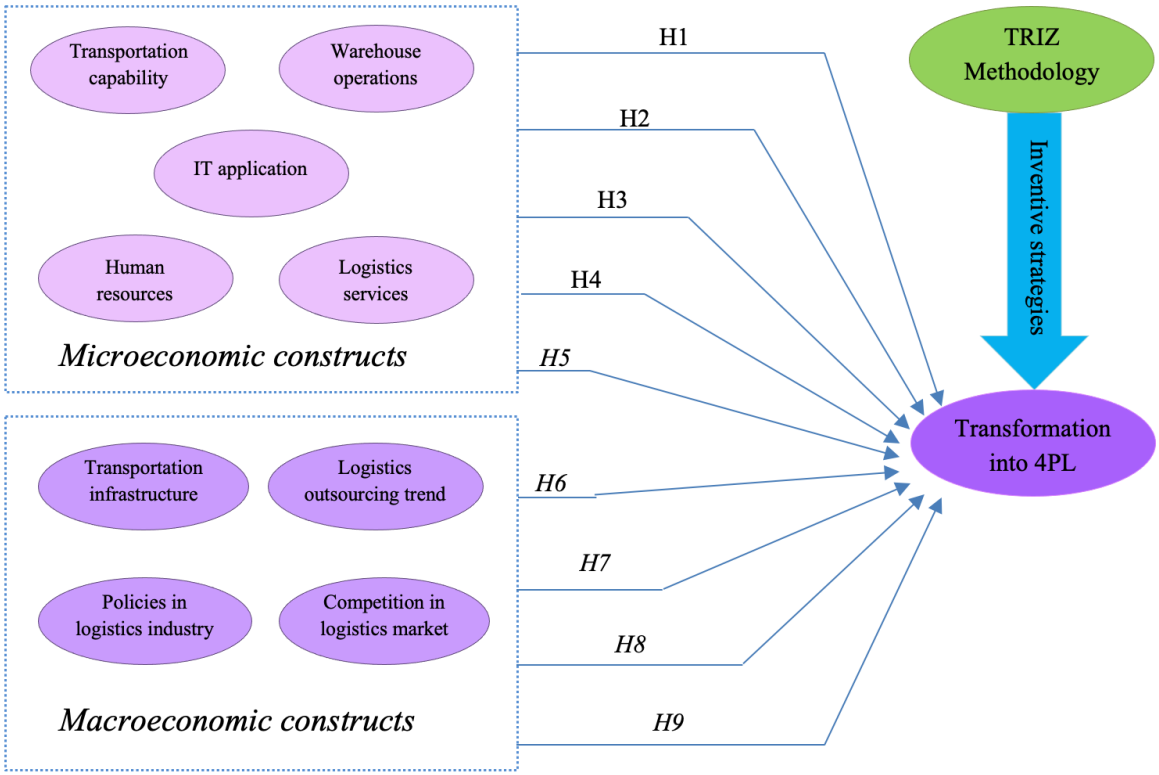


Figure 5.1: Model of variables influencing the transformation into 4PL

Source: The author's suggested research model

In the model, TRIZ inventive approach is applied to establish the development strategies for local LSPs in Vietnam. After evaluating factors impacting the transformation into 4PL, three attributes of 4PL are evaluated by TRIZ methodology with 39 engineering variables, 40 inventive principles, 76 standard solutions, and the contradiction matrix.

5.2 Scales of measurement

From the conceptual model, scales of measurement for 10 constructs, so-called variables, which include independent and dependent factors are established with a total of 31 indicators developed from previous concepts and studies in logistics service provider and transformation into 4PL. All indicators are measured on five-point Likert scale (1 = Very high, 2 = High, 3 = Medium, 4 = Low, 5 = Very low). Specifically, constructs and indicators are as follows:

Table 5.1: Research constructs and indicators

Descriptions	Sources
Transportation capability (TRA)	
TRA1: Owned means of transportation	Morash and Clinton (1997); Chang (1988); Mason *et al*. (2007); Park

TRA2: Speed of transportation nationally and internationally	(2011); Vidalakis et al. (2011); Smith and Nash (2014); Mandic *et al*. (2014); Chakhtoura and Pojani (2016); Rodseth (2017); Cui and Li (2017a, 2017b, 2017c).
TRA3: Connection of transportation chain and logistics services	
Warehouse operations (WOP)	
WOP1: Scale of owned warehouse	Berry (1968); Roberts *et al.* (1972); Chew *et al.* (1999); Rouwenhors *et al.* (2000); Bozer *et al.* (2005); Le-Duc *et al.* (2005); Frazelle (2008); Yu *et al.* (2009); Gu *et al.* (2010); Jacyna-Gołda (2014); Żak (2014); Jacyna et. al. (2016); Michał *et al.* (2017).
WOP2: Technology application	
WOP3: Rate of errors	
WOP4: Cross-docking utilization	
Advanced IT application (ITA)	
ITA1: Highly qualified IT human resources	Stank *et al.* (1999); Devaraj and Kohli (2000); Lim and Palvia (2001); Weill *et al.* (2002); Sauvage (2003); Sabherwal and Jeyaraj (2015); Bardhan *et al.* (2007); Jayaram and Tan (2010); Pinna *et al.* (2010); Sinkovics *et al.* (2011); Evangelista *et al.* (2012); Ghobakhloo and Hong (2014); Karagöz and Akgün (2015); Chaysin *et al.* (2016); Wong *et al.* (2016).
ITA2: Advanced IT infrastructure	
ITA3: Strong partnering relationship between IT and logistics service management	
Human resources (HRM)	
HRM1: Specialized competence	Gatewood and Field (1994); McDaniel *et al.* (1988); Elsdon (1999); Ginter and La Londe (2001); Neumann and Dul (2010); Kam *et al.* (2010); Okeudo (2012); Anastasiou (2012); Alexander *et al.* (2013); Hall *et al.* (2013); Battini *et al.* (2015); The International Ergonomics Association (IEA, 2019).
HRM2: Planning and controlling capability	
HRM3: Learning and integrating competence	
Logistics services (LOS)	

LOS1: Provision of diversification and strategy customization of logistics services	Mangan *et al.* (2008); Bert *et al.*, (2010); Gattorna (2010); The Charter of the Institute of Logistics and Transport (CILT, 2012); Badenhorst-Weiss & Waugh (2014).
LOS2: Provision of value-added services to customers	
LOS3: Logistics service costs	
Transportation infrastructure (INF)	
INF1: Airport infrastructure	Fair *et al.* (1981); Chang (1988), Grzelakowski (2014), Bolumole *et al*. (2015).
INF2: Harbour infrastructure	
INF3: Land infrastructure	
The growth of logistics outsourcing trend (OUT)	
OUT1: Trend of logistics outsourcing	Sheffi (1990); Sink and Langley (1997); Gattorna (1998); Skjoett-Larsen (2000); Hoffman (2000); Tyan *et al.* (2003); Folinas *et al.* (2004); Frankfurt (2005); Mukhopadhyay (2006); Jiang *et al.* (2006); Bourlakis and Bourlakis (2005); Lau and Zhang (2006); Bardhan *et al.* (2006); Lau and Zhang (2006); Gavrielatos (2007); Aimi (2007); Krakovics *et al.* (2008); Marasco (2008); Langley & Capgemini (2008); Deepen *et al.* (2008); K. Gotzamani *et al.* (2010); Soinio *et al.* (2012); Solakivi *et al.* (2013).
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	Amstrong and Associates (2017), Yao and Zhang (2012), Ha *et al*. (2003), Ghiani et al. (2004), Chen (2008), SteadieSeifi (2011), Park and Min (2017).
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	Pilar *et al.* (2004); Hai *et al.* (2005); Masahiro (2010); Magnus & Ruth (2010); Hens *et al.* (2011); Jin (2012); Liu *et al.* (2013); Shuihai *et al.* (2014).
POL3: Directions and strategies of government for the development of the logistics industry	
Transformation into 4PL (4PL)	
4PL1: Value chain creation	Porter (1996); Frost and Sullivan (2005); Hoek (2006); Walters and Rainbird (2007); Bowersox *et al.* (2007); Schaltegger *et al.* (2016).
4PL2: Integration of multiple 3PL providers' activities	Coyle *et al.* (2003); Frost and Sullivan (2004); Langley *et al.* (2005); Boschian and Paganelli (2016); Govindan *et al.* (2016); Gruchmann (2019).
4PL3: Management competence in global supply chain	Cooper *et al.* (1997); Bechtel and Jayaram (1997); Christopher (1997); Lambert *et al.* (1998); Frohlich and Westbrook (2001); Wildemann (2001); The Council of Supply Chain Management Professionals (CSCMP, 2004); Rafele, 2004); Visser *et al.* (2004); Trent and Monczka (2005); Zailani and Rajagopal (2005); Fulconis *et al.* (2006); Laurence *et al.* (2007); Win (2008); Vinay *et al.* (2009); Yao (2010); Jianming Yao (2010); Cao and Zhang (2011); Kastalli and Van Looy (2013); Rajaguru and Matanda (2013); Kasperek (2013); Kim and Min (2015); Karimi and Walter (2016); Schaltegger *et al.* (2016); Verwaal (2017).

Source: The author's study

5.3 Formulation of Research hypotheses

Based on the main research objective of the dissertation, the author developed research hypotheses to find authentic answers to the mentioned research

questions. Nine hypotheses are designed based on the identified factors impacting the transformation into 4PL of local LSPs in Vietnam including:

In the logistics industry, transportation capability is considered one of the key elements of competitive ability between LSPs because transportation is an important activity out of core operations provided to their customers. Once transportation is performed well during the process of providing services to the clients, related operations in the supply chain become more advantageous due to their interconnected relations.

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

In logistics and supply chain, warehousing and inventory storage are core components that create high value in delivering logistics operations to the client. Warehousing is essential in the supply chain because it is an intermediate point in the distribution of products from manufacturers to consumers. As a result, it always plays a vital role in collecting, storing, and distributing products. The warehouse is usually used by LSPs, customs departments, manufacturers, importers/exporters, and distributors for storing material or finished products in between. The warehouse is useful for LSPs to manage products and deliver other services including packaging and labeling. Modern warehouse is equipped with the latest technology for achieving more cost-effectiveness and time-saving.

**H2: Effective warehouse operations have positive influence on the strategic transformation into 4PL of local LSPs in Vietnam.*

With the development of the global economy, the application of IT in creating the connection of logistics systems over the countries is significant in enhancing competitive advantage for LSPs. According to the results of a survey conducted by Vietnam Report, all of the LSPs have increased their investment in digital transformation in the last year. 86% of them expect that IT applications in their logistics services can bring more remarkable growth in productivity and effectiveness in their business. 36% of respondents believe that the IT application in the logistics process can enhance more experiences for global customers. Around 68% have already executed the implementation of advanced technology of the industrial revolution 4.0 in the Internet of Things (IoT), cloud, artificial intelligence, big data, and blockchain.

**H3: Absolute level of advanced IT application has positive impact on the strategic transformation into 4PL of local LSPs in Vietnam.*

Human resources is a vital part of any logistics enterprise because the shortage of qualified workforce can cause obstacles to logistics operations such as inventory management, warehousing, packaging, labeling, transportation, and distribution. Effective human resource strategy creates the guarantee to LSPs for ensuring the competitive advantage. The potential of the workforce can be leveraged by promoting specialized activities including recruitment, training, motivation, and

retainment of high-quality human resources. The right human resource strategy is the successful key to the alignment of the workforce and the company's interests.

Current human resources in the logistics industry in Vietnam are too small compared to the demands for the specialized workforce to meet the growth requirement. According to the forecast results of Vietnam Logistics Research and Development Institute (VLI), Vietnam's logistics industry, by 2030, will need around 2.2 million laborers including 200 thousand qualified staff with specialized degrees, professional skills, and foreign language ability. Another survey conducted by VLI pointed out that 53.3% of LSPs have a demand for qualified human resources with logistics knowledge. Furthermore, the number of LSPs that have to deliver training programs again for their staff is around 30%. There is only 6.7% of LSPs satisfied with their staff's expertise. Therefore, human resources is selected to be a factor in the model.

**H4: High-qualified human resources cause a positive influence on the strategic transformation into 4PL of local LSPs in Vietnam.*

Logistics is one of the service industries that plays an increasingly important role in the world and national economy. Logistics determines the circulation of the entire supply chain, production, and distribution of goods in the market. Along with the socio-economic development, the quality of logistics service becomes a competitive advantage to ensure the success of enterprises. According to Nguyen Thanh Binh *et al.* (2021), there are seven factors impacting the quality of logistics service in LSPs including price, delivery time, safety for goods, premises for providing services (warehouse, vehicle, container, electronic equipment, etc), customer service, trust, and brand name. In this dissertation, the author measures high-quality logistics services by three indicators consisting of provision of diversification and strategy customization of logistics services, provision of value-added services to customers, and logistics service costs. These indicators cover identified factors in the above-mentioned model. As a result, logistics services are considered to assess their influence on the transformation into 4PL of local LSPs in Vietnam.

**H5: High-quality logistics services create a positive impact on the strategic transformation into 4PL of local LSPs in Vietnam.*

One of the important objectives of the logistics industry is cutting costs. There is a variety of solutions for gaining cost-effectiveness such as applying digital technology, improving the qualifications of operational staff, enhancing facilities and premises, etc. However, one of the basic ways for logistics cost reduction is to decrease transportation costs based on a comprehensive strategy and sound transportation infrastructure. Vietnam's logistics infrastructure system currently includes roads, railways, inland waterways, seaports, inland ports, airports, logistics centers, distribution centers, and warehouse systems. With the advantage

of carrying a large quantity of goods and low costs, sea transportation accounts for more than 80% of Vietnam's foreign trade.

According to Decision No. 236/QĐ-TTg approved by the Prime Minister on 23rd February 2018, Vietnam, by 2030, will operate a total of 28 airports including 15 domestic airports, and 13 international airports. It is obvious that transportation by airport is remarkably invested. Moreover, airport transportation is still selected by many enterprises for moving import and export goods, especially goods with fast delivery time although the price is rather high compared to sea transportation. Therefore, air transportation is also a useful choice in logistics operations and supply chain. Besides, road transportation is always effective for domestic business transactions because of its convenience. However, the effectiveness of transportation and distribution of goods depends a lot on the transportation infrastructure. As a result, the author establishes hypothesis 6 for testing the impact of transportation infrastructure on the transformation into 4PL of local LSPs in Vietnam.

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

Logistics outsourcing brings a lot of benefits to enterprises. Firstly, the client companies reduce investment capital and costs when using logistics service outsourcing from LSPs. With high technology and diversified services, LSPs can create an advantage in economy of scale and provide professional services at low costs. Secondly, LSPs' expertise importantly contributes to the enhancement of service quality and meets customer's requirements. According to Frost Sullivan's announcement, the average growth rate of the world logistics service outsourcing market is from 10% to 20% per year. Most large corporations in the world such as Dell, Walmart, Nortel, Nike, etc. use 3PLs or 4PLs. Such a trend has promoted the growth rate of the world logistics service to a two-digital ratio. The annual report on "The reality of global logistics outsourcing" conducted by Georgia Tech University, one of the most prestigious universities in logistics and supply chain training, and Capgemini, DHL, and Oracle pointed out results on logistics outsourcing in the four largest logistics regions today including North America, Europe, Asia-Pacific, and Latin America. Asian countries are also a vibrant logistics outsourcing market, in which Vietnam and ASEAN countries are considered as the young market region with a high potential growth rate. The development of this trend affirms that the growth of the logistics outsourcing trend may have a certain impact on the transformation into 4PL of LSPs in Vietnam.

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

After more than five years of implementing Decision No. 200/QĐ-TTg on approving the Action Plan to improve competitiveness and develop logistics services in Vietnam by 2025, the logistics industry in general, and the capacity of

logistics enterprises, in particular, have made significant strides in both quantity and quality. Logistics enterprises are gradually participating more actively in supporting domestic production and circulation of goods, and import and export. Business capacity and logistics service quality have been significantly improved over the past time. Currently, the number of local LSPs accounts for about 89%, joint venture enterprises account for about 10%, and the remaining 1% are foreign enterprises providing transnational logistics services with big names in the list of 50 largest logistics enterprises in the world such as DHL, Kuehne + Nagel, DSV, DB Schenker, etc. According to VLA, some Vietnamese enterprises such as Transimex, Sotrans, Saigon Newport, etc. have become large logistics businesses, providing 3PL services, being competitive with foreign firms, and having branches or representatives in many markets around the world.

Digitalization has been creating many challenges for LSPs, requiring them to adapt quickly and integrate into the 4.0 economy to be competitive and survive. In the flow of the 4.0 technology era, it is imperative that the logistics industry quickly and comprehensively transform to catch up with this trend. In addition, it is necessary to establish sustainable supply chains, improve the quality of human resources working in logistics companies, and promote the development of green logistics which is considered as an important indicator for the sustainable development of the logistics industry. In general, logistics services with high added value, linking with the development of goods production, import and export, domestic trade, transportation infrastructure, and information technology would improve competitiveness for local LSPs in Vietnam in both domestic and international logistics markets.

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

Currently, the logistics industry in Vietnam and the world is assessed as one of the potential fields and supported by many directions, resolutions, policies, plans, and strategies for completed development over a period.

Firstly, Decision No. 283/QĐ-TTg signed by the Prime Minister approved the project "Plan to restructure the service industry until 2020, with the orientation to 2025". Accordingly, logistics and transportation services aim to achieve important goals including the volume of freight and passenger transport and, the contribution ratio of the logistics service industry to GDP.

Secondly, Resolution No. 136/NQ-CP was issued by the Government to promote the implementation of sustainable development goals in sectors, competent levels, and localities until 2030. In the Resolution, there are many mentioned matters related to logistics and transportation services such as effectively implementing the restructuring of the transport market appropriately; arranging, innovating, and improving the efficiency of the operation of the transport system; promoting the

transport of cargo from the roads to other modes of transport to reduce the pressure to the road system.

Thirdly, Resolution No. 01/NQ-CP was issued by the Government on the main tasks and solutions to implement the socio-economic development plan and the State estimated budget for 2020 mentioning logistics infrastructure policies including speeding up the North–South expressway project; innovating and perfecting IT infrastructure; developing synchronous and modern digital infrastructure.

Fourthly, there are several Circulars issued by Ministry of Transportation including Circular No. 21/2020/TT-BGTVT, Circular No. 14/2015/TT-BGTVT, and Circular No. 33/2016/TT-BGTVT on air transportation. Thanks to government policies and regulations on all aspects of the logistics industry, logistics enterprises have taken advantage of their strengths and opportunities for growing in the highly competitive environment. From the above analyses and illustration of policies from competent authorities for the logistics industry, the author considers government policies as a factor in the research model.

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

6. RESEARCH METHODOLOGY

6.1 Research approach

The general research approach of this study is based on Accenture's concept of 4PL, transformation into the new model of logistics provider of Visser *et al.* (2004) and Hoek (2006), related parties in 4PL of Gattorna (1998), and 4PL's characteristics of Win (2008). While basic research has an orientation on explaining the existing situation through applying original theory, applied science aims to create new models connecting with reality and generating significant contributions to the theory. The content of the applied science is conducted and measured according to the reality of the research object. Following this perspective, this study concentrates on the analyses of factors impacting the development of local logistics enterprises in Vietnam. Then, TRIZ innovative approach is applied to build strategies for the transformation into 4PL of Vietnamese LSPs which are mostly small and medium-sized firms.

In Vietnam, this study contributes to the development of theoretical and conceptual models for identifying determinants of the growth of logistics firms at the industry level. The main object of this research is limited to the domain of local enterprises in the logistics industry in Vietnam. Hence, the first research objective is to investigate factors influencing the transformation into 4PL of local LSPs in Vietnam. The second research objective is to systemize the theories of the role, importance, and characteristics of 4PL in the logistics service industry and global supply chain. For the third objective, the author, based on the results

of identifying influential factors from the research model, establishes innovative strategies for successful transformation into 4PL from LSPs.

As observed in many studies on 4PL and factors influencing the development of LSPs in the logistics industry, qualitative methodologies with surveyed data, theoretical concepts, and literature review are frequently applied. In some studies, a combination of qualitative and quantitative research methodologies is applied at the same time. Quantitative research can be understood as a systematic investigation of phenomena by collecting quantifiable data and implementing statistical techniques. Information is gathered from respondents by using a sampling method and sending out a survey questionnaire. Crucial characteristics of quantitative research include structured tools, sample size, closed-ended questions, prior studies, quantitative data, and generalization of results. With quantitative research, collected data is reliable and accurate; the process of data collection is implemented quickly; the scope of data collection and analysis is wide, the achieved results are numerical and fair due to this research method's eliminating research bias. Quantitative research involves the collection and analysis of numerical data. This method is appropriate for testing relationships, identifying trends, and synthesizing results for large populations.

To implement the main research objective, this study was first conducted with a literature review on various definitions of 4PL and constructs in the model. Then, the PLS-SEM model is applied to identify constructs affecting strategic transformation into 4PL of local LSPs. From the results, development strategies for LSPs to transform into 4PL through TRIZ innovation methodology are proposed. The authors apply TRIZ's innovative problem-solving process with four analyzed steps suggested by Savransky (2002) to generate seven strategies for enhancing the effectiveness of the defined capabilities of 4PL. The findings and recommendations drawn from the study have considerable implications for both academic and practice fields alike.

6.2 Research data and sample size

From the research objectives of investigating factors impacting the transformation into 4PL of local LSPs in Vietnam and establishing strategies for their development, the primary data is selected for analyzing and evaluating the established model. The author uses statistical data from a data collection survey from 414 LSPs in the logistics industry in Vietnam. Respondents to the survey are categorized by operations and geographical locations. To ensure the reliability and validity of the measurement index, the reliability analysis Cronbach's Alpha and Average Variance Extracted (AVE) through SmartPLS 4 is applied to eliminate variables uninterpretable to the research concept.

In this dissertation, the Structural Equation Model (SEM) is used to analyze the relationships between the dependent variable (transformation into 4PL) and independent variables (transportation capability, warehouse operations, IT

application, human resources, logistics services, transportation infrastructure, logistics outsourcing trend, competition in logistics market, and policies in logistics industry) in the model. This method requires a large number of samples due to its dependence on sample distribution theory (Vinzi *et al.*, 2010; Garson, 2016). Besides, Hair *et al*. (2017) affirmed that there are three types of sample size used in SEM including small size at ≤ 100, medium size at 100 – 200, and large size at ≥ 200. The sample size of this study is 414, therefore, it meets the requirement in sample size for the research.

6.3 Survey method

The survey method is implemented to understand the current situation of Vietnam's local LSPs and to test and validate the theoretical models through collected results. Transformation into 4PL is still regarded as a growing scientific field that is short of research, especially survey methods. Survey methodology has proved a valuable research tool to approach various components in the logistics industry from different areas in Vietnam. Nine groups of surveyed logistics enterprises from three parts of the country provide adequate information and a complete image of the logistics industry in Vietnam.

For data collection, both online and offline surveys were conducted with the target population of LSPs in different categories to investigate the factors influencing the transformation into 4PL from 2PL and 3PL. For gaining a more profound understanding of the capability to transform into 4PL, nationwide local LSPs which are of diversified categories of logistics enterprises are selected for the study. Most local logistics firms are small and medium-size with limited competitive advantage in the logistics industry. Therefore, they need to develop their business to a higher level for survival and growth in the fierce competition in the global logistics market.

6.4 Conceptual model evaluation and hypotheses testing

Structural Equation Modeling (SEM) is one of the statistical models that examines and explains the interrelationships among variables presented in the theoretical framework (Hair *et al.*, 2010). Partial Least Squares SEM (PLS-SEM) is initially applied to develop exploratory theories that concentrate on the explanation of the variance in the dependent factors from examining the model (Hair *et al.*, (2014). Being a regression-based approach, PLS-SEM explores the linear relationships between multiple independent constructs and single or multiple dependent variables. According to Vinzi *et al.* (2010) and Shmueli *et al*. (2019), PLS-SEM can be used as a statistical tool to model the causal relationships between observed variables and latent constructs. In the PLS-path model, several variables are the causes and simultaneously effects of others in the established hypotheses of the research (Garson, 2016). PLS-SEM is regarded as an appropriate approach for creating a statistical model with great statistical power and quick handling convergence on large and complex models (Ringle *et al.*, 2012).

Based on the systematic procedure of Hair *et al*. (2017), the objectives and hypotheses of the study, Structural models, and Measurement models are developed to state the relationships between observed variables and latent variables and between the constructs and their relevant indicators as shown in Table 5.1. From the literature review, the factors including 4PL, TRA, ITA, HRM, LOS, COM, OUT, WOP, INF, and POL are assumingly measured by 31 reflective indicators. The specific survey questions are designed for separate indicators as stated in Table 5.1. According to Hair *et al.* (2019), hypothetical model evaluation and hypothesis testing are implemented as follows:

Evaluation of Measurement models

The measurement models are critically evaluated through the metrics of Discriminant validity, Convergent validity, and Internal consistency with their relevant indicators and thresholds as shown in Table 6.3.

Table 6.3: Evaluation of Measurement models

Metrics	Indicators	Thresholds
Convergent validity	Outer loadings	≥ 0.70
	Average variance extracted (AVE)	≥ 0.50
Internal consistency	Cronbach's alpha	0.60 - 0.95
	Composite reliability	0.60 - 0.95
	Rho-A	0.70 – 0.90
Discriminant validity	Heterotrait-Monotrait Ratio of Correlations - HTMT	≤ 0.9

Source: Hair *et al*. (2017, 2019)

From the theory of Hair *et al*. (2017, 2019), over 50% of indicators are acceptable in explaining the construct when outer loadings are from the value of 0.70. The internal consistency of indicators within the construct is measured by Cronbach's alpha and Composite reliability. When Cronbach's alpha is in the amplitude from 0.60 to 0.95, and the Composite reliability has simultaneously the minimum of 0.60 and maximum of 0.95, the consistency of a measurement model is defined. Rho-A which is used to evaluate the reliability of the internal consistency of the construct is assessed to be fit to the measurement model when it is at the thresholds from 0.70 to 0.90.

Discriminant validity shows the distinctiveness of a construct when compared to other constructs in the model. Fornell and Larcker (1981) proposed the use of the AVE square root as an approach to evaluate discriminant validity and recommended that discrimination is assured when the square root of the AVE for each latent variable is higher than all correlations between the latent variables. However, Henseler and colleagues (2015) used simulation studies to demonstrate that discriminant validity is better assessed by HTMT. Garson (2016) suggested

that the discriminant validity between two latent variables is assured when HTMT is less than 1 while Henseler *et al*. (2015) identified that if this value is less than 0.90, the discriminant validity will be assured. SmartPLS uses both of these methods of assessing discriminant validity.

Evaluation of Structural models

When the reliability and validity of construct measurements are confirmed, the evaluation of Structural models is implemented by a systematic approach of five steps relating to collinearity issues of the structural model, significance and relevance of the structural model's relationships, explanatory power, predictive power, and model comparisons. In PLS-SEM, researchers can make comparisons of alternative models depending on the research situation. However, model comparisons are not involved in every PLS-SEM analysis, the step of model comparisons is suggested to be optional (Hair *et al.*, 2022). Details of the evaluation of Structural models that are implemented in this study are presented in Table 6.4.

Table 6.4: Evaluation of Structural models

Criterion	Metrics	Thresholds
Collinearity evaluation	Standardized Root Mean Square Residual (SRMR)	≤ 0.08 or 0.1
Path coefficients of the structural model	Path coefficients	• Closed to +1: strong positive relationships • Closed to -1: strong negative relationships
Coefficient of determination	R^2 values	• 0.75: substantial • 0.5: moderate • 0.25: weak
f^2 effect size	f^2 value	> 0.02: small effect size > 0.15: medium effect size > 0.35: large effect size

Source: Hair *et al*. (2017, 2019)

Firstly, the potential collinearity of the structural model should be examined to ensure that collinearity is not a problem. When the model has collinearity or multicollinearity, the regression coefficients and p-values are distorted, leading to erroneous conclusions about the relationships in the model (Sarstedt and Mooi, 2019). Hair *et al.* (2019) provided VIF value thresholds in assessing collinearity with different value levels. If the VIF value is 5 or above, there is a probability of collinearity among predictor constructs. Collinearity can also occur at lower VIF values of 3-5. Otherwise, there is no collinearity when VIF values are lower than 3. Besides, Henseler *et al*. (2014) affirmed that the SRMR value is "Goodness of fit" in PLS-SEM. This value is measured to avoid model misspecification.

According to Hu and Bentler (1999), the SRMR value must be lower than 0.08 or 0.1.

Secondly, the significance and relevance of the structural model relationships are evaluated to assess the hypothesized relationships among the constructs through the path coefficients. The significance of path coefficients depends on bootstrapping standard errors obtained from the bootstrapping method. The bootstrapping standard errors are considered a basis for calculating *t*-values of path coefficients or confidence intervals (Streukens and Leroi-Werelds, 2016). Being used to assess significant levels of the relationship, p-values are suggested to be less than 0.05 to ensure that the correlations are significant at 5%. If the p-values are greater than 0.05, the impact is not statistically significant. In this case, we still keep the relationship in the model and conclude that it is not statistically significant, but do not remove the factor from the model. In terms of relevance, values of path coefficients are often between -1 and +1. According to Hair *et al*. (2017, 2019), the values are closer to -1 presenting strong negative relationships. Otherwise, the values are closer to +1 showing strong positive relationships. The path coefficients above +1 or below -1 may occur when there is a very high level of collinearity. When the path coefficients are unacceptable due to the values higher than +/-1, methods for reducing multicollinearity must be implemented.

Thirdly, the next step of the evaluation is to examine the coefficient of determination (R^2) of the endogenous constructs to measure the predictive power of the model. According to Shmueli and Koppius (2011), the R^2 is representative of the variance of endogenous constructs and measures the explanatory power of the model. The R^2 has a range from 0 to 1 where higher values indicate greater explanatory power. R^2 values of 0.75, 0.50, and 0.25 are considered substantial, moderate, and weak, respectively (Hair *et al*., 2017). However, depending on the research context and in some disciplines, the R^2 is considered satisfactory even if the values are as low as 0.10 (Raithel *et al.*, 2012). R^2 works as a function of many predictor constructs, the greater the number of predictor constructs, the higher the R^2. Therefore, the R^2 is well explained relative to the research context, referencing the R^2 values from related studies and models with the same levels of complexity.

Fourthly, the f^2 effect size is investigated to evaluate the relevant influence of a predictor construct on an endogenous construct from the perspective of explanatory power (Hair *et al*., 2021). f^2 values are useful in assessing the contribution level of the predictor construct to the R^2 value of a target construct in the structural model. Different f^2 values of 0.02, 0.15, and 0.35 present small, medium, and large effects respectively of the exogenous latent variable. The f^2 is valuable to the explanation of selected endogenous constructs from analyzing the relevance of constructs (Hair *et al*., 2017).

7. RESULTS OF INVESTIGATING FACTORS IMPACTING THE TRANSFORMATION INTO 4PL

7.1 Surveyed data analysis

7.1.1 Respondents' information analysis

In Vietnam, most logistics enterprises fall into small and medium size. They operate in a variety of fields depending on their objectives and capabilities as shown in Table 7.1. In this study's list of survey respondents, the highest rate belongs to 90 firms operating in transportation, forwarding, and warehousing, and accounts for 21.74%. The second largest group falls into transportation and warehousing with 81 companies. 14.98% of respondents operate in transportation and forwarding which are very popular in the logistics industry in Vietnam. The next group consists of 60 enterprises that deliver services in different models of transportation. 3PLs account for only 13.29% of total respondents because the number of 3PLs achieves a very low rate in the logistics industry. The remainder of companies providing services in forwarding and warehousing; forwarding; transportation, forwarding, and shipping agency; and forwarding and shipping agency account for 10.39%, 2.17%, 2.17%, and 1.21% respectively.

Table 7.1: Category of survey respondents based on operations

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
Total	**414**	**100**

Source: The author's calculations

From the list of survey respondents, it is obvious that many LSPs in Vietnam provide transportation services including 302 out of 414 survey respondents, accounting for 72.94% of the total. Although most logistics enterprises in Vietnam provide forwarding services in their operations, the number of LSPs in the area of forwarding and the area of forwarding and shipping agencies accounts for a very low rate in the list of respondents.

Table 7.2: Category of survey respondents based on location

Location	Quantity (firms)	Percentage (%)
The North of Vietnam	60	14.49
The Central of Vietnam	44	10.63
The South of Vietnam	310	74.88
Total	**414**	**100**

Source: The author's calculations

According to the annual report of Ministry of Industry and Trade of The Socialist Republic of Vietnam (2023), there are over three thousand logistics enterprises that provide diversified logistics services nationwide as presented in Table 7.2. The reported statistics reveal that more than 70% of them are operating in the South of Vietnam. The remaining firms are located in the North and the Central of the country. These statistics can be considered a comprehensive explanation for the rate of 74.88% of survey respondents from the South of Vietnam. The second largest number of respondents comes from the North of Vietnam with 14.49%. The smallest group of answered LSPs which is located in the Central accounts for 10.63%.

7.1.2 Descriptive statistics of the surveyed results

As shown in Table 7.3, the positive results of the survey are illustrated with 414 qualified observations. The data values on the statistical mean range from 2.459 to 3.449 where TRA2 is the only indicator gaining the value of 2.459. This means that the observed LSPs' national and international speed of transportation is at a low level while the mean values of all other indicators reach a medium level. A median value of 3 for most indicators reveals that most respondents choose "Medium" for their answers.

Table 7.3: Descriptive statistics of the survey

Indicators	Observations	Mean	Median	Min	Max	Std. deviation
4PL1	414	3.143	3.000	1.000	5.000	0.762
4PL2	414	3.280	3.000	2.000	5.000	0.731
4PL3	414	3.449	3.000	1.000	5.000	0.835
COM1	414	2.601	3.000	1.000	5.000	0.932
COM2	414	2.722	3.000	1.000	5.000	0.999
COM3	414	2.780	3.000	1.000	5.000	1.064
HRM1	414	3.300	3.000	1.000	5.000	0.894
HRM2	414	3.167	3.000	1.000	5.000	1.011

HRM3	414	3.234	3.000	1.000	5.000	1.034
INF1	414	2.577	3.000	1.000	5.000	0.864
INF2	414	2.633	3.000	1.000	5.000	0.983
INF3	414	2.744	3.000	1.000	5.000	1.013
ITA1	414	3.193	3.000	1.000	5.000	0.852
ITA2	414	3.312	3.000	1.000	5.000	0.897
ITA3	414	3.415	3.000	2.000	5.000	0.951
LOS1	414	3.350	3.000	1.000	5.000	0.896
LOS2	414	3.200	3.000	1.000	5.000	0.959
LOS3	414	3.227	3.000	1.000	5.000	1.015
OUT1	414	3.043	3.000	1.000	5.000	0.785
OUT2	414	3.034	3.000	1.000	5.000	0.807
OUT3	414	2.831	3.000	1.000	5.000	0.752
POL1	414	3.060	3.000	1.000	5.000	0.950
POL2	414	3.043	3.000	1.000	5.000	0.947
POL3	414	3.246	3.000	1.000	5.000	0.982
TRA1	414	2.882	3.000	1.000	5.000	0.836
TRA2	414	2.459	2.000	1.000	5.000	0.769
TRA3	414	2.896	3.000	1.000	5.000	0.852
WOP1	414	3.007	3.000	1.000	5.000	0.858
WOP2	414	2.932	3.000	1.000	5.000	0.933
WOP3	414	2.918	3.000	1.000	5.000	0.910

Source: The author's estimations from SmartPLS

Regarding standard deviation, this concept can be explained as a statistical measure of the dispersion of data points around the mean. The coefficient of variation represents the ratio of the standard deviation to the mean. In the above research results, all of the standard deviation values are lower than the mean values. Therefore, the indicators' values of the coefficient of variation are lower than 1. This indicates a lower spread of data values relative to the mean.

7.2 Evaluation of Measurement and Structural Models

7.2.1 Evaluation of Measurement Models

After establishing the model and evaluating all defined factors in the model, a comprehensive analysis and assessment are essential to systematically perform for the affirmation of the research results. Figure 7.1 presents the relationships between variables, so-called constructs, of the model and the significance of indicators to such factors. Values that are shown for each factor indicate their impact on the transformation into 4PL of LSPs in Vietnam.

Based on the recommendations of PLS-SEM theory and the literature of Hair *et al*. (2017), the constructs' reliability is evaluated by using Dijkstra-Henseler's rho-A along with Cronbach's alpha coefficients. As shown in Table 7.1, all values

exceed the thresholds of rho-A as 0.70 - 0.95 and Cronbach's alpha as 0.60 – 0.95 and indicate strong coefficients of the construct's reliability as suggested by Bagozzi & Yi (1998) and Hair *et al*. (2019). Almost all scales meet the threshold of 0.70, as recommended by Hair *et al*. (2017, 2019), except for TRA2 - Speed of transportation nationally and internationally with outer loadings of 0.511. As a result, this indicator is concluded to be not consistent with others and can not measure the construct TRA. After indicator TRA2 is eliminated, the convergent validity of the conceptual model is evaluated due to the satisfaction of other indicators to the thresholds.

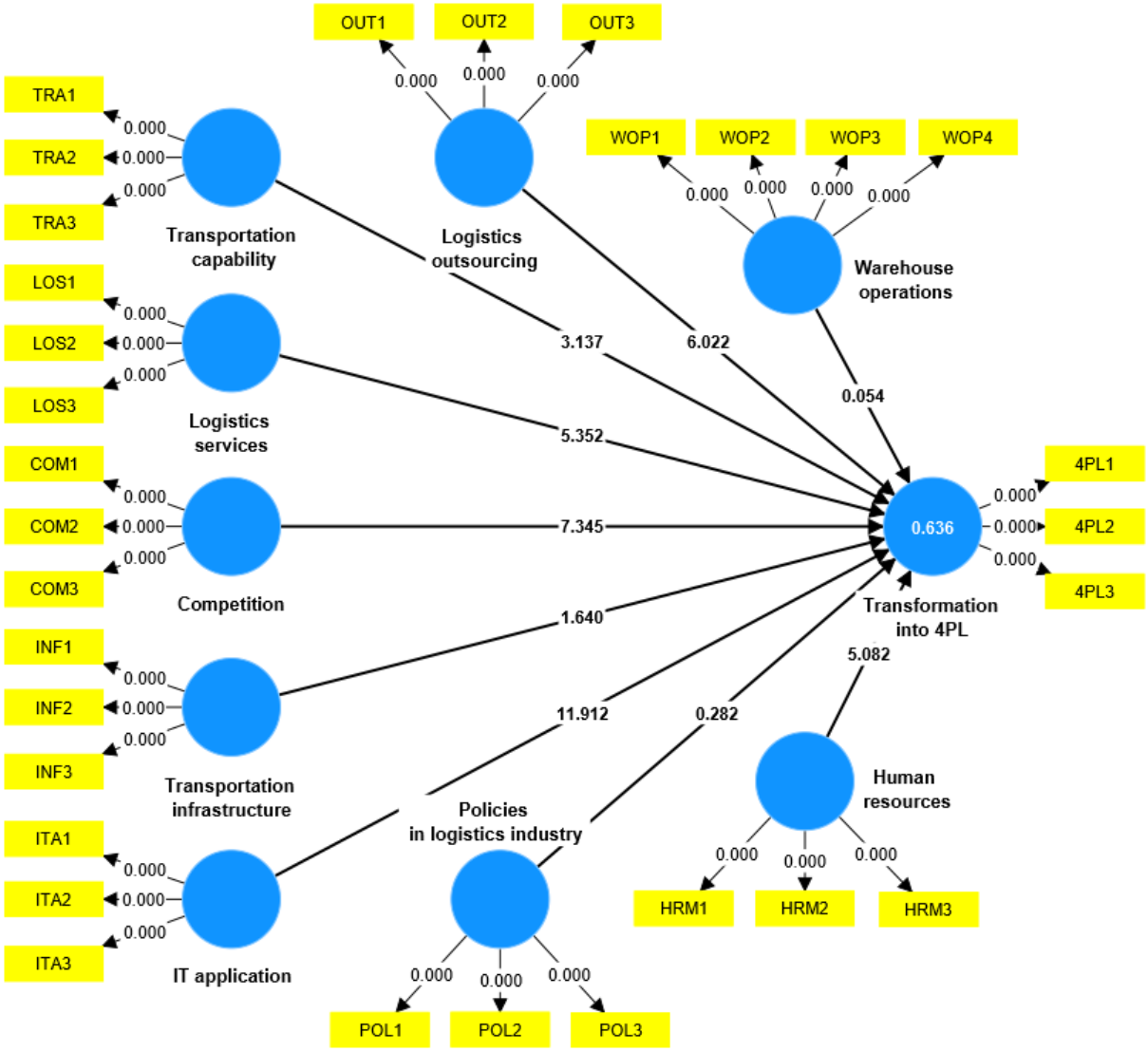


Figure 7.1: Model of transformation into 4PL

Source: The 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 0.50 to meet the standard of reliability. Composite reliability must be higher or equal to 0.70 (Hulland, 1999). All items in the model are loaded meaningfully and satisfactorily to their corresponding constructs. Values are presented in Table 7.1.

Table 7.4: Consistency Reliability and Convergent Validity

Construct	Indicator	Outer Loadings	Dijkstra-Henseler's rho_A	Cronbach's alpha(α)	Composite Reliability	Average Variance Extracted (AVE)
4PL	4PL1	0.801	0.768	0.767	0.866	0.683
	4PL2	0.833				
	4PL3	0.843				
COM	COM1	0.953	0.891	0.886	0.930	0.816
	COM2	0.871				
	COM3	0.884				
HRM	HMR1	0.950	0.887	0.878	0.925	0.806
	HMR2	0.861				
	HMR3	0.879				
INF	INF1	0.865	0.875	0.864	0.916	0.785
	INF2	0.909				
	INF3	0.884				
ITA	ITA1	0.958	0.909	0.896	0.936	0.829
	ITA2	0.883				
	ITA3	0.889				
LOS	LOS1	0.960	0.912	0.894	0.934	0.825
	LOS2	0.870				
	LOS3	0.893				
OUT	OUT1	0.799	0.717	0.713	0.839	0.634
	OUT2	0.826				
	OUT3	0.763				
POL	POL1	0.857	0.891	0.872	0.921	0.795
	POL2	0.926				
	POL3	0.891				
TRA	TRA1	0.929	0.805	0.715	0.847	0.662
	TRA2	0.511				
	TRA3	0.928				
WOP	WOP1	0.940	0.920	0.907	0.935	0.783
	WOP2	0.857				
	WOP3	0.850				
	WOP4	0.890				

Source: The author’s estimations from SmartPLS

Convergent Validity is used to evaluate the stability of scales. Fornell and Larcker (1981) pointed out that the Average Variance Extracted (AVE) must be higher or equal to 0.50 to indicate satisfactory convergent validity. 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 7.4.

Discriminant Validity assessment aims to ensure that a reflective construct has stronger relationships with its indicators than those of any other construct in the PLS path model (Hair *et al.*, 2022). The greater the average correlation coefficient within a scale compared to the average cross-correlation coefficients, the better the results. If the average of cross-correlation coefficients is lower, it means that the latent variable mentioned above shares less variation with other latent variables. Then, the indicators in the two latent variables will achieve discriminant validity. With such a distinctiveness assessment, the HTMT criterion is recommended for implementation. Discriminant validity has been established between two reflectively measured constructs when the HTMT value is less than 0.90.

Table 7.5: Discriminant Validity (Heterotrait-Monotrait Ratio of Correlations - HTMT)

Construct	COM	HRM	ITA	OUT	LOS	POL	4PL	TRA	INF	WOP
COM										
HRM	0.125									
ITA	0.139	0.246								
OUT	0.220	0.158	0.141							
LOS	0.084	0.313	0.225	0.134						
POL	0.171	0.315	0.304	0.257	0.342					
4PL	0.509	0.404	0.331	0.568	0.532	0.721				
TRA	0.249	0.450	0.359	0.318	0.499	0.401	0.619			
INF	0.260	0.084	0.271	0.303	0.059	0.118	0.411	0.163		
WOP	0.215	0.415	0.282	0.203	0.422	0.286	0.455	0.636	0.226	

Source: The author's estimations from SmartPLS

As shown in Table 7.5, the values of constructs in the model range from 0.125 to 0.721. In other words, the HTMT values of variables are below 0.90. These results certify that the discriminant validity of the measurement models is validated.

7.2.2 Evaluation of Structural Models

As presented in the research methodology, the evaluation of Structural Models concentrates on Collinearity evaluation, Path coefficients, Coefficient of determination, and f^2 effect size. Firstly, the collinearity of the model is examined to identify whether there is a collinearity or multicollinearity. VIF values are considered to assess the probability of collinearity among latent constructs

(Sarstedt and Mooi, 2019). Among the three measurement scales recommended by Bollen (2011), reflective measurement is the best choice for the research context. Therefore, it is essential to evaluate the inner VIF values while the assessment of outer VIF values is not necessary. As shown in Table 7.6, all inner VIF values are lower than 3 which means that there is no collinearity in the structural model.

Table 7.6: Inner VIF values

Metrics	Estimated model	Remarks
COM => 4PL	1.111	*Satisfactory*
HRM => 4PL	1.172	*Satisfactory*
ITA => 4PL	1.262	*Satisfactory*
OUT => 4PL	1.131	*Satisfactory*
LOS => 4PL	1.323	*Satisfactory*
POL => 4PL	1.190	*Satisfactory*
TRA => 4PL	1.633	*Satisfactory*
INF => 4PL	1.266	*Satisfactory*
WOP => 4PL	1.594	*Satisfactory*

Source: The author's estimations from SmartPLS

To measure the appropriate level of the model for the research context, the Standardized Root Mean Square Residual (SRMR) value is considered. Based on the thresholds of the SRMR value stated by Hu and Bentler (1999) as lower than 0.08 or 0.1 and the affirmation of Henseler *et al*. (2014) in the SRMR value as "Goodness of fit" in PLS-SEM, the SRMR value of this structural model is measured to avoid model misspecification. Table 7.7 shows the SRMR value of the research model as 0.049. It demonstrates the fitness of the model.

Table 7.7: 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: The author's estimations from SmartPLS

Secondly, the hypothesized relationships among the constructs are assessed through the path coefficients. When 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 author uses the software SmartPLS 3 to build a Structural Equation Model with 5,000 bootstrap samples.

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

Table 7.8: 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*

Source: The author's estimations from SmartPLS

From the bootstrapping results in Table 7.8, the impact of six factors including COM, HRM, ITA, OUT, LOS, and TRA is definitely demonstrated with p-values under the threshold. The three remaining factors of POL, INF, and WOP are not statistically significant due to their p-values over 0.05. For investigating the relevance of the structural model relationships, most of the values of path coefficients are closer to +1, except for POL and WOP. As a result, constructs in the structural model, in general, show strong positive relationships. The values of

POL and WOP are not below -1 because there is no collinearity in the model. Therefore, the reduction of multicollinearity is not necessary.

Thirdly, the examination of the reliability of the research model is the next step of the evaluation. Being known as the coefficient of determination, R Square 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 7.1). It 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. The R^2 is satisfactory in measuring the explanatory power of the model.

Fourthly, Hair *et al*. (2021) suggested investigating the f^2 effect size to assess the contribution level of independent variables to the dependent construct with different values of 0.02, 0.15, and 0.35 presenting small, medium, and large effects respectively. Table 7.9 illustrates the levels of effect size of nine factors to 4PL. Specifically, COM and ITA have medium effects to 4PL while HRM, OUT, LOS, and TRA impact at a small level. The f^2 values of the three remaining variables including INF, POL, and WOP show a very small effect and no effect on the dependent factor of 4PL.

Table 7.9: f2 effect size of constructs in the structural model

Metrics	Estimated model	Remarks
COM => 4PL	0.150	*Medium effect*
HRM => 4PL	0.065	*Small effect*
ITA => 4PL	0.327	*Medium effect*
OUT => 4PL	0.107	*Small effect*
LOS => 4PL	0.092	*Small effect*
POL => 4PL	0.000	*No effect*
TRA => 4PL	0.028	*Small effect*
INF => 4PL	0.007	*Very small effect*
WOP => 4PL	0.000	*No effect*

Source: The author's estimations from SmartPLS

From the analyses and evaluations of the Measurement models and Structural models as stated above, the results of hypothesis testing can be affirmed on the significance and effect of each variable in the conceptual model. The evidence from the bootstrapping procedure 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 weakest influence on 4PL. Otherwise, Policies in the 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. As a result, it may be interpreted that hypotheses 1, 3, 4, 5, 7, and 8 are supported and hypotheses 2, 6, and 9 aren't supported. From such results, three variables of WOP, POL, and INF are eliminated from the model, structural equation modeling has been assessed again to affirm the results of the research. Although previous studies showed the importance and role of warehouse operations, transportation infrastructure, and policies in the logistics industry to the transformation into 4PL, they aren't significant in the context of local LSPs in Vietnam. In summary, the research findings explain the influence of determinants including ITA, LOS, OUT, TRA, HRM, and COM on the transformation into 4PL.

8. DEVELOPMENT STRATEGIES THROUGH THE APPLICATION OF TRIZ INNOVATIVE APPROACH

In the research on the transformation into 4PL of local LSPs in Vietnam, six variables that have influences on this transition process are determined by Diem et al. (2023). Three key capabilities of 4PL are used as indicators to measure the dependent construct in the conceptual model, i.e. transformation into 4PL. The research results pointed out that Vietnam's local LSPs could gradually become 4PLs if they improve their capabilities to meet the requirements of 4PLs' power. In order to gain a competitive advantage in the global logistics market, local LSPs must generate innovation to become superior to their competitors. Based on this foundation, the author applies the TRIZ contradiction matrix to create inventive solutions for three core attributes of 4PL consisting of value chain creation, integration of multiple 3PL providers' activities, and management of the global supply chain.

Based on the identified capabilities of 4PL under the studies of Porter (1996), Walters and Rainbird (2007), Frost and Sullivan (2014), Fulconis *et al*. (2006), Rajaguru and Matanda (2013), and the above results, innovative recommendations are established for the development into 4PL of local LSPs in Vietnam under the implementation of TRIZ inventive approach. The three mentioned core capabilities of 4PL are considered problems that local LSPs must identify contradictions and determine relevant innovative solutions.

TRIZ implementation to the first attribute - "Value chain creation"

Stage 1: Identifying the capability

Walters and Rainbird (2007) outlined the process of making a value chain for companies to be predominant to their competitors consisting of distinguishing value expectations, making the value, creating the value, communicating the

value, distributing the value, and servicing the value. Beneath expanding expectations of the value chain, Bowersox (2013) asserted that integrated service providers started to launch into the market a range of logistics services. Korpela *et al*. (1996) pointed out that the provision of value-added services to customers is recognized as a core successful element in value creation. Therefore, the wide range and added value of logistics services become key components in creating value for clients.

Stage 2: Determining the improving and worsening parameters

From the viewpoint of clients, they desire to get great choices of offers and demand high-quality services. However, 4PL must pay consideration to the balance between the quality and benefits of offered services to costs that customers suffer to reach their goals. To effectively complete the important role of granting value to clients, 4PL utilizes all of its resources from its own and best-added value providers simultaneously. In TRIZ 39 engineering variables, "Reliability" which is explained as "A system's ability to perform its intended function in predictable ways and conditions" significantly influences the effectiveness of value chain creation. As a result, the improving parameter for value chain creation is "27- Reliability". In line with satisfying the reliability requirement, 4PL must make partial or total changes to the system for a short or long time. Therefore, the worsening parameter can be regarded as "26- Quantity of substance/the matter" which is described as "The number or amount of a system's materials, substances, parts or subsystems which might be changed fully or partially, permanently or temporarily".

Stage 3: Studying innovative principles

According to the improving parameter "27- Reliability" and the worsening parameter "26- Quantity of substance/the matter", innovative principles of this logistics capability corresponding to the contradictory matrix are "Principle 21- Skipping, Principle 28- Mechanics substitution, Principle 40- Composite materials, and Principle 3- Local quality". From careful consideration of various aspects, "Principles 21, 28, 40, and 3" may contribute to LSPs in value chain creation in the development into 4PLs. Therefore, all of them are chosen for developing strategies.

Stage 4: Formulating strategies based on defined innovative principles

"Principle 21- Skipping" mentions the implementation of the process at high speed. One of the key characteristics of 4PL is to supply logistics services in an effective and timely manner. 4PL providers mainly concentrate on the role of granting value to the organizational clients through collaborated resources supplied by the selected superior providers with cost-effectiveness. Therefore, the improvement of process speed within the logistics operations can be considered a key indicator for LSPs in the transformation into 4PL.

"Principle 28- Mechanics substitution" consists of sub-principles as follows:

- "Replace a mechanical means with a sensory means": LSPs, instead of simply providing logistics services, should create and deliver values to their clients to make essential changes to the degree of flexibility to strengthen the level of customization on logistics services.
- "Use electric, magnetic, and electromagnetic fields to interact with the object": technology is, nowadays, recognized as a key tool that LSPs should utilize to improve the quality of logistics services. ICT could be useful for the performance of activities and the execution of decision-making more quickly to gain higher efficiency in logistics services.
- "Change from static to movable fields, from unstructured fields to those having the structure": LSPs should transform the service provision from supplying designed logistics services such as transportation and warehousing to dealing with clients in the manner of partnership for long-term contracts.

"Principle 40- Composite materials lead to the change from uniform to composite services": Working as an integrator, 4PL combines logistics services from multiple 3PL providers and generates comprehensive strategies for the clients. Therefore, it is essential for LSPs to upgrade their logistics services to integrated logistics solutions for the whole supply chain instead of providing separate offers to create more benefits and value for clients.

"Principle 3- Local quality" mentions three following strategies:

- "Change an object's structure from uniform to non-uniform, change an external environment (or external influence) from uniform to non-uniform": Many operations are contributing to logistics services including goods moving and distribution, packaging, warehousing, procurement, and order processing. The remarkable growth of logistics outsourcing all over the world has proven its outstanding advantages including cost reduction, flexibility, and customer services. The requirements in logistics services become higher and more complicated due to the changes of the business environment. Therefore, LSPs must be able to expand their service range and offer great customization schemes if they desire to operate as 4PLs.
- "Make each part of an object function in conditions most suitable for its operation": 4PL offers clients an abundant service range of logistics operations at three levels. Firstly, transactional logistics services provide contracts of specialized logistics functions. Secondly, tactical logistics services concentrate on the 3PL's management of parts in the client's supply chain. Thirdly, strategic logistics services supply comprehensive supply chain solutions for customers through the integration of 3PL, IT, and business process management.
- "Make each part of an object fulfill a different and useful function": "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" (Mangan *et al*., 2008). 4PL must ensure all of these functions are controlled effectively.

TRIZ implementation to the second attribute - "Integration of multiple 3PL providers' activities"

Stage 1: Identifying the capability

Cost-effectiveness accompanying qualified logistics services is considered one of the main objectives of 4PL's business. 4PLs always keep a special concentration on the utilization of resources. Being considered a modern configuration of logistics providers, 4PLs reinforce the integration of their assets, partners' resources, and IT applications. 4PLs are always excellent in indicating their ability to develop and manage the logistics networks with strong cooperation with 3PLs and firms providing the latest logistics IT services (Gattorna, 1998). As a result, the concentration on the diversity of relationships is essential to 4PL when coordinating with partners to create a comprehensive supply chain network.

Stage 2: Determining the improving and worsening parameters

Regarding 4PL's characteristics, partnership, joint venture, value-based, risk sharing, long-term, core value, alignment, and trust are positively assessed. However, to successfully assemble the resources, capabilities, and technology to design, produce, and operate comprehensive supply chain solutions, 4PL needs to improve its service in terms of broad and deep scope to be adaptive to 4PL's characteristics. From the above-mentioned analyses, the improving parameter is determined as "36- Device complexity". According to the explanation of 39 parameters of the contradiction matrix, Device complexity is referred to as "the number and diversity of elements and element interrelationships within a system". However, the management of coordinated activities and resources from partners becomes more complicated when 4PL operates as an integrator of breakthrough supply chain solutions. As a result, the worsening parameter is regarded as "37- Difficulty in detecting and measuring". From the description of parameter 37 stated in the contradiction matrix, it takes a lot of time to set up and implement complex and costly systems or systems that have complex relationships between components or components that interfere with each other.

Stage 3: Studying innovative principles

According to the improving parameter "36- Device complexity" and the worsening parameter "37- Difficulty in detecting and measuring", innovative principles of logistics capability corresponding to contradictory matrix consist of "Principle 15- Dynamics, Principle 10- Preliminary action, Principle 37- Thermal expansion, and Principle 28- Mechanics substitution". After being seriously investigated identified innovative principles, "Principles 15 and 10" are adopted

to generate strategies. “Principle 37” is more suitable for engineering activities while “Principle 28” has already been applied in previous capability.

Stage 4: Formulating strategies based on defined innovative principle

“Principle 15- Dynamics” recommends three strategies for creating the innovation of 4PL’s integrated logistics services. Firstly, LSPs that are in the process of transforming into 4PLs should build the optional collaboration system in their logistics networks for partners including 3PLs and enterprises supplying IT solutions. Because 3PLs and IT firms perform their operations as core elements in this connected chain, they need to have a more flexible and dynamic environment to supply their dedicated services in specific operating conditions. Secondly, all components in the integrated logistics services can be redesigned or exchanged within the network in terms of assuring the 4PL’s prime goals of effective operations and cost reduction. Thirdly, the external business environment constantly fluctuates and makes certain influences on customers’ demands. As a result, a diversity of flexible customized solutions should be offered to clients to catch up with their adaptive business strategies.

“Principle 10- Preliminary action refers to the process of pre-actions adding to the service system”. It is essential that customers are provided the complete logistics plan for their company’s business from starting the transaction in which all participating components of the supply chain are presented. The pre-arrangement would be useful for both 4PLs and the customers in negotiating to reach an agreement on large projects. Such preliminary action also creates the activeness for 4PLs to adjust components in the supply chain solutions to make the trade-off between the benefits of all related partners and cost assumptions.

TRIZ implementation to the third attribute - “Management of global supply chain”

Stage 1: Identifying the capability

According to Wildemann (2001), the objectives of SCM focus on the optimization of the process cycles, improvement of the service value, and increase of the flexibility of logistics operations through the utilization of resources in efficient and cost-effective ways. 4PL’s ability to achieve these goals by planning strategies for the whole supply chain is proven in many studies by Win (2008), Vinay *et al*. (2009), Yao (2010), Rajaguru and Matanda (2013), and Kasperek (2013).

In the global supply chain, ranges of operations are complicated and the requirements for effective management are at a high level. As a result, 4PLs must have the ability to connect different resources and effectively control management capability in every stage of a global supply chain such as designing, constructing, and running the whole process. With the global scope of operations, 4PLs serve

a huge number of clients all over the world in flexible approaches. Therefore, adaptability is the key factor for global supply chain management.

Stage 2: Determining the improving and worsening parameters

Regarding the scope of activities, 4PLs build broad logistics networks around the world to promote their global operations. Their monitoring of compositions in the network becomes especially important. There may be constraints, obstacles, and problems arising during the coordination of partners besides effective cooperation due to both various demands from the clients and changes in the international business market. As a result, 4PLs need to focus on adaptability and flexibility within the integrated logistics projects to be adaptive to the fluctuations in the external environment. From such detailed analyses, the improving parameter is regarded as "35- Adaptability". This improving parameter is described as "the extent to which a system positively responds to external changes, also a system that can be used in multiple ways for under a variety of circumstances". However, when the logistics service system becomes flexible to be responsive to specific features of definite projects, the stability of the network may be impacted in composition. Elements of the system embrace the motion towards common trends and transition all over the world. Therefore, the worsening parameter is defined as "13- Stability of the object's composition". This parameter mentions the integrity of the logistics service system and the relationship between the system's constituent elements.

Stage 3: Studying innovative principles

According to the improving parameter "35- Adaptability" and the worsening parameter "13- Stability of the object's composition", innovative principles of logistics capability corresponding to the contradictory matrix are "Principle 35- Parameter changes, Principle 30- Flexible shells and thin films, and Principle 14- Spheroidality – Curvature". From the formal thorough examination of these parameters and concerning innovative directions of these principles, "Principle 30 and Principle 14" are specifically applied to the engineering area. As a result, "Principle 35- Parameter changes" are selected to develop strategies for the transformation.

Stage 4: Formulating strategies based on defined innovative principle

"Principle 35- Parameter changes" leads to three tactics that support the improvement of global SCM. Firstly, the status of the international logistics network needs to be flexible to meet the diversified demands of clients' customized contracts in every market in the world. Nowadays, plenty of scientific innovations have been applied in manufacturing such as new materials, production processes, and advanced technology. These changes create significant adjustments and rearrangements in the supply chain of large multinational corporations. 4PLs' role is not only to assure the effective management of the whole supply chain to their clients but also to provide outstanding proposals with

predominant added values. Secondly, the focus on core elements of the logistics service system should be flexibly changed in terms of the capability and compatibility of participating partners in the network. In the global supply chain, many 3PLs are responsible for supplying plenty of complicated logistics activities to create integrated strategic solutions for customers. Specifically, the second tactic for "Principle 35" suggests that "4PLs' global supply chain management becomes more effective for both provider and customer when there is more participation of 3PLs and IT service firms". In this case, 4PLs may take advantage of partners' specified strengths to maximize benefits and decrease costs. Thirdly, the changes in the flexibility level of operations in the logistics system should be made corresponding to specific situations consisting of characterized clients, specialized operations, definite periods, and defined markets.

In summary, the application of TRIZ methodology suggests seven strategies to be established for LSPs to improve three capabilities that are considered key attributes of 4PLs. These strategies would be meaningful and useful to LSPs in the transformation into 4PLs due to their concentration on the improvement of the logistics service system. Recommended strategies that are created based on the TRIZ contradiction matrix mention the fields of speed, structure, components, functions, process, flexibility, and change management of 4PL's logistics service system. The performance of the seven proposed strategies at LSPs would contribute to the completion of an integrated logistics service system at the global level.

Strategy summary

The growth of international trade and e-commerce in the Vietnamese market creates both opportunities and threats to local LSPs. They, nowadays, run their operations with the tendency of providing integrated logistics solutions in terms of added value creation, cost-effectiveness, and time-saving. Local LSPs may lose competitive advantage to rivals, i.e. large multinational logistics corporations when they can't fulfill ever-increasing demands from the clients. Then, local LSPs shall suffer fierce competition in both the Vietnamese and international logistics market which has a high potential for development.

From the transparent evidence of analyses and comparisons between LSP and 4PL, it is obvious to assert that 4PL is superior and brings greater value to customers. Therefore, the establishment of strategies for the transformation into 4PL is essential to meet high levels of requirements from customers. Suggested solutions are built from the foundation of 4PL's three capabilities including value chain creation, integration of multiple 3PL provider activities, and management of the global supply chain under the application of TRIZ inventive approach. From the implementation process of analyzing and solving problems under the TRIZ contradictory matrix, seven innovative strategies are developed to improve LSP's logistics operations. They are categorized into two groups including short-term and long-term strategies. Three strategies among seven ones are

recommended to perform in a short time. The remaining 4 strategies shall be appropriate to execute over a long time.

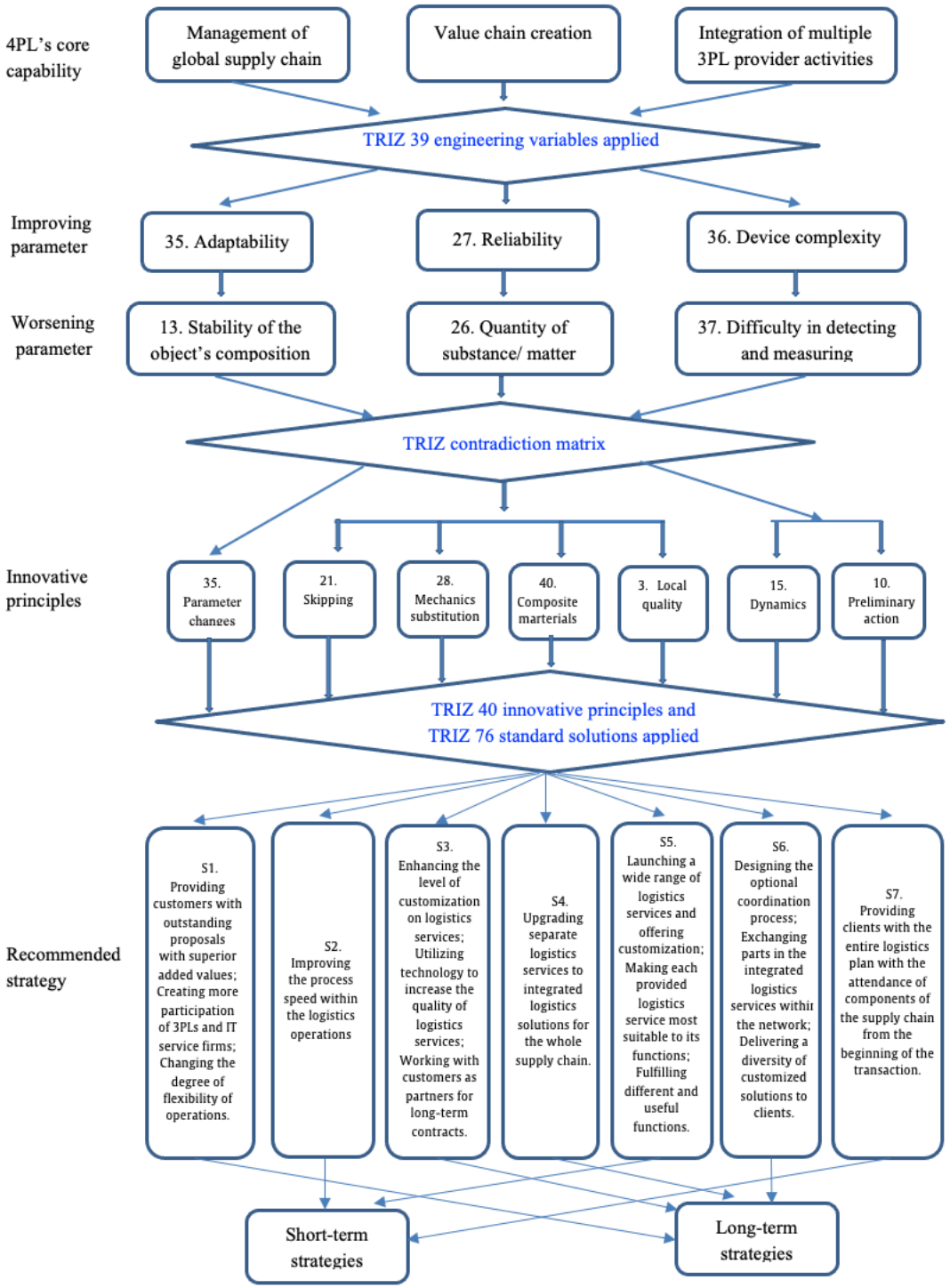


Figure 8.1: Suggested strategies constructed under TRIZ application

Source: The author's study

In short-term strategies, LSPs should focus on the enhancement of the velocity of logistics service provision to reach the objective of cost- and time- effectiveness. Moreover, the organizational clients that have diversified logistics demands

require a wide range of specialized customization to fit with their business. Offered services should hand in reliability to the clients to ensure that all functions of the delivered services are appropriate and meaningful. In addition, comprehensive proposed plans for the whole transaction need to be clearly discussed from the start of the service contract.

In long-term strategies, LSPs need to have great upgrading on comprehensive logistics services with advanced added values. Besides, new technology plays a vital role in the quality enhancement of logistics services to meet the customers' high-level requirements. As a result, long-term contracts or projects that are recommended to be created should pay attention to customization and ICT utility. Due to 4PL's attribute as an integrator, the diversified participation of 3PLs is essential to create flexibility during the service provision process. Overall, these strategic recommendations are prime elements in the transformation into 4PL of Vietnamese local LSPs thanks to their values in creating a competitive advantage for logistics providers.

Table 8.1: Short-term and long-term strategies

Short-term strategies	Long-term strategies
S2. Improving the process speed within the logistics operations. S5. Launching a wide range of logistics services and offering customization; Making each provided logistics service most suitable to its functions; Fulfilling different and useful functions. S7. Providing clients with the entire logistics plan with the attendance of components of the supply chain from the beginning of the transaction.	S1. Providing customers with outstanding proposals with superior added values; Creating more participation of 3PLs and IT service firms; Changing the degree of flexibility of operations. S3. Enhancing the level of customization on logistics services; Utilizing technology to increase the quality of logistics services; Working with customers as partners for long-term contracts. S4. Upgrading separate logistics services to integrated logistics solutions for the whole supply chain. S6. Designing the optional coordination process; Exchanging parts in the integrated logistics services within the network;

	Delivering a diversity of customized solutions to clients.

9. CONTRIBUTIONS

9.1 Contribution for science

Through the research results, the dissertation would have the following contributions:

- The study systemizes general theories in 4PL providers, transportation capability, warehouse operations, IT application, human resources in logistics service, logistics services, transportation infrastructure, logistics outsourcing trend, competition in the logistics market, policies in the logistics industry, value chain creation, integration of multiple 3PL providers' activities, global supply chain management, and TRIZ theory. Therefore, the study will provide significant contributions to the completion of the theoretical framework in 4PL services.
- The study would contribute to the measurement system in variables influencing the strategic transformation into 4PL of LSPs.
- The study suggests the application of TRIZ inventive approach for establishing development strategies for LSPs to transform into 4PL.

9.2 Contribution for practice

This study will be helpful for managers of LSPs in Vietnam and practitioners to enhance their capabilities for the strategic transformation into 4PL. Through the utility of their resources and the integration of others, LSPs can gain a competitive advantage in the global ever-increasing logistics market. The logistics industry in Vietnam has a high growth potential and benefits thanks to Vietnam's favorable strategic position in the Asian area. 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).

10. CONCLUSIONS

Nowadays, 4PL has become meaningful and important to both manufacturing and trading enterprises around the world due to its predominant benefits. It is obvious to affirm that 4PL 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). This dissertation has established a model for transformation into 4PL for local LSPs in Vietnam with nine independent variables and one dependent factor. 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 well. The factor WOP isn't significant in the model due to 4PL's attributes stated as integrating resources of the 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. Besides, three key indicators of transformation into 4PL which are evaluated in the research highlight the superiority of logistics service provision (Gattorna, 1998; Hoek, 2006). Overall, the results of hypothesis testing with the 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).

The findings of this study which are analyzed and discussed above affirm that the study has achieved the following results:

Firstly, all of the established research objectives have been totally reached with demonstrated results including the identification of the role, importance, and characteristics of 4PL in the logistics service industry and global supply chain, the establishment of a comprehensive research model for the transformation into 4PL of local LSPs in Vietnam, and the development of strategies for successful transformation into 4PL of local LSPs in Vietnam. With the first objective, the author has systemized theories in 4PL to create the foundation for constructing the model. Detailed results from the SmartPLS model have pointed out that the constructed model is comprehensive and meaningful. Then, feasible and innovative strategies have been developed logically and completely.

Secondly, the study has specifically presented the answers to three research questions. The mentioned superior benefits and advantages of 4PL have shown the reasons why local LSPs in Vietnam should transform into 4PL. From the results of the quantitative model, six constructs that impact the strategic transformation into 4PL of local LSPs have been pointed out including transportation capability, IT application, human resources, logistics services, logistics outsourcing trend, and competition in the logistics industry. Specifically, the study suggests that these factors play a key role in the process of LSPs' development establishment and should be recognized completely for sustainable competitive advantage. The changes in the logistics service market in the world currently influence the scale and role of LSPs in providing operations and coordination. Information technology application which has the strongest influence acts as a significant tool in ensuring the provider network when combined with driving forces. The third research question which mentions the method for local LSPs in Vietnam to successfully transform into 4PL has been cleared up through the application of TRIZ innovative approach. Seven completed strategies have been developed by the implementation of three key attributes of

4PL in TRIZ 39 engineering variables, 40 innovative principles, 76 standard solutions, and a contradictory matrix. The suggested recommendations could be applied flexibly and comprehensively in establishing the growth process for logistics enterprises with inventive and breakthrough strategies.

Thirdly, after being tested by structural equation modeling, hypotheses H1, H3, H4, H5, H7, and H8 have a positive impact on the strategic transformation into 4PL of local LSPs in Vietnam. It means that transportation capability, advanced IT application, highly qualified human resources, high-quality logistics services, the growth of the logistics outsourcing trend, and the increase of competition in the logistics market directly influence on LSPs' development to 4PL. These factors belong to both microeconomic and macroeconomic sectors. Three hypotheses that don't support the transformation process into 4PL of LSPs include H2, H6, and H9. The results illustrated that effective warehouse operations, good transportation infrastructure, and completed government policies don't have a direct influence on the transformation. Although these variables also play an important role in logistics providers, the impact isn't shown clearly in the results of this study.

In summary, the research points out determinants impacting the transformation into 4PL of local LSPs based on the collected data from the survey of 414 local LSPs in Vietnam. Respondents are a variety of 3PLs; forwarding and shipping agency; forwarding; transportation, forwarding, and warehousing; forwarding and warehousing; transportation and forwarding; transportation and warehousing; transportation; transportation, forwarding, and shipping agency. Our data was focused only on the enterprises that performed their operations in the logistics industry. Further empirical research should consider the scale of local LSPs which leads to the impact of constructs on the transformation into 4PL. Factors may have significant differences in the effect to LSPs at the variant size. Hence, the type of operations and size of LSPs should be noticed when selecting respondents for the survey to collect data for the model.

Another limitation of this study is that the findings could explain 63.6% of the variation of transformation into 4PL. Six constructs that have direct and positive impacts including ITA, LOS, OUT, COM, TRA, and HRM could interpret 63.6% of the research. In reality, there may be other factors influencing the transformation into 4PL of local LSPs but they aren't assessed in this study due to the limitation of respondents. Further research should enlarge the survey scale to widely perform the assessment. For instance, enterprises that have high potential in development into 4PL account for a low rate of respondents such as 3PL and shipping agencies. Besides, the type of company and financial potential of LSPs may be significant and have remarkable impacts on the transformation into 4PL. As a result, these factors should be seriously considered in future research to have a completed investigation.

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APPENDIX 1

SURVEY QUESTIONNAIRES
ON LOGISTICS SERVICE PROVISION

Introduction and acknowledgement

Dear Sirs/Madams,

I am Trang Le Truong Diem, PhD. candidate at Tomas Bata University in Zlín, the Czech Republic. Now I am conducting scientific research in strategic transformation into 4PL for local logistics service providers in Vietnam with the purpose of identifying factors affecting the transformation process and then fostering the development of the logistics industry in Vietnam. Please kindly answer the following questionnaires as a way to support me in completing my research well. Your contribution will be highly appreciated.

I hereby ensure that:

- All information provided by you is confidential (answers will be deleted right after they are processed and encoded).
- This research survey will not bring any negative impacts to a person or organization.

It takes around 10 minutes to complete the questionnaire. Thank you very much for your kind support!

Wish you and your company success and prosperity!

A. Company's transportation capability (TRA)

1. *How is the Company's capability in owned means of transportation for providing logistics services to clients' contracts? (TRA1)*
   a. Absolutely good
   b. Good
   c. Medium
   d. Under medium
   e. Non

2. *How is the Company's speed of transportation nationally and internationally in comparison to the average speed of others in the industry? (TRA2)*
   a. Very fast
   b. Fast
   c. Medium
   d. Slow
   e. Very slow

3. *How is the Company's capability to connect transportation chain and logistics services for supplying a multimodel of transportation services? (TRA3)*
   a. Very high
   b. High
   c. Medium
   d. Low
   e. Very low

B. Company's warehouse operations (WOP)

4. *How is the scale of the Company's owned warehouse? (WOP1)*
   a. Very large
   b. Large
   c. Medium
   d. Small
   e. Very small

5. *How is the level of technology application in the Company's warehouse operations? (WOP2)*
   a. Absolutely
   b. Mostly
   c. Halfly
   d. Partly
   e. Non

6. *How is the rate of errors in the Company's warehouse operations? (WOP3)*
   a. Very low
   b. Low
   c. Medium
   d. High
   e. Very high

7. *How is the level of cross-docking application in the Company's warehouse operations? (WOP4)*
   a. Absolutely
   b. Mostly
   c. Halfly
   d. Partly
   e. Non

C. Modern technology application in the Company (ITA)

8. *How are the Company's highly qualified IT human resources? (ITA1)*
   a. Very good
   b. Good
   c. Normal
   d. Bad
   e. Very bad

9. *How is the Company's advanced IT infrastructure? (ITA2)*
   a. Very advanced
   b. Advanced
   c. Medium
   d. Bad
   e. Very bad

10. *How is the partnering relationship between IT application and logistics service management in the Company? (ITA3)*
    a. Very good
    b. Good
    c. Normal
    d. Bad
    e. Very bad

D. The company's human resource (HRM)

11. *How is the specialized competence of the Company's human resources? (HRM1)*
    a. Very good
    b. Good
    c. Medium
    d. Weak

e. Very weak

12. *How is the planning and controlling ability of the Company's human resources? (HRM2)*
    a. Very good
    b. Good
    c. Medium
    d. Weak
    e. Very weak

13. *How is learning and integrating competence of the Company's human resources? (HRM3)*
    a. Very good
    b. Good
    c. Medium
    d. Weak
    e. Very weak

E. Company's Logistics services (LOS)

14. *How is the diversification and strategy customization of the Company's logistics services? (LOS1)*
    a. Very good
    b. Good
    c. Medium
    d. Bad
    e. Very bad

15. *How is the level of providing added value to customers of the Company's logistics services? (LOS2)*
    a. Very good
    b. Good
    c. Medium
    d. Bad
    e. Very bad

16. *How are your costs for logistics services in comparison to those of other logistics service providers in the industry? (LOS3)*
    a. Very low in comparison to those of other logistics service providers
    b. Lower than those of other logistics service providers
    c. Same as those of other logistics service providers

d. High in comparison to those of other logistics service providers
e. Very high in comparison to those of other logistics service providers

F. Transportation infrastructure (INF)

17. *How does airport infrastructure impact the development of the Company's logistics service provision?* (INF1)
    a. Very highly impacted
    b. Highly impacted
    c. Impacted at medium level
    d. Lightly impacted
    e. Not impacted

18. *How does harbor infrastructure impact the development of the Company's logistics service provision?* (INF2)
    a. Very highly impacted
    b. Highly impacted
    c. Impacted at medium level
    d. Lightly impacted
    e. Not impacted

19. *How does road infrastructure affect the development of the Company's logistics service provision?* (INF3)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

G. The growth of the logistics outsourcing trend (OUT)

20. *How does the trend of logistics outsourcing affect the development of the Company's logistics service provision?* (OUT1)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

21. *How does the size of the organization adopting logistics outsourcing affect the development of the Company's logistics service provision?* (OUT2)

a. Very highly affected
b. Highly affected
c. Affected at medium level
d. Lightly affected
e. Not affected

22. *How does the level of logistics outsourcing of an organization adopting logistics outsourcing affect the development of the Company's logistics service provision?* (OUT3)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

H. Competition in logistics industry (COM)

23. *How does a number of rivals who are local logistics service providers (LSPs) affect the development of the Company's logistics service provision?* (COM1)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

24. *How does the market share of LSPs affect the development of the Company's logistics service provision?* (COM2)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

25. *How does the type of rivals' logistics service provision affect the development of the Company's logistics service provision?* (COM3)
    a. Very highly affected
    b. Highly affected
    c. Affected at medium level
    d. Lightly affected
    e. Not affected

I. Policies in logistics industry (POL)

26. *How does the Company assess the usefulness of government policies in the logistics industry to the development of the Company's logistics service provision?* (POL1)
    a. Very useful
    b. Useful
    c. Useful at medium-level
    d. Lightly useful
    e. Not useful

27. *How does the Company assess the usefulness of government-supported policies for LSPs to the development of the Company's logistics service provision?* (POL2)
    a. Very useful
    b. Useful
    c. Useful at medium-level
    d. Lightly useful
    e. Not useful

28. *How does the Company assess the effectiveness of government directions and strategies for the development of the logistics industry to the development of the Company's logistics service provision?* (POL3)
    a. Very effective
    b. Effective
    c. Effective at medium level
    d. Lightly effective
    e. Not effective

J. Tranformation into 4PL (4PL)

29. *How does the Company assess the Company's value chain creation from logistics service provision? (4PL1)*
    a. Very good
    b. Good
    c. Medium
    d. Bad
    e. Very bad

30. *How does the Company integrate multiple 3PL providers' activities? (4PL2)*
    a. Very good
    b. Good

c. Medium
d. Bad
e. Very bad

31. *How does the Company affirm about Company's owned management competence in the global supply chain? (4PL3)*
    a. Very good
    b. Good
    c. Medium
    d. Bad
    e. Very bad

----------The end----------

Le Truong Diem Trang

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Strategická transformace na logistiku čtvrtého typu: metodický přístup místních poskytovatelů logistických služeb ve Vietnamu

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