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THE THIRD PARTY LOGISTICS SELECTION: A REVIEW OF LITERATURE

Aicha Aguezzoul¹

Abstract — *The outsourcing of logistics activities to third-party logistics service providers (3PL) has become a common practice by many companies. The majority of research in this field is of exploratory type and is mainly focused on reasons, benefits, and risks to work with the 3PL as well as the role of those in supply chain management. This paper presents a literature analysis on 3PL selection and evaluation. This selection is a very complex process that depends on several factors. The selection criteria evolved a lot these past years and the 3PL have currently diversified by offering various services and by ensuring various activities. As for the methods of 3PL evaluation, they range from simple analytical techniques to multi-criteria methods. A comparison of these methods in terms of advantages and disadvantages is also presented in this paper.*

Keywords — *Third-party logistics, performance, criteria and methods*

INTRODUCTION

In today's business world, a large number of companies outsource their logistics functions to Third-Party Logistics service providers (3PL) in order to focus on their core competencies. These 3PL have become important players in many chains and industries because they take part in the cost reduction, the productivity profits as well as the improvement of the service quality of their customers.

Once the decision has been made to work with a 3PL, the next step is to determine which provider to choose. Thus, the selection of an efficient and potential set of 3PL that can meet the particular requirements of the customer and with whom the customer can strengthen its relationships becomes a crucial decision. This decision is influenced by several factors such as price, services offered, location, technology, quality, etc.

Literature reviews on the logistics outsourcing in a broader way were already published ([1]-[2]). However, the 3PL selection is just mentioned in these researches as being a critical decision in the outsourcing process and no detail was specified as for the selection criteria and methods to be used. This paper aims to present a literature analysis on criteria and techniques used to select the 3PL and it's organized as follows: in the following section, the 3PL characteristics are presented. A review of literature on the criteria and the methods for selecting 3PL is examined in the third section. The fourth section gives a comparison of these methods in terms of advantages and disadvantages. Last section concludes the study and summarizes its findings.

3PL CHARACTERISTICS

A 3PL company is a private firm that provides logistics services under a contract to a primary manufacturer, vendor, or user of a product or service. It is called third-party because the logistics provider does not own the products but participates in the supply chain at points between the manufacturer and the user of a given product. The 3PL can perform logistics functions of their customer either completely or only in part ([3]-[4]). Initially, the 3PL were carriers, storage companies or forwarding agents. Currently, they diversified by offering various services and by ensuring various activities. The principal 3PL have their own warehouses, transport fleets and their credits are often deployed throughout the world. Table 1 provides a list of possible activities of 3PL and their related logistics functions ([5]). Most 3PL have specialised their services through differentiation, with the scope of services encompassing a variety of options ranging from limited services to broad activities covering the supply chain.

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TABLE 1
Categories of Possible Activities of 3PL

Logistics Function	Activities
Transportation	Shipping, forwarding, (de)consolidation, contract delivery, freight bill payment/audit, cross-docking, household goods relocation, load tendering, brokering.
Warehousing	Storage, receiving, (re)assembly, return goods, kitting.
Inventory management	Forecasting, location analysis, network consulting, slotting/layout design.
Order processing	Order entry/fulfillment, consignee management, call centre.
Information systems	EDI/VANS, routing/scheduling, artificial intelligence, expert systems, bar-coding, RFID, web-based connectivity, tracking and tracing.
Value-added activities	Design and recycling of packaging, marking/labelling, billing, call center activities, customization.

CRITERIA AND METHODS OF 3PL SELECTION

The most recent studies conducted on the 3PL use are generally results of many exploratory surveys. They are mainly interested in the following topics:

- Reasons, benefits and risks of outsourcing decision ([5]-[7])
- Modelling, planning and evaluation of the integrated logistics network for 3PL ([8]- [11])
- Analysis of relationships between 3PL and supply chain members ([12]-[14])
- 3PL selection and evaluation.

The last topic, that is 3PL selection and evaluation, is the objective of this paper. The various 3PL selection criteria and the methods of their evaluation are presented in the sections that follow.

3PL Selection Criteria

In 2003, the International Warehouse Logistics Association (IWLA), that comprises more than 550 logistics companies of North America, conducted an exploratory study with several 3PL customers. Their study showed a major change in the selection criteria's rankings. The results of this study are summarized in table 2 (reprinted from: www.iwla.com).

In 1994 and 1999, this table shows that the top three determinants in selecting a 3PL were service quality, reliability and on-time performance. By 2003, the price became the most important selection criterion. This change is mainly due to the increase of quality and the number of services offered by the 3PL. While the cost of these services continued to decrease, the price remained the crucial part of the negotiation with the 3PL.

Colson and Dorigo [15] present a software tool which allows the selection of public warehouses. Their extensive list of decision criteria includes: storage surface and volume, dangerous items, geographical distance to highway connection, certification (ISO 9001/9002, SQAS, HACCP), assistance with customs, use of technology such as RFID/Bar-coding, modem connection, etc. Similarly, Moberg and Speh [16] study the process of selecting 3PL in order to outsource warehousing. Their empirical survey in the US shows that the most important indicators for choosing a particular 3PL are related to responding to service requests, quality of management, and track record of ethical performance. The three least important criteria are investment in state-of-the art technologies, size of firm, and national market coverage.

The empirical study conducted by McGinnis et al. [17] in the US depicts that both the firm's competitive responsiveness strategy and the level of environmental hostility affect the selection criteria. They also show that there are eight important criteria which are: on time shipment and deliveries, superior error rates, financial stability, creative management, ability to deliver as promised, availability of top management, responsiveness to unforeseen occurrences, and importance of meeting performance requirements before price discussions occur.

TABLE 2
Ranking of 3PL Selection Factors

Selection Factors	2003	1999	1994
Price	1	4	11
Reliability	2	2	2
Service quality	3	1	1
On-time performance	4	3	3
Cost reduction	5	6	14
Flexibility and innovation	6	5	7
Good communication	7	10	4
Management quality	8	7	8
Location	9	12	13
Customise service	10	13	9
Speed of service	11	8	6
Order cycle time	12	9	10
Easy to work with	13	16	12
Customer support	14	11	5
Vendor reputation	15	15	15
Technical competence	16	18	19
Special expertise	17	14	16
Systems capabilities	18	17	17
Variety of available services	19	20	20
Decreased labour problems	20	23	22
Personal relationships	21	19	18
Decreased asset commitment	22	22	23
Early notification of disruptions	23	21	21
Increased competition	24	24	24
Global capabilities	25	25	25

The various studies mentioned above show that the order of importance of the criterion depends on several factors such as the demand level of the firm, its activity, the relation type which it projects to create with the 3PL, etc. Aghazadeh [18] has presented the five steps involved in selecting an effective 3PL and which are: making decision on the need to use or not a 3PL, developing criteria and objectives which the provider should meet, weeding out process by making a list of possible 3PL, determining the top prospect to meet the potential 3PL, and beginning the new partnership with the chosen provider.

The 3PL selection is hence a complex process involving various criteria, which are often in conflict with one another, such as price, quality, service, location, technology, etc. Various approaches for supplier selection are generally proposed in the literature such as linear weighting models, mathematical programming models, statistical/probabilistic approaches, etc. A more comprehensive review of these approaches can be found in [19]. The main approaches in the 3PL selection and evaluation previously published in the literature are described in the following section.

3PL Evaluation Methods

Our literature analysis enables us to classify the various methods of 3PL selection and evaluation according to four categories listed below:

- 1- Linear weighting models
- 2- Artificial intelligence
- 3- Statistical/probabilistic approaches, and
- 4- Mathematical programming models

The most utilized approaches are linear weighting models. These models place a weight on each criterion and provide a total score for each 3PL by summing up the 3PL performance on the criteria multiplied by their associated weights. So et al. [20] apply the analytic hierarchy process (AHP), which is a category of linear weighting models, to evaluate the service quality of 3PL. This service takes account of five generic dimensions which include: tangibles, reliability, responsiveness, assurance and empathy. Analytic Network Process (ANP) which is a more general form of AHP is also investigated in the literature. Jharkharia and Shankar [21] use ANP as a tool to classify the 3PL criteria selection into three levels. The first one contains strategic criteria named determinants which include: compatibility, cost, quality, and reputation. At the second level, the criteria which support the achievement of the upper-level determinants also known as dimensions are also identified. These dimensions are long-term relationship, operational performance, financial performance and risk management. The third level criteria are named enablers. These enablers support their respective dimensions and have some interdependencies among themselves. Meade and Sarkis [22] use ANP for selecting and evaluating 3PL in the context of reverse logistics. The operations activities included in the decision are: collection, packing, storage, sorting, transitional processing, and delivery. To model uncertainty and inaccuracy of the criteria weights, Bottani and Rizzi [23] propose the fuzzy sets theory.

Artificial intelligence aims to integrate qualitative factors and human expertise in the selection process. The two main systems that characterise the artificial intelligence are: expert systems and case-based reasoning (CBR). Expert systems are used to represent knowledge and expertise which professionals hold on the 3PL as well as the information collected from the literature on the various stages of the 3PL selection such as the formulation of criteria, etc. Ying and Dayong [13] suggest an e-commerce based 3PL system which contains five intelligent agents: order management, logistics process reengineering, resource scheduling, dynamic union management and simulating and evaluating. The second system, CBR, represents the process of solving new problems based on the solutions of similar past problems. Yan et al. [24] propose a CBR model framework for a 3PL evaluation and selection system. Their work expands upon CBR theoretical basis and its reasoning process by discussing its advantages and practical value for a 3PL evaluation and selection system.

Statistical/probabilistic approaches: The statistical tools most used in the selection process of 3PL are the mean and the standard deviation and they refer to the data gathered from the empirical studies [17]. Tsai et al. [25] use a binary logit model to investigate the 3PL behaviour of high-tech industry. The variables considered in this model are of two types: generic variables which include: service cost, service performance, value-added, and perceived capability; and alternative specific variables which are: company size in sale, product status, shipment size, and shipment destinations. Confirmatory factor analysis (CFA) is used to examine the interrelationships among generic variables.

The last category, mathematical programming models, consists generally of a function objective to be optimized and a set of constraints faced by the decision-maker. They are most used for modelling, evaluating or planning the logistics network for 3PL ([8]-[11]). In the 3PL selection process, few articles propose the use of mathematical programming techniques. Chen et al. [26] propose a linear programming model for selecting the optimal 3PL warehousing contracts with commitments. Kumar et al. [27] formulated a multi-objective programming model for 3PL allocation problem under a set of conflicting multi-objective criteria. Hamdan and Rogers [28] propose a Data Envelopment Analysis (DEA) to evaluate the efficiency of a group of 3PL warehouse logistics operations. The selected warehouses have common processes, similar product of consumer electronics and telecommunication equipment, and similar inputs and outputs.

Methods integrating two or several of these various methods mentioned above are also discussed in the literature. For example, Isiklar et al. [29] suggest a hybrid intelligent decision support framework for effective 3PL selection which integrates CBR, RBR (rule-based reasoning) and compromise programming techniques in fuzzy environment. Two groups of evaluation criteria are used. The first group focuses on the strategic aspects of the 3PL service provider and identifies them as follows: financial stability, successful track record, similar size, comparable culture, similar values and goals, and fit to develop a sustainable relationship. The second group is developed to measure important aspects of the supplier's business in five main categories: information technology, performance, quality, cost and services. Another study by Thakkar et al. [30] applies an approach integrating interpretive structural model (ISM) and ANP for a proper selection of 3PL. Efendigil

et al. [31] propose an integrated framework combining artificial neural networks and fuzzy logic for selecting 3PL in the context of reverse logistics.

These various approaches present many advantages and disadvantages which are defined in the next section.

ADVANTAGES AND DISADVANTAGES OF 3PL SELECTION METHODS

Table 3 below summarises the main advantages and disadvantages of the various 3PL selection methods:

TABLE 3
Advantages and Disadvantages of 3PL Selection Methods

Methods	Advantages	Disadvantages	
Linear weighting	<ul style="list-style-type: none"> - Rapid and simple to use - Takes account of the subjective criteria - Implemented inexpensive 	<ul style="list-style-type: none"> - Depends on the human judgment - No possibility of introducing constraints into the model 	
Artificial intelligence	<ul style="list-style-type: none"> - Offer a flexible base of knowledge - Takes account of the qualitative factors 	<ul style="list-style-type: none"> - The collection of knowledge on the 3PL - The access to the expertise is long and difficult 	
Statistical/probabilistic	<ul style="list-style-type: none"> - Analyzes the dubious behaviour of 3PL 	<ul style="list-style-type: none"> - No optimal solution - Difficult to analyze - No possibility of introducing mathematical constraints into the model 	
Mathematical programming	Multi-objective	<ul style="list-style-type: none"> - Criteria do not have a common dimension inevitably - Proposes several solutions - Possibility of introducing or not the constraints into the model 	<ul style="list-style-type: none"> - Takes account with difficulty of the subjective criteria - Does not propose an optimal solution - Difficult to analyze the results of the method.
	Mono-objective	<ul style="list-style-type: none"> - Proposes an optimal solution - Possibility of introducing or not of constraints into the model. 	<ul style="list-style-type: none"> - Does not take account of the subjective criteria

CONCLUSION

In this article, a literature review on 3PL selection and evaluation decision was presented. This review shows that this decision is complex because it requires the use of several often conflicting criteria such as price, reliability, service quality, on-time performance, etc. Also, it allows the classification of the various approaches of 3PL selection and evaluation in four categories namely: linear weighting models, artificial intelligence, statistical/probabilistic approaches, and mathematical programming models. Each one of these models presents its own advantages and disadvantages.

This literature review also shows a lack of theoretical work in 3PL selection and evaluation when compared with empirically based studies. In particular, little attention is given to the application of mathematical models in this field. These models are mainly used in modelling, optimization, planning and evaluation of the integrated logistics network for 3PL. Similarly, the models based on total cost like ABC (Activity-Based Cost) or TCO (Total Cost of Ownership) which are used in selecting the suppliers of products, are not proposed in the case of 3PL selection and evaluation.

Further research should be undertaken to establish more mathematical models and techniques based on cost.

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