# An Application of TRIZ Inventive Approach in Development Strategy into Fourth-party Logistics

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## ABSTRACT

**Purpose:** The study aims to affirm the application of TRIZ in logistics service and then develop innovative strategies for Vietnamese local logistics service providers (LSPs) to transform into fourth-party logistics (4PL) through TRIZ inventive methodology.

**Methodology/Approach:** The integration of Savransky's methodology into TRIZ proposals enables to identify the core correlated dependencies of selected parameters. The analyses of the theoretical background and the application of the TRIZ matrix are comprehensively conducted to create innovation for three important attributes of 4PL.

**Findings:** The research results propose seven strategies through Savransky's suggested steps from the analytical application of TRIZ. The established recommendations are categorised into short-term and long-term strategies and can be flexibly applied depending on the corporate growth process.

**Research Limitation/implication:** TRIZ approach was initially constructed for solving engineering problems. As a result, several inventive principles in the contradiction matrix were not entirely appropriate to the service area. In such cases, the authors can't apply all suggested solutions from the contradiction matrix.

**Originality/Value of paper:** The study provides local LSPs in Vietnam with comprehensive strategies for improving their capabilities to meet the requirements of 4PLs' power.

**Category:** Research paper

**Keywords:** logistics; fourth-party logistics; transformation; logistics service providers; TRIZ

# 1 INTRODUCTION

The development trend of LSPs derives from the increasing demand for advanced logistics services. Globalisation, outsourcing trends, 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). LSPs have to pay more attention to inventive approaches, which play a key role in the success of LSPs in adapting to the companies' demands in 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) 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 2022 show that more than three thousand LSPs are operating in the Vietnamese market, of which 89% are domestic firms, 10% 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 accounts for around 15% out of these logistics firms, and most local LSPs operate as 2PL service providers. Most of them are small enterprises 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.

According to the World Logistics Performance Index (LPI) ranking published in 2023 by World Bank, Vietnam's logistics industry has achieved 43th position out of 160 countries. In the ASEAN region, Vietnam is in the top five after Singapore, Malaysia, and Thailand, and at the same ranking as the Philippines. Although Vietnam has created an impressive development in the logistics industry over the years, 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% 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%. The fierce competition of international trade has forced domestic LSPs to create competitive advantage, time saving, cost-effectiveness, risk reduction, and flexibility. Meanwhile, Vietnamese logistics enterprises have to face the pressure of rivals which are foreign logistics corporations.

TRIZ is known as the Russian acronym for the "Theory of Inventive Problem Solving" which is applied to generate new concepts. In TRIZ implementation, an analysis of the problem is conducted, and then a set of alternatives for solutions is pointed out (Altshuller, 1994; Subzwari, 2006). TRIZ can be considered as a systematic problem-solving process that consists of the identified problem and

resolution tools. According to TRIZ methodology, problems are formulated in the form of contradictions, which are synthesised in the TRIZ contradiction matrix (Altshuller, 2002). Thanks to TRIZ's ability to eliminate contradictions, breakthrough solutions are generated under the application of 40 inventive principles.

This paper proposes to develop strategies for LSPs to transform into 4PL through TRIZ inventive methodology. The authors apply TRIZ's inventive problem-solving process with four analysed steps suggested by Savransky (2000) to generate seven strategies for enhancing the effectiveness of the defined capabilities of 4PL.

## 2 METHODOLOGY

As mentioned above, the TRIZ methodology can be adapted to solve different kinds of problems with the core role of contradictions. From the analyses in the theoretical background, there are various methods for solving contradictions by applying the TRIZ matrix. In this paper, we adopt Waransky's algorithm of 4 stages in the process as follows:

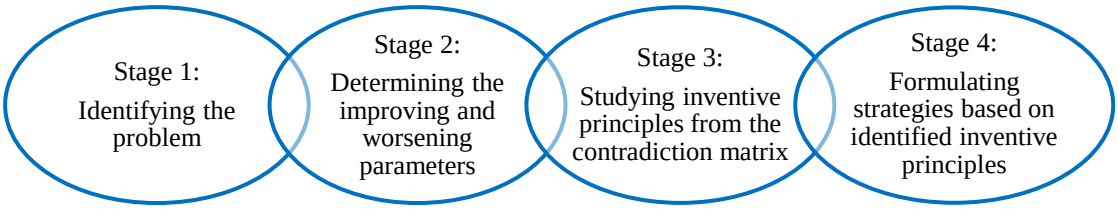


*Figure 1 – Process of TRIZ implementation*

The core goals of our study are to affirm the effective application of TRIZ in 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. In order to assess the attainment of the mentioned research goals, the results of the study will show 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?

# 3 THEORETICAL FRAMEWORK

## 3.1 Fourth-party logistics (4PL)

Logistics and LSPs are considered as core factors in the development of supply chains (Rafele, 2004). According to Hosie et al. (2012) and 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). LSPs often have the intention 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 tendency of the market requires logistics enterprises to provide wide 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 more innovative model of logistics provision to keep up with the times and gain a competitive advantage.

There is a variety of definitions of 4PL depending on different studies of researchers. Substantially, the term 4PL is owned by Accenture Consulting Company and is defined as "A 4PL is an integrator that assembles the resources, capabilities, and technology of its own organisation and other organisations to design, build, and run comprehensive supply chain solutions" (Dollet and Diaz, 2011). According to Van Hoek and Chong (2001), the 4PL definition is stated as "A 4PL is a supply chain service provider that participates rather in supply chain co-ordination than operational services". Concentrating on a comprehensive supply chain perspective, 4PL is an integration of various kinds of management capabilities, expertise, and 3PL combination (Skjoett-Larsen, 2006). Coyle et al. (2003) mentioned 4PL as an actor that operates in shaping and constructing effective relationships in supply chains between other actors by providing specialised skills and competencies in information technology. Moreover, 4PL can manage cost-effectiveness and handle un-expectations of market fluctuations flexibly (Frost and Sullivan, 2014). Mukhopadhyay and Detaputra (2006) affirmed that "4PL is treated as a strategic partner, rather than a tactical one, and is a supply chain integrator that synthesises and manages the resources, capabilities, and technology of its organisation and those of complementary service providers to deliver a comprehensive supply chain solution". 4PL acts as an independent integrator with the role of executing and controlling logistics solutions of high value and time effectiveness, while Win (2008) affirmed that 4PL's function of value creation in its customer enterprise reflects the level of its performance and success. In addition, there are many other studies on 4PL and its characteristics, including Foster and Wild (1999), Magill (2000), Copacino and Byrnes (2001), Marino (2002), Craig (2003), Visser et al. (2004), Supply Chain Executive Board (2005), Hoek (2006), Alan Win (2008), Hingley et al (2011).

## 3.2 TRIZ – Theory of Inventive Problem Solving

Genrich Altshuller developed TRIZ in 1946 based on the investigation of 200,000 patents from engineering fields around the world. Then, 1,500 technical contradictions were introduced through the extraction of useful solutions from sampled patents. In TRIZ approach, problems can be determined by features and classified on engineering parameters. Technology-based improvements for products are made by applying inventive principles in the contradiction matrix (Bogatyreva et al., 2004). From such characteristics and functions, TRIZ is acknowledged as the unique systematic technology for generating inventive solutions in solving problems through the analyses and application of a series of suggestions. Altshuller initially constructed a set of tools and methods to identify and resolve problems for engineers. Then, these approaches were improved with a theoretical corpus. Technological innovation in TRIZ is considered as a revolution for both product development and strategic management (Savransky, 2000). Until now, TRIZ has provided foundations and assumptions with a framework to build problem-solving methods in many fields with breakthrough solutions to enhance the effectiveness of the results.

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

- Contradictions: contradictions derive from evolutionary trends, expectations, or chances for the system development. If contradictions are not overcome, the system might not exist.
- The laws of evolution of technical system: evolution of technical system and trends are studied to evaluate and orient the problem-solving process.
- The specific requirements: contextualisation of evolution and the identified problem is creating.

In the application of TRIZ, contradiction represents the core of the problem. Therefore, the contradiction tool will be used first to analyse the problem. In the contradiction matrix, 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. From the analysis of the problem, improving parameters are identified, and then worsening ones will also be 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. Such recommendations could be implemented flexibly and appropriately in different cases by client companies.

Altshuller classified standard solutions into five large groups, including improving the system with no or little change, improving the system by changing the system, system transitions, detection and measurement, and strategies for simplification and improvement (Terninko *et al*., 2000). Based on such standard solutions, effective strategies can be established quickly to settle complex problems. A

typical model of TRIZ contradiction matrix of several specific engineering variables is illustrated in the following Figure 2.

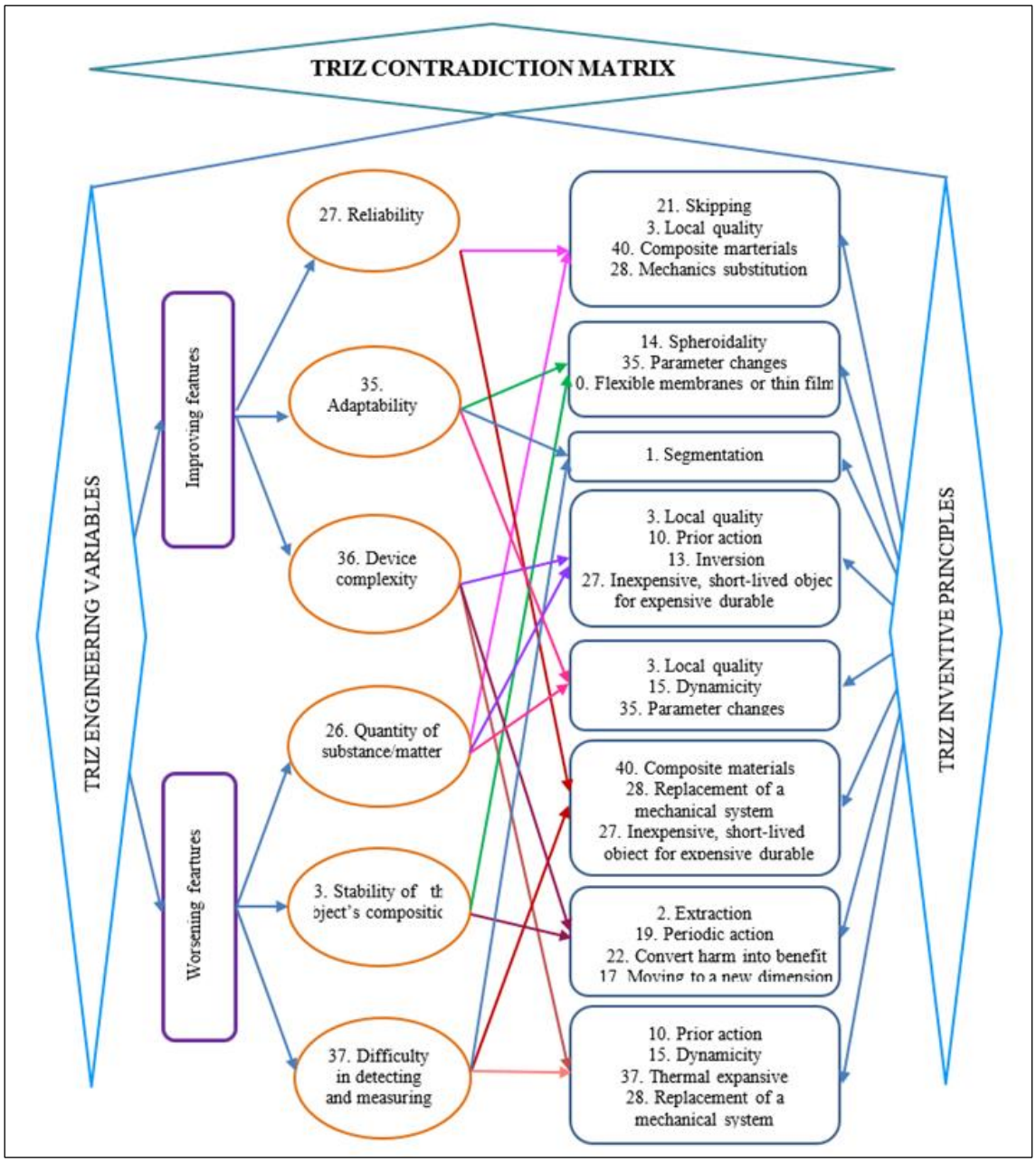


*Figure 2 – Model of TRIZ contradiction matrix*

Based on the principles of TRIZ, Simon (1977) pointed out that there are four steps in problem-solving consisting of defining the problem, constructing solutions, selecting solutions, and implementing solutions. However, Mann (2009) made some changes in this problem-solving process, which included four steps: problem identification, tool selection, solution generation, and solution evaluation. Meanwhile, four steps in the analytical application of TRIZ were suggested by Waransky (2000), including identifying the problem, determining the parameters for improving and worsening, studying inventive 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, TRIZ contradiction matrix, and 76 standard solutions.

## 3.3 Relevance of TRIZ to services

Recently, the TRIZ approach has not only been applied to technical problems but also 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 conducted studies concerning the further development involving the application of TRIZ methods in non-technical areas (Zlotin et al., 2001), 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). Moussa et al. (2017) pointed out twenty-one studies applying TRIZ in the supply chain. These authors proposed a specific matrix to associate contradictions with TRIZ inventive principles.

In TRIZ methodology, knowledge-based tools are utilised to eliminate contradictions and create inventive resolutions after identifying contradictions. 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. From the study of the similarities between services and TRIZ through innovated patterns, critical methods of service remodelling could be classified into preservice, self-service, direct service, physical service, and bundled service (Berry and Lampo, 2000). The research pointed out that it is possible to forecast innovations in services.

## 3.4 Development into 4PL

In recent years, the increasing competition between logistics enterprises and the expectations of clients for service development, relationship improvements, seamless information flows, and integrated operations have led LSPs to think strategically about the retention of their positions and relationships with clients. The improvement of competitiveness requires LSPs to concentrate on the provision of 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). The limitations of LSPs' service provision have strongly promoted the inevitable transformation into 4PL. When considering the evolvement of LSPs' services into 4PL, Visser et al. (2004) and Hoek (2006) argue that LSPs must have well-defined strategies to begin the transition process into 4PL.

Table 1 shows that, in comparison to LSP, 4PL is superior due to its outstanding attributes, such as integrated logistics solutions with added value, effective IT

utility, and a wide network of 3PLs. The trend of logistics outsourcing has promoted the demand for high-level service provision. Therefore, LSPs have gradually realised that transformation into 4PL becomes essential for their growth.

*Table 1 – Comparison between LSP and 4PL*

| LSP | 4PL |
|---|---|
| Mainly providing separate transportation and warehousing services. | Settling the whole supply chain operations and solutions. |
| Implementing different functional operations based on its own capabilities. | Creating the integrated provision of multiple logistics services in the supply chain. |
| Providing professional logistics services. | Operating with a partner for generating solutions based on a long-term contract. |
| Utilising IT in providing logistics operations and controlling cost reduction. | Combining IT and 3PL's resources to enhance efficiency and added value for logistics operations. |

Source: Saglietto (2013)

## 4 RESULTS AND DISCUSSION

Diem et al. (2023) affirmed six factors affecting the transformation into 4PL of local LSPs in Vietnam. In the model, three indicators, which are also core capabilities of 4PL were used to measure the dependent construct. The research results pointed out that local LSPs in Vietnam could gradually become 4PLs after improving their own capabilities to meet the requirements of 4PLs' power. In the global logistics market, where fierce competition is dramatically increasing, innovation is vital for local LSPs to be superior to their rivals. Based on this foundation, we adopt the TRIZ matrix to identify innovative recommendations for three important attributes of 4PL, including value chain creation, integration of multiple 3PL providers' activities, and management of the global supply chain.

### 4.1 TRIZ implementation to value chain creation

*Stage 1: Identifying the capability*

Walters and Rainbird (2007) illustrated the process of creating a value chain for companies to be superior to their competitors, including identifying value expectations, creating the value, producing the value, communicating the value, delivering the value, and servicing the value. Under increasing expectations of the value chain, Bowersox (2013) affirmed that integrated service providers began to market a range of logistics services. Korpela et al. (1996) pointed out that the provision of value-added services to clients is recognised as a core successful element in value creation. As a result, the wide range and added value of logistics services become key elements in creating value for customers.

*Stage 2: Determining the improving and worsening parameters*

From the client's perspective, they want to make great choices of provided services and require high- quality services. However, 4PL must pay attention to the trade-off between service quality and benefits of offered services to costs that clients have to suffer. In order to fulfill the prime role of granting value to customers, 4PL utilises 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 of 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 refers to the conduct of the process at high speed. One of the important characteristics of 4PL is that it supplies logistics services effectively and in a timely manner. 4PL mainly focuses on the role of offering value to the client organisation through coordinated resources implemented by the selected superior providers with cost reduction. As a result, 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 supplying logistics services, should produce and communicate values to their clients to change the degree of flexibility to enhance the level of customisation on logistics services.
- Use electric, magnetic, and electromagnetic fields to interact with the object: technology nowadays has become a vital tool that LSPs must utilise to enhance the quality of logistics services. Information and communication

technology is helpful for performing activities and executing decision-making more quickly to reach more efficiency in logistics services.

- Change from static to movable fields, from unstructured fields to those having the structure: LSPs should move from providing designed logistics services such as transportation and warehousing to working with customers as partners for long-term contracts.

**Principle 40** - Composite materials lead to the change from uniform to composite services: 4PL works as an integrator to combine logistics services from multiple 3PL providers and generate strategies for the customers. Therefore, LSPs should upgrade separate logistics services by integrating logistics solutions for the whole supply chain 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: Logistics services include many operations from goods movement, packaging, warehousing, and procurement, to order processing. Logistics outsourcing has remarkably grown worldwide due to its advantages, which include cost reduction, flexibility, and customer service. The changes in the business environment lead to higher and more complicated requirements in logistics services. As a result, LSPs must be aware of launching a wide range of logistics services and offering customisation if they want to operate as 4PLs.

- Make each part of an object function in conditions most suitable for its operation: the range of logistics services consists of operations at three levels, which 4PL offers to the clients. Firstly, transactional logistics services supply contracts of specialised logistics functions. Secondly, tactical logistics services focus on the 3PL's management of parts in the client's supply chain. Thirdly, strategic logistics services provide comprehensive supply chain solutions for customers through the integration of 3PL, IT, and business process management.

- Make each part of an object fulfil 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.

### 4.2 TRIZ implementation to the integration of multiple 3PL providers' activities

*Stage 1: Identifying the capability*

One of the main objectives of 4PL is to provide qualified logistics services with cost reduction. LSPs are always aware of the utilisation of resources. 4PLs are considered as modern configuration of logistics providers due to their integration

of their own assets, partners' resources, and IT applications. 4PLs develop and manage the logistics networks with strong cooperation with 3PLs and firms providing the latest logistics IT services (Gattorna, 2017). Therefore, 4PLs need to concentrate on the diversity of relationships when coordinating with partners to create a comprehensive supply chain network.

*Stage 2: Determining the improving and worsening parameters*

4PL works with characteristics such as partnership joint venture, value-based, risk sharing, few partners, long term, common core value, alignment, and trust. In order to successfully assemble the resources, capabilities, and technology to design, build and run comprehensive supply chain solutions, 4PL needs to improve its service complexity to fulfil 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". Based on the description of parameter 37 in the contradiction matrix, monitoring systems that are complex and costly or systems that have complex relationships between components or components that interfere with each other requires a lot of time to set up and implement.

*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 suggests three strategies for innovating 4PL's integrated logistics services. Firstly, 4PLs should design the optional coordination process in the logistics networks for 3PLs and firms supplying IT solutions. Operating as core elements in the chain, 3PLs and IT firms should have a more flexible environment to provide their dedicated services in definite operating conditions. Secondly, all parts in the integrated logistics services can be rearranged or exchanged within the network to ensure the 4PL's prime goals of effective operations and cost reduction. Thirdly, customers' demands have constantly changed due to the fluctuation of the external environment. Therefore, a diversity of customised solutions should be delivered 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. 4PLs should provide clients with the entire logistics plan with the attendance of components of the supply chain from the beginning of the transaction. The pre-arrangement would be useful for both 4PLs and the clients in the negotiation of agreements in large projects. Preliminary action also creates the activeness for 4PLs to adjust elements in the supply chain solutions to make the trade-off between the benefits of all related partners and cost assumption.

### 4.3 TRIZ implementation to management of global supply chain

*Stage 1: Identifying the capability*

Wildemann (2001) pointed out that supply chain management aims to optimise the process cycles, improve the service value, and increase the flexibility of logistics operations by utilising resources in efficient and cost-effective ways. Win (2008), Vinay *et al*. (2009), Yao (2010), Rajaguru and Matanda (2013), and Kasperek (2013) proved that 4PLs could be able to reach these objectives through strategic planning within the supply chain.

The global supply chain contains complicated operations and requires highly effective management. For designing, building, and running a global supply chain, 4PLs must be able to connect resources and control management capability. With the global scope of operations, 4PLs serve a large number of customers 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*

4PLs create wide logistics networks around the world to foster their global operations. It is of special importance that they must monitor compositions in the network. There may be difficulties, obstacles, and problems arising during the coordination of partners besides the efficient cooperation due to both diverse demands from the clients and fluctuations in the international business market. As a result, 4PLs need to focus on adaptability and flexibility within the integrated logistics projects to be responsive to the changes in the external environment.

From the above 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 adaptive to specific characteristics of definite projects, the stability of the network may be affected in composition. Elements of the system face the movement towards universal trends and transformation 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 serious investigation of these parameters and in 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 is selected to develop strategies for the development.

*Stage 4: Formulating strategies based on innovative principles*

**Principle 35** – Parameter changes leads to three tactics that support the improvement of global supply chain management.

Firstly, the state of the logistics network should be changed to meet the requirements of clients' customised contracts in different markets all over the world. Nowadays, a lot of scientific innovations have been adopted in manufacturing, including new materials, production processes, and technology. These changes create significant adjustments and rearrangements in the supply chain of large multinational corporations. 4PLs' role is not only to ensure the effective management of the whole supply chain to their clients but also to provide outstanding proposals with superior added value.

Secondly, 4PLs should change the concentration within the logistics service system based on the ability and appropriateness of participating partners in the network. In the global supply chain, multiple 3PLs are in charge of 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 increase benefits and reduce costs.

Thirdly, the degree of flexibility of operations in the logistics system should be changed corresponding to certain circumstances including special clients, specialised operations, definite periods, and defined markets.

In summary, seven strategies have been developed for LSPs to improve three capabilities that are considered key characteristics of 4PLs. These strategies would be helpful to LSPs in the transformation into 4PLs due to their concentration on the improvement of the logistics service system. Suggested strategies which are generated based on the TRIZ contradiction matrix regard the fields of speed, structure, components, functions, process, flexibility, and change management of 4PL's logistics service system. The implementation of seven proposed strategies at LSPs would contribute to the completion of an integrated logistics service system at the global level.

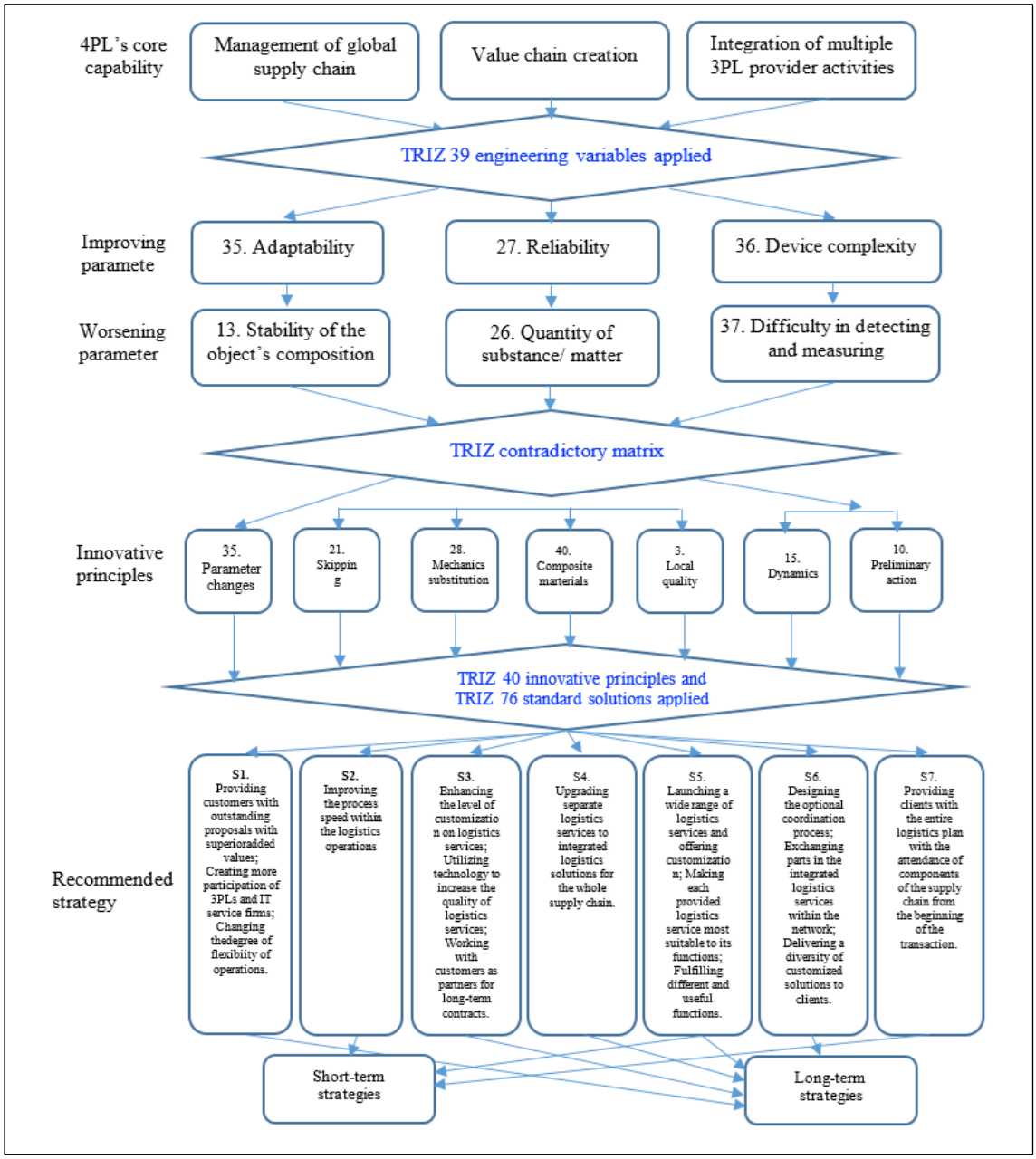


*Figure 3 – Suggested strategies constructed under TRIZ application*

## 5 CONCLUSION

The growth of international trade and e-commerce in the Vietnamese market creates both chances and threats to local logistics enterprises. Nowadays, they run their operations with the tendency to provide integrated logistics solutions in terms of added value creation, cost-effectiveness, and time-saving. If their services don't meet high-level demands from the customers, competitive advantage will be transferred to giant foreign logistics companies. Then, local LSPs shall face fierce competition in both the Vietnamese and international logistics market which has a high potential for development.

From the analyses and comparison between LSP and 4PL, it is obvious to affirm that 4PL is superior and brings greater value to customers. Therefore, the development of strategies for the transformation into 4PL is essential to meet ever-increasing requirements from clients. Suggested recommendations are constructed based on 4PL's three capabilities, which include value chain creation, integration of multiple 3PL providers' activity, and management of the global supply chain under the application of TRIZ inventive methodology. From the implementation of the TRIZ contradiction matrix, seven strategies are developed to improve LSP's logistics operations. They are divided 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 four strategies shall be appropriate to execute over a long time. The presented research results state responses for established questions in the way of the application of TRIZ inventive approach in logistics service provision and the strategic solutions for the transformation into 4PL of local LSPs in Vietnam. The suggested recommendations could be applied flexibly and comprehensively in establishing the growth process for logistics enterprises with inventive and breakthrough strategies.

For short-term strategies, LSPs should concentrate on the enhancement of the velocity of logistics service provision to reach the objective of cost- and time-effectiveness. In addition, the client companies that have diversity in their logistics demands require specialised customisation to fit with their business. Provided services should be ensured to be appropriately delivered and meaningful to fulfill functions. Moreover, comprehensive proposals for the whole transaction need to be specifically discussed from the start of the contract.

For long-term strategies, LSPs should have great upgrading on comprehensive logistics services with superior added values. Besides, 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 that are suggested to develop should focus on customisation 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. Generally, these strategic recommendations are prime elements in the transformation into 4PL of Vietnamese local LSPs thanks to their benefits in creating a competitive advantage for logistics providers.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.