



Selection of 3PL providers for overseas market expansion: insights from a Vietnamese company

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Abstract – Logistics outsourcing has become a strategy for companies so that they can focus on their core competency and increase their competitive advantages. Although there has been a wide range of studies on the selection of Third-Party Logistics (3PL) providers during the operation and supply chain management of the companies, research focusing on the phase of market expansion is lacking. The aim of this study is to analyze the selection of 3PL providers with an emphasis on overseas market expansion. A Vietnamese company in the chemical industry aiming to select the most suitable 3PL provider for overseas market expansion to Brazil is considered. The Analytic Hierarchy Process (AHP) is applied to five main criteria that are cost, service, global network, industry experience, and local presence. A list of five 3PL providers is evaluated and ranked. Group decision-making with a sharing approach is used, such that three decision-makers (DMs) achieve a consensus on the assessment. The results indicate that industry experience and responsiveness to urgent occurrences are the two most important criteria when the company chooses a 3PL provider for overseas market expansion while the lowest priority belongs to communication.

Keywords: 3PL provider selection; Market expansion; Multi-criteria decision-making; Analytic Hierarchy Process; Logistics outsourcing

1. Introduction

In the contemporary world, companies gradually have the tendency to revise their priorities and focus their resources on a limited number of selected functions called core competency (Sink and Langley 1997). These companies are transferring several activities that they do not have competitive advantage to external providers. This process is known as outsourcing, which means that an organization hires an outside organization to provide goods or services that it can provide using its own resources, because this third party has better expertise in providing these goods or services (Douglas et al. 1998).

Logistics and supply chain management have been taking an increasingly vital role in the operation of companies, especially ones with import and export functions. However, not every company possesses sufficient knowledge and experience in this field. As a result, they choose to outsource logistics-related activities with the aim of reducing costs, improving performance, focusing on their core business and building virtual enterprises through strategic alliances (Aguzzoul 2014). The market for third-party logistics (3PL) service has been remarkably developing thanks to this emerging demand.

The selection of appropriate 3PL providers can be considered a multi-criteria decision-making (MCDM) problem. Due to the intense competition in the market of 3PL service, it is challenging to choose a suitable logistics provider, especially when a number of parameters can be used to characterize these providers (Jovčić et al. 2019).

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A wide range of previous articles have focused on the selection of 3PL providers. A list of possible criteria to be evaluated when this selection is made can be found. Besides cost-related and performance-related attributes (Sing and Langley 1997, Andersson and Norrman 2002, Göl and Çatay 2007, Banomyong and Supatn 2011, Aguezzoul 2014, Hwang et al. 2016, Jovčić et al. 2019, Asian et al. 2019, Suroto and Hasbullah 2022), some other interesting factors were also considered such as social sustainability (Jung 2017) or the firm's competitive environment (Menon et al. 1998). Literature reviews considering the guidance on choosing the potential candidate list of 3PL providers have already been published (Sink and Langley 1997, Bottani and Rizzi 2006, Liu and Wang 2009, Banomyong and Supatn 2011, Daim et al. 2013).

With regard to the technical methodologies of evaluating, comparing or ranking the list of 3PL providers, various MCDM techniques have been applied, namely Fuzzy Sets Theory (FST), Analytic Hierarchy Process (AHP), Analytic Network Process (ANP), Interpretive Structural Model (ISM), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Multi-criteria optimization and compromise solution (VIKOR), Decision-Making Trial and Evaluation Laboratory (DEMATEL), Elimination and Choice Expressing Reality (ELECTRE) (Aguezzoul 2014). In addition, a number of papers implemented a combination of methods (Ho et al. 2012, Efendigil et al. 2008, Büyüközkan et al. 2008).

After studying the literature, we realize that there is currently a lack of comprehensive literature that provides insights into the selection of 3PL providers when a company has an overseas market expansion plan. Sink and Langley (1997) reasoned that the market for 3PL services was at its best in the growth stage of the product life cycle. This can be understood as when the companies want to expand their market and boost their product growth, they are in considerable need of cooperating with 3PL providers. Key issues of the cooperation in this phase are formation of true partnerships and alliances, contractual business arrangements, gain sharing and investment sharing, performance measurement, and pricing of services (Sink and Langley 1997). According to Foster and Muller (1990), outsourcing could assist in opening new markets as it could enable users to gain competitive advantage, add measurable value to products, enhance customer service, and provide dedicated resources. Bradley (1994b, 1994c) suggested that a 3PL provider with national and regional expertise could provide a company with a local image of a different market even though that company may have no local presence. However, hardly any research did apply a specific method to analyze the selection of 3PL providers for overseas market expansion.

Hence, this paper concentrates on evaluating the 3PL provider selection on the occasion of overseas market expansion. A case study is conducted in a company in Vietnam to select the most suitable 3PL provider for them to cooperate with in their market expansion strategy to Brazil. The insights are accumulated from the company's DMs to make clear how overseas market expansion can affect the company's chosen list of criteria, their evaluation of each criterion, and their considered list of potential candidates. In this respect, the outcomes of this study may provide valuable insights into the 3PL literature in terms of market expansion. The case study in a Vietnamese company also deals with the present research gap that most of the published articles in logistics outsourcing were derived from developed countries, whereas more research needs to be conducted in developing countries (Akbari 2018).

The rest of this paper is organized as follows. A literature review regarding the importance of 3PL services, 3PL provider selection criteria, 3PL provider identification, and 3PL provider evaluation methods is presented in Section 2. An overview of the Analytic Hierarchy Process (AHP) method can be found in Section 3. Section 4 is the application with a case study of a Vietnamese company, problem structure, and data collection. Section 5 provides the main results of the study. Key findings are discussed in Section 6. Finally, the conclusion of the paper is presented in Section 7.

2. Literature Review

In this section, we first emphasize the significance of 3PL services in logistics and supply chain management, giving a meaningful context for subsequently reviewing the literature about particular aspects of 3PL provider selection, which are the assessment of 3PL provider selection criteria, the identification of potential 3PL providers, and the methods that have been used to evaluate 3PL providers.

2.1 Importance of 3PL services

Lieb (1992) conducted a survey of US manufacturing firms and found that the use of 3PL services had a positive impact on the firms' total logistics costs, logistics system performance, and customer satisfaction. Africk and Calkins (1994) highlighted the relationship between a shipper and 3PL providers, which helped the shipper to have more customized offerings and to encompass a broader number of service functions.

Sink and Langley (1997) argued that outsourcing 3PL services was a viable business strategy allowing noncore functions to be turned over to external suppliers, enabling management to leverage its resources, spread its risk, and concentrate on issues critical to survival and future growth. Razzaque and Sheng (1998) had a detailed literature survey about the outsourcing of logistics functions. The survey determined the importance of logistics outsourcing as this could enable companies to gain a competitive advantage, to enhance value creation for customers, to exploit the expertise and experience from 3PL providers for possibly lowering costs and improving customer service. Yan et al. (2003) suggested that the market had become more globalized, resulting in the increasing importance of logistics which helped industries cut costs and improve their customer service quality.

Jayaram and Tan (2010) used the extant theory to propose that there were significant differences in the postures of firms, including and excluding 3PLs in their supply chain management efforts. Their study identified that firms cooperating with 3PLs emphasized certain supply chain management constructs to a higher extent compared to firms not outsourcing logistics functions. Salih and Ismail (2017) collected 258 questionnaires from Turkish manufacturing firms. The analyzed data suggested that corporate governance and supply chain network governance of 3PL providers positively affected sales competence, logistics competence, and buyers' intention. According to Li et al. (2018), a company could take advantage of logistics outsourcing to focus on its core business and competence, save transportation costs, and gain flexibility in many aspects, such as supply chain flexibility, operations flexibility in logistics management, and the flexibility with warehouse space and labor. Flexibility for future business can also be obtained thanks to a strategic partnership with 3PL providers.

2.2 3PL provider selection criteria

Stank and Maltz (1996) compared the influence of key forces that drove the logistics outsourcing decision in the domestic and international setting, which is near to the approach in this research with both local and international 3PL providers presenting in the candidate list. The outcome was the proposal of six key factors, namely asset investment, learning capability, long-term cooperation, organizational characteristics, service capability, and uncertainty. Sink and Langley (1997) concluded that quality, delivery, and price were the selection factors to receive the greatest attention from industrial manufacturers. This result was achieved after they conducted industry focus group interviews (automotive, electronics, computer, and peripherals), eight third-party logistics user case studies, and a comprehensive mail study involving 116 managers of firms identified as users of third-party logistics services. Menon et al. (1998) examined how the firm's competitiveness and competitive environment could affect the criteria for selecting 3PL providers. They gained the insights that supplier perceived performance, perceived capability, and pricing affected this selection.

In 2002, a research was conducted on evaluating supply chain performance (SCP) in transport logistics by Lai et al (2002). The authors developed a measurement model in transport logistics, carrying out a survey with 134 companies in Hong Kong. Two aspects of evaluating operations efficiency for transport logistics service providers were cost-related and asset-related. There were five components of cost, namely transportation, warehousing, facility-and-manpower-related costs, order processing, and logistics administration. Meanwhile, three measures of assets were cash-to-cash cycle time, utilization of facilities and manpower, and asset turns. In the same year, Andersson and Norrman wrote a paper about the procurement of logistics services and had an interesting approach when analyzing factors that various companies with differences in complexity in outsourced services focused on. According to their paper, company Alpha which wanted to outsource the execution of the inbound logistics system focused on operational factors as capacity, equipment, and cost. Companies Beta and Gamma, which were more complex and involved transferal of responsibilities, cared about IT, management, and cultural aspects (Andersson and Norrman 2002).

Gol and Catay (2007) gave insights of 3PL provider selection from a Turkish automotive company. A total of 27 criteria were considered, which were general company considerations (price, financial considerations, experience in the same industry, location, asset ownership, international scope, growth forecasts, yearly

efficiency), capabilities (optimization capabilities, information technology system, customer service, supply chain vision, creative management, responsiveness), quality (service quality, continuous improvement, KPI measurement and reporting), client relationship (availability of top management, cultural fit, service cancellation, general reputation), and labour relations (human resource policies, availability of qualified talent).

A total of 24 freight logistics service attributes were identified and categorized by Banomyong and Supatn (2011) based on the SERVQUAL model into six dimensions: reliability, assurance, tangibility, empathy, responsiveness, and cost. Daim et al. (2013) did not have any specific industry approach, but chose six criteria that could be broadly applicable. The six main criteria were cost, service, global capabilities, information technology capabilities, industry experience, and local presence. For cost and service, sub-criteria were considered. While cost was broken down as transportation costs, warehousing costs, fixed costs, hourly fees, and transaction fees, service was evaluated by an operating margin, employee satisfaction, and revenue per employee.

A detailed literature review on the criteria of 3PL provider selection was conducted in 2014 by Aguezzoul. Within the scope of this research, 87 papers published between 1994 and 2013 were analyzed. 11 key criteria were identified, each one was defined by a set of attributes. Cost was found as the most widely adopted criterion, followed by relationship, services, and quality. Hwang et al. (2016) studied the integrated circuit manufacturing industry in Taiwan by using the triangulation method. They found key 3PL selection criteria including performance as the most important criterion group, followed by cost, service, quality assurance, intangible and information technology. At the detailed sub-criteria level, document accuracy, problem-solving capability, continuous cost reduction, value-added services, and associated cost control capability were found to be the top five sub-criteria. Jung (2017) also considered social sustainability as one of the important evaluation criteria.

In 2019, Jovčić et al. had a proposal for a decision-making tool in 3PL provider selection. In their research, by an extensive review of the literature and interviewing experts in the field of logistics and supply chain, the authors determined a set of evaluation criteria and sub-criteria. The first criterion taken into account was price of service, followed by delivery (delivery state and delivery time), safety (accident rate and average vehicle age), technology level (software support and modern transport equipment), and social responsibility (air pollution level and noise level). Asian et al. (2019) used a Japanese quality engineering tool – the Kano model to assess the importance of service performance and customer satisfaction in 3PL provider selection in the automotive industry. According to their findings, there were seven core criteria influencing the selection of 3PL companies in the automotive industry, namely price, financial considerations, asset ownership, optimization capabilities, inventory management, technological innovation, and continuous improvement. A recent research by Suroto and Hasbullah (2022) focused on 3PL selection in the industry of fast-moving consumer goods and found that logistics cost was more important than responsiveness, location, information technology, and service quality.

2.3 3PL provider identification

According to Sink and Langley (1997), an initial screening should be made to remove unsuitable 3PL providers from the considered list. The candidate list should consist of six to eight candidates, then the board of DMs will finally consider two to three candidates. The authors put focus on business alliances and logistics partnership when choosing 3PL providers as a way to reduce conflict, concentrate on mutual goals, increase efficiency and stability, and establish legitimacy in the marketplace. Bottani and Rizzi (2006) suggested that feasible alternatives should be developed by comparing the use of internal expertise, knowledge, experience to hiring outside experts and obtaining professional logistics service. The company should evaluate the service provided to control the performance, to select a new service provider, or to enhance the relationship between the firm and the logistics service provider.

Liu and Wang (2009) acknowledged that unsuitable providers should be eliminated from the list to save the time and effort of the decision process. They also specified three steps of this. At first, the DMs should identify all possible providers for logistics outsourcing. Next, the DMs should describe their heuristics for screening out the unacceptable providers based on their experiences, expertise or knowledge. Daim et al. (2013) started their research with two dozen potential candidates, then shortlisted them to eight 3PL providers by a combination of previous industry knowledge and discrimination based on size. Finally, the authors decided to narrow the research to four providers for the reason of insufficient resources. The chosen ones were all large operations with global logistics networks and were publicly traded on an American stock exchange.

2.4 3PL provider evaluation methods

Aguezzoul (2014) summarized the popularity of different methods of multi-criteria decision-making (MCDM) techniques used in 3PL selection. Fuzzy Sets Theory (FST), Analytic Hierarchy Process (AHP), and Analytic Network Process (ANP) were mentioned as the three most frequently used methods, with respectively 10, 8, and 6 papers within 38 papers applying MCDM. Other methods were the Interpretive Structural Model (ISM), Technique for Order Preference by Similarity to Ideal Solution (TOPSIS), Multi-criteria Optimization and Compromise Solution (VIKOR), Decision-Making Trial and Evaluation Laboratory (DEMATEL), and Elimination and Choice Expressing Reality (ELECTRE).

AHP was used in numerous papers researching 3PL provider selection for general approach. For example, the paper by Daim et al. in 2013 contained an extensive literature review on the usage of AHP and related methods in a logistics context. The authors also applied AHP to a 3PL provider selection for international business. Besides, AHP was also used in papers specializing in particular industries. Göl and Çatay (2007) conducted research on 3PL selection for the Turkish automotive industry, applying AHP to redesign the logistics operations and to select a global logistics service provider. Suroto and Hasbullah (2022) also used AHP to determine which criteria were more important than others in 3PL provider selection in the industry of fast-moving consumer goods. Meade and Sarkis (2002) used ANP to utilize the high-level model of the relationships that influenced the selection of a third-party reverse logistics provider. Jharkharia and Shankar (2007) also constructed an ANP model to explain the complex relationships of the relevant attributes in the decision-making of 3PL selection.

Besides, integrated methods were found in a number of papers. Ho et al. (2012) combined Quality Function Deployment (QFD), FST and AHP approach to evaluate and select the optimal 3PL providers. In the field of reverse logistics, Efendigil et al. (2008) combined fuzzy AHP and Artificial Neural Networks (ANN) to produce synergistic effects through an integrated frame approach. The integrated fuzzy AHP–ANN model was developed to categorize and select the performance criteria and determine the appropriate providers depending on their past performances (Efendigil et al. 2008). Büyüközkan et al. (2008) applied both fuzzy AHP and fuzzy TOPSIS to evaluate e-logistics-based strategic alliance partners. In this research, fuzzy AHP was used to calculate the criteria weights and fuzzy TOPSIS was implemented to achieve the ranking.

3. An overview of Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) method is applied in this paper. AHP was first suggested by Saaty (1977) and has proven to be one of the most widely used methods in MCDM (Aguezzoul 2014). AHP is a straightforward method with the ability to effectively handle both qualitative and quantitative data (Efendigil et al. 2008). AHP is adapted in this paper because it is convenient for the DMs to compare different potential candidates using the pairwise comparison matrices. This method allows us to calculate the priorities of each criterion, getting valuable insights in the importance of different criteria for choosing 3PL providers under the consideration of market expansion. Moreover, the overall priorities and ranking of the list of 3PL providers can also be obtained by means of AHP, which results in further recommendations for the company and the industry in general. In terms of behavioral consideration, when AHP is chosen in the research with a hierarchical estimation of weights, we can significantly reduce equalizing bias, one of the main cognitive biases, where DMs tend to assign the same weight to different attributes (Rezaei et al. 2022).

According to Saaty (2008), the steps of AHP are as follows.

- (1) Define the problem.
- (2) Structure the decision hierarchy.
- (3) Construct a set of pairwise comparison matrices. A pairwise comparison matrix A is formed as follows.

$$A = \begin{bmatrix} a_{11} & \dots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \dots & a_{nn} \end{bmatrix}$$

where a_{ij} shows the comparison of element (criterion or alternative) i to element j . We also have $a_{ij} = 1/a_{ji}$.

The pairwise comparison scale contains the numerical values between 1 to 9 (Table 1).

Table 1. The fundamental scale of absolute numbers (Saaty 2008).

Intensity of importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to the objective
2	Weak or slight	
3	Moderate importance	Experience and judgement slightly favor one activity over another
4	Moderate plus	
5	Strong importance	Experience and judgement strongly favor one activity over another
6	Strong plus	
7	Very strong or demonstrated importance	An activity is favored very strongly over another; its dominance demonstrated in practice
8	Very very strong	
9	Extreme importance	The evidence favoring one activity over another is of the highest possible order of affirmation
	A reasonable assumption	
	If activity i has one of the above non-zero numbers assigned to it when compared with activity j , then j has the reciprocal value when compared with i	

(4) Calculate the priority of each criterion and the priority of each alternative with respect to each criterion using the eigenvalue function as follows.

$$AW = \lambda_{max}W$$

where W is the priority vector and λ_{max} is the largest eigenvalue.

(5) Check consistency ratio (CR) implying the extent to which the decision-maker has been consistent in providing the pairwise comparisons:

$$CR = \frac{CI}{RI}$$

where CI (Consistency Index) is calculated as $CI = \frac{\lambda_{max} - n}{n - 1}$, and λ_{max} is the largest eigenvalue. RI (Random Index) is presented in Table 2.

Table 2. Random consistency index (Saaty 1994).

n	0	1	2	3	4	5	6	7	8	9
RI	0	0	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49

$CR \in [0; 0.1]$ shows an informed judgment (Saaty 1994).

(6) Calculate the global priority of the sub-criteria by multiplying the priority of each sub-criterion (if there is a sub-criterion) by the priority of the corresponding main criterion.

(7) Calculate the overall priority of the alternatives by multiplying the priority of each alternative with respect to each sub-criterion by the global priority of that sub-criterion (if there is a sub-criterion) or by the priority of the corresponding main criterion (if there is no sub-criterion), then add them to the final value.

(8) Rank the alternatives by the overall priorities.

4. Application

This section first provides information about the case study of this paper, which is carried out in a Vietnamese company in the chemical industry that has a strategic plan to expand its market to Brazil. Next, the problem

structure is explained in detail with the choice of objectives, attributes, alternatives, and the finalized decision hierarchy. At last, the process of data collection is also mentioned.

4.1 Case Study

The case study is conducted in a company in Vietnam that specializes in providing specialty materials and chemical manufacturing solutions. The company has headquarters in Hanoi, the capital of Vietnam, branches in Da Nang city and Ho Chi Minh city. In the process of globalization, they have built a representative office in the Philippines and are preparing to open one in Singapore and the United States. In their market expansion strategies, they consider Brazil as a great potential market after they have an office in the United States and plan to penetrate this market in 2024. Currently, the company is outsourcing all logistics operations, as they do not have equipment and experience in global transportation, customs, warehouse, and local trucking. They want to focus their resources on improving products and developing manufacturing solutions. They have cooperated with many logistics service providers, both local and international. This cooperation usually comes from the suggestion of their suppliers and customers. However, they have not had any strategic 3PL provider. For each shipment, they usually ask for preliminary quotes from different providers, then choose a provider mostly based on costs and service evaluation. This way of choice, sometimes, leads to problems in their shipments such as incurring additional costs due to the provider's lack of an international network or inexperience in solving urgent situations. Therefore, in order to ensure the success of the market expansion to Brazil that is within a long distance of Vietnam and in which the company does not have a strong network at the beginning, the company hopes to decide on a 3PL provider to create a strategic and long-term relationship.

We base on scientific literature to choose the most appropriate DMs in the company. Sink and Langley (1997) concluded about the roles of corporate executives in the process of 3PL provider selection that the department of logistics and transportation had the greatest power (77%) in choosing the suppliers, followed by the department of finance (13.5%) and manufacturing area (13.5%). Therefore, we contact the supply chain manager (logistics/transportation area), the supply chain supervisor (logistics/transportation area) and the sales manager (finance area) of the company to provide us with insights for problem structuring and to answer the questionnaire for the AHP method (pairwise comparison matrices). These DMs, especially the sales manager, have great experience in their industry (specialty materials and chemicals). The supply chain manager and supply chain supervisor have profound knowledge in the route between Vietnam and the Americas as the company has frequent businesses with the United States. Therefore, although they have never had business in Brazil, they still have useful insights about similar routes and the performance of 3PL providers on these routes. In addition, all the DMs have had experience in cooperating with the considered list of 3PL providers, so their evaluation and comparison appear to be trustworthy.

4.2 Problem structure

4.2.1 Objectives

The supply chain manager, supply chain supervisor, and sales manager of the company are interviewed together in a meeting about the objectives of the company in finding a strategic 3PL provider to handle their route from Vietnam to Brazil. Three main objectives are mentioned: lowering logistics costs, ensuring efficient handling of goods, and broadening the network of business partners. First, lowering logistics costs allows the company to lower its total cost and goods prices, increasing its competitive advantage when penetrating a new market like Brazil. Second, ensuring efficient handling of goods is also crucial to protect the company from unwanted issues when fulfilling the responsibilities with suppliers and customers, such as inappropriate handling of dangerous products (chemicals), problems with customs clearance, or delivery delays. Broadening the network of business partners is the final objective that the company takes into account. At the moment, the company often chooses 3PL providers based on the recommendation of their suppliers and customers. Hence, they believe that when they operate their business in Brazil, their 3PL provider can also introduce them to potential business partners through business alliances or logistics relationships, which is useful for their development in the long run.

4.2.2 Attributes

First, we come up with a list of criteria and sub-criteria for selecting 3PL providers based on scientific literature that are potentially suitable for the company's above-mentioned objectives. This list of attributes is then discussed with the DMs to be adjusted according to the DMs' perspectives. According to the DMs, the criteria should be closely relevant to their aim of overseas market expansion, especially when the company hardly has any experience in Brazil, the new market. Therefore, they have particular adjustments to our proposed list of criteria as follows.

For the sub-criteria of cost, besides transportation costs and warehousing costs, the DMs add customs costs, expressing the concern that there are differences in exporting requirements and charges in Vietnam and those for the importing process in Brazil. Regarding the sub-criteria of service, they agree with communication, responsiveness to urgent occurrences and availability of top management. These sub-criteria are believed to ensure that any problem arising thousands of miles away can be efficiently solved when the company does not possess a large supporting network in the new market.

The DMs agree with other criteria (global network, industry experience and local presence). According to their explanation, 3PL providers with a broad global network can aid the company in developing business relationships with potential business partners in the new market. Industry experience is also included in the list with the aim to ensure the safety and efficiency of chemical goods handling over a long distance and to deal with distinct export and import requirements for chemical products in Vietnam and Brazil. Lastly, the local presence of 3PL providers in Vietnam is believed to contribute to more timely support.

4.2.3 Alternatives

The DMs want to choose a strategic 3PL provider within a list of providers that they have been cooperating with, which not only enables them to save time and effort, but also avoids any misunderstanding and problems at the starting phase of new market penetration. According to Sink and Langley (1997), the candidate list should typically consist of six to eight candidates. Discussing possible 3PLs, the DMs come up with a list of six candidates as presented in Table 3.

Table 3. List of 3PL providers considered as alternatives for this study.

No	3PL provider	Type	Years of operation
1	DB Schenker	Global company	150
2	NNR Global Logistics	Global company	114
3	Yusen Logistics	Global company	67
4	BDP International	Global company	50
5	Bee Logistics	Local company	18
6	Thami Shipping & Airfreight Corp	Local company	24

Nevertheless, after more detailed research being made on these six providers, Yusen Logistics is removed from the list due to its not operating the Vietnam - Brazil direct route at the moment. The remaining five 3PL providers all have been cooperating with the case company and have offices in Vietnam. During previous business relationships, the company highly evaluates the professionalism, the quality of service, and the efficiency of shipments handled by these 3PL providers. About global network, Bee Logistics, DB Schenker, and BDP International are three providers having the largest numbers of countries with offices and partners (200, 140, and 133 countries respectively). Remarkably, DB Schenker and BDP International possess profound experience in the chemicals and electronics industry. While the former handles 1.8 million TEUs by sea and 1.1 million tons by air each year, the latter annually carries 1.6 million TEUs by sea and 80 million kilograms of this product type by air.

From all the above-mentioned attributes, sub-attributes, and alternatives, a decision hierarchy was built as below (see Figure 1).

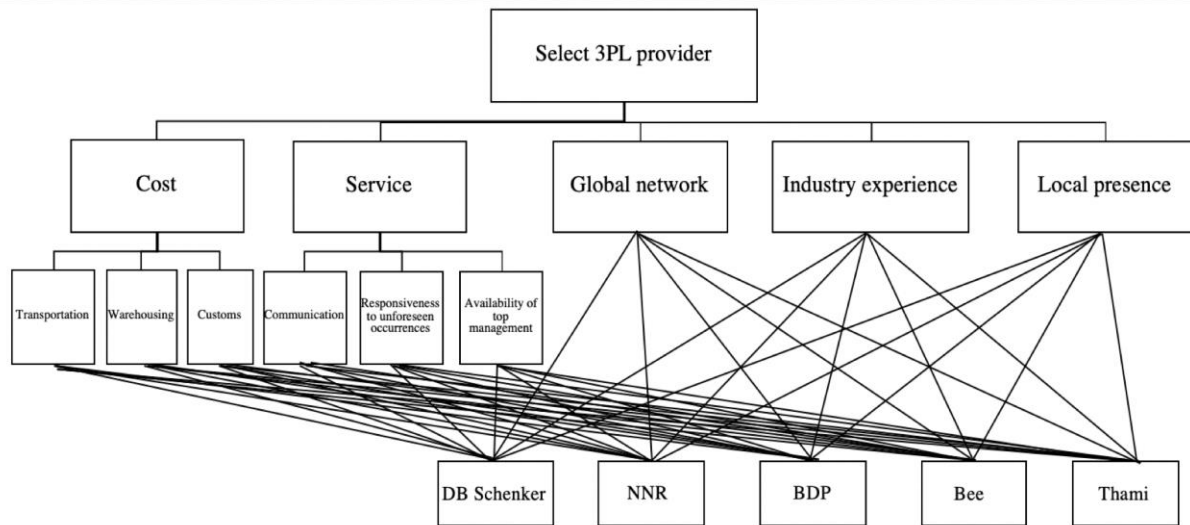


Figure 1. Decision hierarchy.

4.3 Data Collection

4.3.1 Data collection about 3PL providers

Data about 3PL providers are found whether directly on their website, or provided by the company based on their experience of previous cooperation with those 3PL providers. The data include:

- Costs (transportation costs, warehousing costs, customs costs).
- Service quality (communication, responsiveness to urgent occurrences, availability of top management).
- Global network (the number of countries in which the 3PL providers are operating or having networks).
- Industry experience (the weight of chemical or electronics products handled by the 3PL providers per annum).
- Local presence (the number of offices in Vietnam).

4.3.2 Data collection from the company

Group decision-making is applied in this research. Three DMs are brought together in an online meeting with the aim of achieving a group decision on evaluating the list of 3PL providers using pairwise comparison matrices. There are three approaches for group decision-making, namely sharing, comparing, and aggregating (Belton and Pictet 1997). In this research, we apply the approach of sharing to obtain a common element by consensus, through a discussion of the views and the negotiation of an agreement. This approach addresses the differences and tries to reduce them by explicitly discussing their cause. In the group meeting, differences in perceptions and values, which arise, are explored through extensive sensitivity analysis. The eventual aim of the process is to arrive at a shared understanding and commitment to an agreement (Belton and Pictet 1997). As mentioned, all the alternatives are common to the group of DMs, and the group of DMs all have a good understanding of logistics and supply chain management, of their specific products, and of their company’s objectives when expanding their market to Brazil. Hence, it is not a challenge for three DMs to discuss and reach an agreement on evaluating potential 3PL providers.

5. Results

This section highlights the key findings of the study regarding priorities and ranking. The priorities of the main criteria and sub-criteria, as well as the global priorities of each criterion, are presented. After that, the overall priorities of the alternatives and the final ranking are provided. The consistency of DMs needs to be discussed before presenting the results. Originally, DMs were sometimes inconsistent in their responses to the questions of pairwise comparison matrices. However, after continuous interaction and clarification with the experts during the meeting, DMs became more consistent. The consistency ratios of all the matrices are a value between 0 and 0.1, showing an informed judgment (Saaty 1994). Regarding some pairwise comparison matrices for the alternatives with respect to customs costs, communication, responsiveness to urgent occurrences, availability of top management, and local presence, the consistency ratio is equal to 0, which means that DMs are fully consistent. This is because in these cases, DMs can very confidently judge the differences in the performance among three global 3PL providers and between two local 3PL providers, which easily leads to full consistency.

All the tables with values in pairwise comparison matrices and consistency ratios can be found in the Appendix. The priorities of criteria and priorities of alternatives with respect to each criterion are presented as follows (see Tables 4 and 5).

Table 4. Results of priorities.

Criteria	Cost		Service			Global network	Industry experience	Local presence	
Priority of criteria	0.288		0.271			0.076	0.334	0.031	
Sub-criteria	Transportation costs	Warehousing costs	Customs costs	Communication	Responsiveness to urgent occurrences	Availability of top management			
Priority of sub-criteria	0.429	0.143	0.429	0.061	0.579	0.349			
DB Schenker	0.292	0.292	0.077	0.111	0.294	0.286	0.327	0.233	0.143
NNR	0.261	0.261	0.077	0.111	0.294	0.286	0.190	0.085	0.143
BDP	0.292	0.292	0.077	0.111	0.294	0.286	0.288	0.216	0.143
Bee	0.077	0.077	0.385	0.333	0.059	0.071	0.122	0.233	0.286
Thami	0.077	0.077	0.385	0.333	0.059	0.071	0.074	0.233	0.286

Global priorities of criteria are then obtained by multiplying the priority of each sub-criterion (if there is a sub-criterion) by the priority of the corresponding main criterion.

Table 5. Results of priorities.

Criteria	Cost			Service		Global network	Industry experience	Local presence	
Sub-criteria	Transportation costs	Warehousing costs	Customs costs	Communication	Responsiveness to urgent occurrences	Availability of top management			
Global priority	0.124	0.041	0.124	0.016	0.157	0.094	0.076	0.334	0.031

Finally, we calculate the overall priorities of the alternatives by multiplying the priority of each alternative with respect to each criterion by the global priority of that criterion, then add them to the final value (see Table 6).

Table 6. Overall priorities and ranking of the alternatives.

Alternatives	Overall priorities	Ranking
DB Schenker	0.240	1
NNR	0.175	4
BDP	0.231	2
Bee	0.178	3
Thami	0.174	5

6. Discussion

The main results of the research and specific implications relating to overseas market expansion are discussed in this section.

With regard to global priorities of criteria, industry experience is assigned the top priority (0.334), followed by responsiveness to urgent occurrences (0.157), transportation costs and customs costs have the same priority of 0.124. First, chemicals are products with special requirements of storage and delivery, also with different export and import regulations in different countries all over the world. Therefore, the company attaches the greatest importance to the criterion of industry experience. A 3PL provider with extensive experience in handling chemical products, especially in the route of Vietnam - Brazil will be highly considered as this provider helps the company to ensure the safety of their products, as well as the certainty that their products can be imported to the Brazil market without considerable troubles. Another insight from the company is that a 3PL provider with good industry experience can support the company to expand the network and develop the relationship with potential business partners that are using the 3PL service of the same provider in Brazil. Second, because the new market (Brazil) is very far away from the home country of the company (Vietnam), the company expresses their serious concern that they cannot take immediate action if any trouble occurs relating to the delivery of products to the customers. This leads to their growing dependence on the strategic 3PL provider who can perform quick responses to these urgent occurrences on behalf of the company. Third, transportation costs and customs costs are the third important criteria. Transportation cost is the highest cost accounting for 60% of the total logistics costs of Vietnamese companies (Hoa et al. 2020). Hence, it is understandable that the company also highlights this criterion in order to find a 3PL provider with reasonable transportation costs, reducing total logistics costs and increasing competitive advantage of product prices in the new market. The long distance between Vietnam and Brazil, which may drastically add up the transportation fees, should also be taken into account. In addition, because of the limited understanding of the DMs about the customs clearance procedure in Brazil regarding chemical products, they also consider customs costs as a vital criterion when choosing 3PL providers.

The least important criteria in the list are communication (0.016), local presence (0.031) and warehousing cost (0.041). First, communication is in greater need for cooperation with new 3PL providers. All the potential candidates have already worked with the company, so the two sides have been familiar with mutual communication. Second, the local presence of 3PL providers in Vietnam is not highly regarded with the support of the internet for distance cooperation. Nonetheless, a local presence is still needed for urgent situations, and the

3PL providers with local presence often possess a broad local network, possibly reducing some types of local costs such as local warehousing costs and customs costs. Third, warehousing cost is not the focus because the company plans to store the products in its own warehouse in Brazil. This criterion is on the list because the size of the company's own warehouse is limited, and they still consider the possibility of outsourcing warehousing service when the demand grows (this is a new market and they are not certain about the market demand in the long term).

When it comes to the ranking of alternatives, DB Schenker has the first ranking (0.240). This is mainly thanks to its leading scores in almost all the criteria with high global priorities including industry experience, responsiveness to urgent occurrences, and transportation costs. Its scores for communication and local presence are low, but these criteria also have low global priorities. Hence, the ranking of DB Schenker is not negatively affected. The interesting finding is that there is a minor gap between the overall priority of DB Schenker - the first ranked alternative and BDP International - the second ranked one with an overall priority of 0.231. This has its roots in the fact that BDP International has the same scores as DB Schenker in seven out of nine criteria, only having small differences in the scores of industry experience and global network.

The above findings have been validated with the DMs. They agree with this ranking and also suggest that they see minor differences in the performance of DB Schenker and BDP International in previously cooperated international routes. Local 3PL providers namely Bee Logistics and Thami Shipping & Airfreight Corp do not have a lot of competitive advantages for long international routes, especially in terms of costs and responsiveness to urgent occurrences in the new market. With DB Schenker's outstanding scores regarding global network and industry experience, they hope that this 3PL provider can assist them in broadening the business network in their industry in Brazil.

As our recommendation, the case company can consider DB Schenker as the most potential 3PL provider to create a strategic business relationship in their market expansion strategy to Brazil. BDP International is another strong candidate to be considered if the company has difficulty in cooperating with the first choice. In this research, specific assumptions have been made to ease the data collection. Only the shipment from Hai Phong, Vietnam to Sao Paulo, Brazil has been taken into account, which means local transportation costs from the company's factories or warehouses in Vietnam to the port and from the port to the customers' factories or warehouses in Brazil have been neglected. It might be a solution for the company to ask for quotations from the most potential candidates and additionally compare these charges. Moreover, this research only looks at the data of direct shipments from Vietnam to Brazil. Still, it could be interesting to also look at non-direct shipments that could possibly result in lower costs. Southeast Asia has many global ports, Singapore is an example, and a transit port could be considered. Connecting trips that might include different 3PL providers are also worth considering. For example, a 3PL provider could be the best choice to perform the shipment from Vietnam to Singapore, and another one could be the best option to continue the delivery to Brazil.

As this case study closely relates to the 3PL provider selection of a Vietnamese company in the chemical industry with an overseas market expansion strategy, suggested insights and findings might be useful for other companies in the same industry in Vietnam with plans to expand their market overseas. These companies could also consider the 3PL providers' industry-related experience, global network, local presence, similar cost and service-related issues when choosing the appropriate 3PL providers.

7. Conclusion, limitation, and further research direction

In this paper, we proposed an approach for a Vietnamese company to select the most suitable 3PL provider for the company, focusing on the aim of overseas market expansion. This paper suggests that overseas market expansion could have impacts on the choices of DMs regarding the chosen list of alternatives, the chosen list of criteria and the weights assigned to each criterion.

AHP, one of the most widely used methods in MCDM, is applied to evaluate the criteria and alternatives. There are five main criteria considered in this paper including cost, service, global network, industry experience, and local presence. Cost is divided into three sub-criteria which are transportation costs, warehousing costs, and customs costs whereas service is evaluated based on three sub-criteria which are communication, responsiveness to urgent occurrences, and availability of top management. The following results were obtained: the most important criterion for 3PL selection for overseas market expansion is industry experience, followed by responsiveness to urgent occurrences. Transportation costs and customs costs have the same priority and rank third in the list of criteria. Meanwhile, the least important criteria are communication and local presence. DB

Schenker surpasses four other candidates to be the most potential 3PL provider for strategic cooperation with the company for overseas market expansion. In general, global 3PL providers have higher positions in the final ranking in comparison to Vietnamese 3PL providers. The results have been validated with the case company.

This paper has contributed to the literature by concentrating on the research gap of analyzing the 3PL provider selection on the particular occasion of overseas market expansion which raises different concerns and affects the way DMs evaluate alternatives. The case study in a Vietnamese company also contributes to the currently limited insights from developing countries about logistics outsourcing.

This study has a number of limitations. First, this study focuses on only one company in Vietnam. A larger sample of companies in the same industry, multi-country and multi-industry studies are recommended if the aim is to achieve findings related to, for instance, the industry or the country. Second, this study takes into consideration only 3PL providers that the company has already worked with. The 3PL providers appearing in this list may not be the best alternatives. Future research could extend the list of alternatives, including some alternatives that the company has never cooperated with. Finally, when sharing is the chosen approach for group decision-making in this study, we realized that the supply chain manager seems to act as a supra DM who has more power than other DMs. This DM has influenced others and her opinions are often carefully considered by the other two DMs. This limitation implies the possibility for testing another approach for future study. Aggregation can be considered, which calculates the representative value without explicitly discussing the differences (Belton and Pictet 1997), minimizing the influenced effects.

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Appendix

Table A. Pairwise comparison matrix for the main criteria with respect to the goal with priorities.

	Cost	Service	Global network	Industry experience	Local presence
Cost	1	1	5	1	8
Service	1	1	6	1/2	8
Global network	1/5	1/6	1	1/5	5
Industry experience	1	2	5	1	7
Local presence	1/8	1/8	1/5	1/7	1

$\lambda_{max} = 5.2769$

CR = 0.0624 shows an informed judgment

Table B. Pairwise comparison matrix for the sub-criteria with respect to the cost.

	Transportation costs	Warehousing costs	Customs costs
Transportation costs	1	3	1
Warehousing costs	1/3	1	1/3
Customs costs	1	3	1

$\lambda_{max} = 3$

CR = 0 shows an informed judgment

Table C. Pairwise comparison matrix for the sub-criteria with respect to the service.

	Communication	Responsiveness to urgent occurrences	Availability of top management
Communication	1	1/8	1/7
Responsiveness to urgent occurrences	8	1	2
Availability of top management	7	1/2	1

$\lambda_{max} = 3.0349$

CR = 0.0336 shows an informed judgment

Table D. Pairwise comparison matrix for the alternatives with respect to the transportation costs.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	4	4
NNR	1	1	1	3	3
BDP	1	1	1	4	4
Bee	1/4	1/3	1/4	1	1
Thami	1/4	1/3	1/4	1	1

$\lambda_{max} = 5.0133$

CR = 0.003 shows an informed judgment

Table E. Pairwise comparison matrix for the alternatives with respect to the warehousing costs.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	4	4
NNR	1	1	1	3	3
BDP	1	1	1	4	4
Bee	1/4	1/3	1/4	1	1
Thami	1/4	1/3	1/4	1	1

$\lambda_{max} = 5.0133$

CR = 0.003 shows an informed judgment

Table F. Pairwise comparison matrix for the alternatives with respect to the customs costs.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	1/5	1/5
NNR	1	1	1	1/5	1/5
BDP	1	1	1	1/5	1/5
Bee	5	5	5	1	1
Thami	5	5	5	1	1

$\lambda_{max} = 5$

CR = 0 shows an informed judgment

Table G. Pairwise comparison matrix for the alternatives with respect to their communication.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	1/3	1/3
NNR	1	1	1	1/3	1/3
BDP	1	1	1	1/3	1/3
Bee	3	3	3	1	1
Thami	3	3	3	1	1

$\lambda_{max} = 5$

CR = 0 shows an informed judgment

Table H. Pairwise comparison matrix for the alternatives with respect to their responsiveness to urgent occurrences.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	5	5
NNR	1	1	1	5	5
BDP	1	1	1	5	5
Bee	1/5	1/5	1/5	1	1
Thami	1/5	1/5	1/5	1	1

$\lambda_{max} = 5$

CR = 0 shows an informed judgment

Table I. Pairwise comparison matrix for the alternatives with respect to the availability of top management.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	4	4
NNR	1	1	1	4	4
BDP	1	1	1	4	4
Bee	1/4	1/4	1/4	1	1
Thami	1/4	1/4	1/4	1	1

$\lambda_{max} = 5$

CR = 0 shows an informed judgment

Table J. Pairwise comparison matrix for the alternatives with respect to the global network.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	2	1	3	4
NNR	1/2	1	1/2	2	3
BDP	1	2	1	2	3
Bee	1/3	1/2	1/2	1	2
Thami	1/4	1/3	1/3	1/2	1

$\lambda_{max} = 5.0718$

CR = 0.0162 shows an informed judgment

Table K. Pairwise comparison matrix for the alternatives with respect to the industry experience.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	3	1	1	1
NNR	1/3	1	1/2	1/3	1/3
BDP	1	2	1	1	1
Bee	1	3	1	1	1
Thami	1	3	1	1	1

$\lambda_{max} = 5.0198$

CR = 0.0045 shows an informed judgment

Table L. Pairwise comparison matrix for the alternatives with respect to the local presence.

	DB Schenker	NNR	BDP	Bee	Thami
DB Schenker	1	1	1	1/2	1/2
NNR	1	1	1	1/2	1/2
BDP	1	1	1	1/2	1/2
Bee	2	2	2	1	1
Thami	2	2	2	1	1

$\lambda_{max} = 5$

CR = 0 shows an informed judgment