Determinants of success in transport services outsourcing: empirical study in Europe

Abstract

Purpose - This research proposes *ideal interaction patterns for structural dimensions* (buyer and supplier representatives involved in the interaction and buyer and supplier critical capabilities) for transport service outsourcing. The objective of this paper is to establish whether those *ideal interaction patterns* are determinants of success of the interaction. In this paper, the latter is measured against the corresponding process success and outcome success.

Methodology - This paper proposes a conceptual model based on prior literature and adapted to this specific case of transport services. The proposed model is approached using the Partial Least Squares Simultaneous Equation Models (PLS-SEM). For this, the result of a survey to senior management at European machinery, electronics and automotive sector manufacturing plants has been used.

Findings - When companies possess the proposed ideal patterns for the structural dimensions, this brings with it positive effects on both the process success and the outcome success obtained by the outsourcing plant. Therefore, buyer-supplier relationships have been recognized to play a key role in the outcomes of this interaction and that the design and management of interfaces between companies and their logistics providers are critical.

Practical implications - Managers can use the present research findings to produce an appropriate interaction design that includes the representatives and capabilities required to make a success of transport service outsourcing.

Originality/value - This paper contributes to the literature on transport research by specifically establishing *ideal interaction patterns for the structural dimensions* that buyer and supplier's companies need to consider for successful transport services outsourcing to be achieved. Besides, the present research proposes a multidimensional measure of outcome success that combines major strategic, operational and financial outputs. Finally, this research represents the first survey-based empirical evidence on the topic, having used a sample of 93 plants belonging to many different companies in 5 European countries.

Keywords — Outsourcing services, logistics, transport, buyer-supplier interaction.

1. Introduction

Outsourcing any activities generates relationships between the buying and selling companies that need to be well managed to ensure that a positive effect comes from said relationships (Roth and Menor, 2003). In the particular case of logistics activity there are many companies that forge long-term links with specialized suppliers in order to increase benefits and decrease risks in logistics outsourcing, improve efficiency and profitability, and offer a better customer service performance (Krizman, 2009). The success of these relationships and, by extension, of the outsourcing of the logistics activity, can become important for achieving a competitive advantage (Fawcett and Cooper, 1998). However, customer company - logistics services provider relationship design and management during the interaction (herein referred to as *interaction interface*) have been considered to be at the root of the wide differences found in the results of logistics outsourcing (Hartmann and de Grahl, 2012), as can be observed in a range of studies (e.g., Boyson *et al.*, 1999; Lieb and Bentz, 2005; Gadde and Hulthen, 2009). Accordingly, it seems that it is essential for special attention to be given to the design and management of the interfaces of the interaction that determines the logistics outsourcing buyer-service provider relationships (Whipple and Roh, 2010; Hammervoll, 2009). A variety of authors state in relation to this that the design and management of these interfaces is a major determinant of the results that come from customer-provider relationships (e.g., Sampson, 2000; Hertz and Alfredsson, 2003) and that it is essential to know what aspects positively impact the results of outsourcing (Deepen *et al.*, 2008). Despite the importance of the topic, empirical research in the field is limited (Wallenburg *et al.*, 2010).

In order to address this gap, the present paper focuses on the design of the interaction interface and its effects on the success of logistics outsourcing. This design establishes the organizational resources required from the buyer and the seller (van der Valk, 2008), among which human resources are especially relevant (Roth and Menor, 2003). In fact, the quality and productivity of outsourced services are often highly dependent on the human resources involved in the production, delivery and consumption of said services on both sides of the relationship (Grönroos, 2000).

In line with the above, following Cunningham and Homse (1986), Wynstra *et al.* (2006) consider that there are two aspects of human resources that must be taken into account in interaction design, which together comprise what these authors call ***structural dimensions of interaction***. These dimensions are the types of organizational resources of either party involved in the outsourcing and, more specifically:

- Representatives involved: type of functional representatives involved in on-going interactions, both in the buying company and the service provider.
- Critical capabilities: skills that buyer and service provider representatives involved in the interaction should master.

Said authors also consider that the configuration of these structural dimensions is influenced by the key objective pursued in the interaction, which depends on how the buying company uses the outsourced service in its business process. In relation to this, taking the Chisnall (1982) study of the interaction between buyers and suppliers of industrial goods as their basis, Wynstra *et al.* (2006) distinguished four services types: *component services* (distributed to customers with no type of processing by the buying

company); *semi-manufactured services* (transformed by the buyer before being distributed to customers); *instrumental services* (affecting the way that the company's primary processes are carried out but not distributed to customers); and *consumption services* (consumed within the organization and concerning the support processes of the buyer). The same authors state that each type of service requires the mentioned structural dimensions to be configured in different and specific ways, resulting in *ideal interaction patterns for each type of service*, *which means that said ideal interaction patterns are determinants of the interaction's success.* In other words, if the buyer and service supplier companies in question use said *"ideal interaction patterns"* for the structural dimensions (representatives involved and critical capabilities) that they are going to use for the interaction, this will facilitate said interaction's success. It should not be forgotten that not only does the type of outsourced service influence these ideal interaction patterns, but the risk linked to the outsourced service as perceived by the buyer is also important (Wynstra *et al.,* 2006; van der Valk *et al.*, 2008). The same authors that propose these patterns state the need for them to be tested empirically for specific services.

In keeping with what has been stated in the foregoing, it has been considered appropriate for these ideas to be tested in the area of a service considered to be very representative, as it is one of the most frequently outsourced (Razzaque and Sheng, 1998; Song *et al.*, 2000): logistics services (an instrumental service type). It should also be stated that there is an additional interest in this kind of outsourcing, as it is regarded as a veritable challenge, since it does not always produce the anticipated benefits (Deepen, 2007; Krakovics *et al.*, 2008).

In other regards, logistics activity includes a range of functions (transport, fleet management, warehousing, return and reverse logistics, packaging, freight payments and auditing (Boyson *et al.*, 1999; Wilding and Juriado, 2004)). As each of those activities may require its own particular *structural dimensions (representatives involved* and *critical capabilities*), it was also considered advisable for this first study to focus on only one of these functions. Of these, the part of logistics with the highest rate of outsourcing has been chosen, ***transport services*** (Wilding and Juriado, 2004). This will enable a greater degree of specification in the delivery of the study and the subsequent conclusions, as it can be seen in the scales shown in Appendix A.

It seems that it can be deduced from the bibliography examined for the present study that, despite the stated importance, no research has been published that has focused on the relationship between the *structural dimensions of interaction* and the success of the interaction for transport services outsourcing. As a consequence, the present study will contribute the very first results in this specific field.

Thus this study's main objective is to establish whether the *ideal interaction patterns* of the structural dimensions (proposed in the prior literature and adapted to this specific case of transport services) are a determinant of the success of the interaction (when the latter is measured against the corresponding service process and outcomes). For this the results of a survey to senior management at European machinery, electronics and automotive sector manufacturing plants has been used (see section IV).

The present study is the first in this field that conducts a broad empirical study of a large number of companies in a range of different countries. Prior studies that have addressed *ideal interaction patterns* of the structural dimensions (Wynstra *et al.*, 2006; van der Valk *et al.*, 2008 and 2009; van der Valk and Wynstra, 2012) use case research in a limited number of companies. To achieve the stated objective, the following section sets

out the research hypotheses, preceded by the corresponding theoretical framework. The methodology section details the way in which the data required for the present research were obtained. Subsequently, the results are presented and finally a series of conclusions and implications are set out along with some limitations and possible future lines of research.

2. Theoretical Framework

Despite the fact that the appropriate design and management of buyer-seller interactions have long been regarded as a key factor in outsourcing in general (Håkansson, 1982), few studies have focused on exploring this aspect in the field of logistics (Marasco, 2007), and even fewer in the field of transport (Paiva *et al.*, 2008). There is an even more evident need for a greater number of contributions in this respect given that bad design and management have been pointed to as a source of flaws and high costs in logistics services outsourcing (Chen *et al.*, 2010). It is therefore important to know which interaction design and management aspects positively impact outsourcing outcomes (Deepen *et al.*, 2008).

From the point of view of outsourcing in general, multiple aspects of the interaction have been analysed in the relationship with performance. The following can be highlighted (S. Tsanos *et al.*, 2014; Autry and Golicic, 2010; Rossiter Hofer et al., 2014; Fynes and Voss, 2002; Wilson and Moller, 1991): trust, commitment, co-operation, adaptation, satisfaction, dependence and communication.

As can be observed in Table I, focusing on studies that analyze logistics services outsourcing, most of the above mentioned aspects appear, along with others such as Personal relationships, Uncertainty, Reciprocity and Equity.

In the specific case of transport, the factors that seem to influence the outcome of outsourcing are: co-operation (Fugate et al., 2009), communication and dependence (Paiva et al. 2008), along with trust, commitment and dependence (Golicic and Mentzer, 2006).

It can be deduced from the above that not only is there a lack of studies that focus exclusively on the area of transport outsourcing but that, in addition, none of these (including those that focus on logistics outsourcing) take into consideration aspects directly related to the design of the interaction, but focus on its management instead. It should be remembered that interaction design establishes the organizational resources required from buyer and seller (van der Valk, 2008) that are the focus of the present study. Following authors such as Yang et al. (2016) and Granovetter (1985), successful relational mechanisms require close attention to human resources, which is why this study focuses on said resources to analyze whether ideal patterns of structural dimensions of interaction affect buying company performance.

Table I: Relational antecedents in logistics services outsourcing

Transport services belong to the instrumental type of outsourced services in the Wynstra *et al.* (2006) classification mentioned in the Introduction Section. In this case, the *key objective* is that the service has the desired effect on the buying company's primary processes. It therefore has to be taken into account that the role played by transport in the logistics system is more complex than that of mere shipping in the sectors under study (machinery, electronics and automotive sectors), as appropriate connections have to be made between the various supply chain links so that raw materials can be transformed into finished products and delivered to customers on the desired dates, in the desired quantities and with the desired qualities. Among other things, this means that the transport system has to be perfectly synchronized with the production schedules of the companies involved in the different stages.

This should guide the way that the *ideal patterns of structural dimensions of interaction* are configured. These patterns will also be influenced by the risk linked to the outsourced service.

As was previously mentioned, the *structural dimensions of interactions* are related to the *representatives involved* and to the *critical capabilities* used in the interaction. Both those of the buyer and those of the supplier must be taken into account since, as some authors indicate, the results of business services are often highly dependent on the human resources involved on both sides of the relationship (Grönroos, 2000). The two *structural dimensions* are described in detail below along with the other constructs. Their validity is analysed in the results section.

2.1. Representatives involved in the interaction

The representatives involved in the interaction should be connected with the processes related to the outsourced service (Jackson and Cooper, 1988; Fitzsimmons *et al.*, 1998; Boyson *et al.*, 1999). More specifically, Wynstra *et al.* (2006) and van der Valk (2008) state that on the buyer's side all the internal users affected by (or who affect) the services should be highly involved in the interaction. Said authors indicate that in the case of the provider, the representatives involved in the interaction should be professionals with experience in the content of the supplied services (this statement is supported by other studies, such as Selviaridis and Spring (2010).

Taking this into consideration, a scale formed of 4 items has been developed for the specific case of transport service outsourcing. The items include the questions of the degree to which *buyer representatives* from the following areas are involved in the outsourcing process (see Appendix A): Upstream supply chain management (e.g., buyer specialists, purchasing manager, materials manager), downstream supply chain management (e.g., sales manager, materials manager), Production/operations management and Marketing. The same questions are posed for the case of the *supplier* with a second 4-item scale that envisages representatives from the following areas (see

Appendix A): Downstream supply chain management (e.g., sales manager, materials manager), Production/operations management, and Marketing and Service specialists.

2.2. Critical capabilities

The *buyer's critical capabilities* basically relate to collaboration with the supplier in the service delivery process. This is due to the fact that buyers not only act as customers, but also as service co-producers (Sampson, 2000). The scale used has been developed on this basis and consists of five items taken from van der Valk *et al.* (2009) and adapted to the case of transport services. These are (see Appendix A): Communicating the demands of our external customers to our transportation service providers; Optimizing the fit between our operations and those of our transportation service suppliers; Specifying desired changes to our transportation service suppliers; Communicating our plant's needs to our transportation service suppliers; Tracking user satisfaction associated with transportation services.

Firms that outsource a service are really buying capabilities (knowledge, skills and, on occasion, resources) considered to be of value (Pressey *et al.*, 2009; Harmsen and Jensen, 2004; Ulaga and Chacour, 2001; Day, 1994). For instrumental services such as transport, the *supplier's critical capabilities* are linked to the supplier's ability to understand the processes of the buying company with which it must interact and, on this basis, to design a service that has the desired effect on said processes (Wynstra *et al.*, 2006).

Taking this into consideration, the supplier's critical capabilities construct includes six items relating to the capacities of the following (see Appendix A): *production* (service delivery), quality, development, process design, adaptation (all taken from van der Valk *et al.* (2009)). To these has been added the capacity for innovation, which has been considered by other authors (Deepen *et al.*, 2008). These capabilities are also highlighted by authors such as Pressey *et al.* (2009) and Möller and Törrönen (2003).

2.3. Perceived Risk

Organizational Buying Behavior (OBB) researchers state that much of the variation in OBB can be related to the level of perceived risk associated with a particular purchase situation (Johnston and Lewin, 1996). This leads other authors to suggest that companies that buy services are mindful of said perceived risk when designing the interaction with their suppliers, as it is necessary for it to be taken into consideration (Wynstra *et al.,* 2006 and van der Valk *et al.*, 2008). ***Buyer-perceived risk*** is determined by the *importance* attributed to the outsourced activity and by the *uncertainty* of the results of said outsourcing (Gelderman and Van Weele 2002).

Taking the study by van der Valk *et al.* (2009) as the basis, the following have been considered for measuring the *importance* associated with transport services (see Appendix A): the expense entailed, how essential (or not) it is for customer satisfaction

and for the continuity of daily operations, and also whether they are essential for complying with regulations.

Uncertainty has been analysed from different perspectives in earlier works. For example, Lee (2002) addresses uncertainty in a transaction relationship depending as much on unstable supply as on unstable demand. Yang *et al.* (2016) broaden the scope with the addition of technological uncertainty and vendor contribution unpredictability. For their part, Lai *et al.* (2005) consider two types of uncertainty: external (related to changes in technology, prices, demand, and so on) and internal (related to the difficulty of obtaining or understanding information regarding a task).

However, the present study follows the McQuiston (1989) classification, which states that uncertainty depends on the level of *complexity* and *novelty* associated with the outsourced service. According to van der Valk *et al.* (2009), *complexity* refers to the degree of specialization and customization of services. Whether they have features that are difficult to assess, and whether said services need to be integrated with the company's processes and systems and/or customer participation may also be taken into consideration. Finally, the degree of *novelty* depends on the prior experience that the buying company has of the outsourced transport service's use, purchase, integration and/or assessment (see Appendix A).

2.4. Performance assessment in transport services outsourcing

In conceptualizing the success of transport services outsourcing, this study will follow the work by van der Valk *et al.* (2009) (based on Grönroos, 1982 and Edvardsson and Olsson, 1996), in which interaction is considered to be successful when the buying company is satisfied with the outsourced service *process* (the way in which it receives the service) and with the *outcomes* of the outsourced service (what the customer receives). There is therefore a distinction between *process success* and *outcome success.* Process success evaluates the service exchange process (i.e., whether the service is provided in accordance with the buyer's expectations). Outcome success evaluates whether the buying company achieves the desired outcomes compared to its pre-purchase expectations.

Measuring the ***process success*** seeks to determine whether the buying company is satisfied with the way in which the supplier delivers the transport service. Following van der Valk (2008), a 7-item scale has been used to measure this (see Appendix A).

Outcome success. There would seem to be a consensus that outcome success should be measured multidimensional, considering the various aspects of interest (Krizman, 2009). However, there is no agreement as to the specific way that this measurement should be approached (neither in general terms, nor when speaking specifically of logistics), and it has been defined and measured in different ways (see e.g., Stank *et al.*, 2003; Knemeyer and Murphy, 2004; Deepen *et al.*, 2008; Krizman, 2009; Hartmann and Grahl, 2012). The present study considers the need to contemplate a multidimensional measure for *outcome success* that takes into account the different aspects that could justify the buyer outsourcing the service from both the strategic/tactical and financial points-of-view, which represents a contribution to this

field of research. The items that are considered to be the constituent parts of these aspects are taken from different sources, to be specific (see Appendix A):

- *Strategic performance*: access to innovative ideas (van der Valk, 2008), focus on key competences (Hung Lau and Zhang, 2006; Kroes and Ghosh, 2010) and access to cutting edge technologies and knowledge (Hung Lau and Zhang, 2006; Hoecht and Trott, 2006; Kroes and Ghosh, 2010).
- *Operational performance*: customer service (Krakovics *et al.*, 2008; Rajesh *et al.*, 2011), flexibility (Rafele, 2004; Krakovics *et al.*, 2008; Rajesh *et al.* 2011), delivery time (Bhatnagar *et al.*, 1999; Rafele, 2004), and perceived quality (van der Valk, 2008).
- *Financial performance*: costs (Sahay and Mohan, 2006; Power *et al.*, 2007; Ghodeswar and Vaidyanathan, 2008; van der Valk, 2008; Rajesh *et al.*, 2011), return on assets (Hung Lau and Zhang, 2006; Ghodeswar and Vaidyanathan, 2008; Rajesh *et al.*, 2011) and value added (van der Valk, 2008).

Lastly, it should be stated that although the model was proposed several years ago, it is used as a reference in some recent studies that examine business service buyers and sellers (Rottmann et al., 2015, Zhou et al., 2017). The following section is devoted to establishing our hypotheses for the case of transport services outsourcing.

3. Conceptual model and research hypotheses

According to the proposed theoretical framework, the aim of this research is to establish whether the above-described *ideal interaction patterns* are determinants of the success of the interaction. If this is the case, this implies that when buyer and supplier companies possess structural dimensions (composed of the critical capabilities and representatives involved) characterized by the above-indicated different dimensions (ideal proposed patterns), this would facilitate the achievement of a positive significant effect on the success of the interaction (measured by outcome success and process success). Whether this set of patterns complies or not will differentiate some companies from others and, should the mentioned effect be noted, said compliance will influence outsourcing success. The present study will also enable the influence of each of the dimensions on the structural dimensions to be determined and ranked, and therefore also their influence on success, albeit indirectly. A second complementary aim is to observe the influence of buyer-perceived risk of transport services outsourcing on the degree to which the ideal interaction patterns for said services should be fulfilled.

Figure 1 show the conceptual model and the corresponding hypotheses, which are commented on below. The hypotheses are supported by what is stated in prior studies by Wynstra *et al.*, 2006; van der Valk *et al.*, 2008 and 2009; and van der Valk and Wynstra, 2012, and studies by other authors mentioned in the following paragraphs.

Figure 1: Conceptual Model

As previously stated, the satisfaction of the buyer of a service with the *process* delivered by the supplying company depends, among other things, on the *Representatives involved* and the *Critical capabilities* that they use during delivery of the service, in this case, the transport service. Deepen *et al.* (2008) indicate in this respect that any proactive improvement deployed by the supplier is positively related to the achievement of the goals set by the buyer (process success). Said improvement includes aspects such as adaptation and innovation, which appear on the *Supplier Critical Capabilities* scale (see Appendix A). In addition, it should not be forgotten that the collaboration of the buying company is of great importance in the service delivery process. In this respect and in the specific case of logistics, Boyson *et al.* (1999) state that the success of logistics outsourcing agreements depends, to a great extent, on the management skill of the companies that contract said services from third parties (*involved Buyer's representatives* and *Buyer's Critical Capabilities*).

In keeping with all the above, the following hypothesis can be formulated for the present case:

H1. The proposed *ideal interaction patterns of structural dimensions* have a positive significant effect on the process success being achieved in transport services outsourcing.

Firm capabilities are the main determinants of superior performance and sustained competitive advantage (Pressey *et al.*, 2009; Roth and Menor, 2003; Teece *et al.*, 1997). In the case of logistics capabilities, a number of authors state that these contribute, among other things, to better company performance, and so they are strategically important (Cho *et al.,* 2008). On the other hand, Stank *et al.* (2003) state that aspects such as knowledge of needs, cooperation and continuous improvement (which form an explicit or implicit part of the critical capabilities analysed in the preceding section), are antecedents of both operational performance and cost performance. In line with all this, the second hypothesis for the current research is formulated as follows:

H2 The proposed *ideal interaction patterns of structural dimensions* have a positive significant effect on the outcome success being achieved in transport services outsourcing.

As previously mentioned, companies that buy services are mindful of the perceived risk when designing the interaction with their suppliers and this risk should be taken into account when designing the service outsourcing interaction interface (structural dimensions) as the greater the risk, the more implicitly and formally companies should design their interfaces with suppliers (Wynstra *et al.,* 2006). Empirical studies by van der Valk *et al.* (2008, 2009) confirm this. These results can be adapted to the case of transport with the following hypothesis:

H3 The greater the *buyer-perceived risk* of transport services outsourcing, the greater the degree to which the ideal interaction patterns *of structural dimensions* for said services should be fulfilled.

4. Methodology

The proposed model is approached using the Partial Least Squares Simultaneous Equation Models (PLS-SEM) methodology due to its capability for modelling unobservable or latent variables, such as firm performance (Hair *et al*., 2013). The importance of this technique is growing in Business Management and Operations Management research (Peng and Lai, 2012; Luo *et al.,* 2014) and particularly in Supply chain management (Hazen *et al.*, 2015). PLS is a variance-based technique that: (i) can deal with small samples (Reinartz *et al.,* 2009), (ii) makes no assumption regarding data distribution (Barroso *et al.*, 2010; Chin, 1998) and (iii) can deal with complex models that involve many indicators and many theoretical relationships simultaneously (Hair *et al.*, 2013). PLS-SEM enables latent variables to be empirically modelled and thereafter evaluated with a set of "composites" (aggregate multidimensional construct), which are proxies that capture the multidimensional features of the latent variable (Henseler *et al.*, 2016). To be specific, the constructs used in this research are composite in type (Henseler *et al.*, 2016), which means that applying PLS to the proposed model generates practically no skew (Sarstedt *et al*., 2016; Becker *et al.*, 2013; Rigdon (2016)). The dimensions and the items included in the questionnaire were chosen to complement each other. In our questionnaire design, each of these items represents a different aspect of the composite with which it is associated, meaning that they cannot be considered to be either redundant or replaceable by any other (Henseler, 2017). Moreover, and according to our model design in the research, the only alternative for estimating the model (quoted as covariance-based methods) suffers an indeterminacy problem in the estimation procedure and therefore is inappropriate (Díaz-Casero *et al.*, 2011). Additionally, authors could add identifying key driver constructs to achieve both dependent variables, and the use of latent variable in subsequent analyses (Hair *et al.*, 2013), such as the use of the two-stage approach to model high-order constructs (Roldán and Sánchez-Franco, 2012).

4.1. Design of the sample and surveys

This research exploits data collected as part of the fourth round of the international High Performance Manufacturing (HPM) survey. The database used for this study was completed in 2015. This project, which started its first round in USA in 1989, becomes international for the following 4 rounds. Starting in 1991 with 5 countries (USA; Japan, UK, Germany and Italy), it currently involves more than 25 research groups in 19 countries in Europe, America and Asia. Country selection was limited to countries in regions known for their strength of Manufacturing and for having both high performing manufacturers and traditional manufacturers.

This project re-examines three industrial sectors (Machinery, Electronics and Automotive) in light of recent changes in the global economy. These three industries were chosen for the HPM Project as they are in transition and the environment that they operate in is one of extreme global competition. There are large numbers of plants on all

three continents working in a variety of competitive environments (Jiménez *et al*., 2015). In relation to this specific research, transport services in these sectors are of great importance due to the high numbers and size variations of transported parts. Furthermore, these parts must arrive in a prescribed production sequence (Reeves *et al.*, 2010). As different cultural aspects may result in significant differences in logistics outsourcing relationship management (Zhao, 2008), the present study has focused on the European countries in the sample whose databases were available at the time that the research was conducted. The theoretical section analyses Production Practices (e.g., lean manufacturing, Supply Chain management and Total quality management, among others) and their impact on performance and competitiveness. The fourth round survey of the HPM Project included Business Services for the first time, which took in transport services.

The unit of research was the manufacturing plant. Given that it was necessary to be sure that there were sufficient managers and employees in the plants to take the survey, only plants with 100+ employees were included (Morita *et al.*, 2015). In the HPM Project, plants are randomly selected in each country in order to obtain a balanced number of observations for each country-industry combination whilst avoiding sampling bias. Plants in a single country all belong to different corporations (Machuca *et al.*, 2011). Members of the research team contacted the selected plants by telephone and/or e-mail to explain the objective and content of the survey, as well as the benefits of taking part. The questionnaires indicated the functions of the personnel that they should be completed by. In particular, transport services outsourcing scales could be answered by: Logistics Directors, Sales Directors, Marketing Directors, Customer Relations Directors, Customer Services Directors, Demand Directors and After-Sales Service Directors. In many cases, the measurement scales were included in more than one different questionnaire so that information could be triangulated and variability generated by individual differences minimized. This ensures greater instrument reliability and provides a cross-section of plants, whilst also preventing individual bias (Van Bruggen *et al*., 2002; Sakakibara *et al.*, 1997) and improving validity. The fact that the respective questionnaires were completed by two informants from each function in the plants guaranteed reliability of information. Random combinations of scale items and questions in the questionnaires prevented surveyed bias.

The information was requested from buyer companies. As a common practice in Operations Management (Wagner and Bode, 2014; Brandon-Jones *et al.*, 2014), a dyadic research approach has been used, asking buying firms about their interactions with their transportation service providers, as can be seen in appendix 1.

In line with the model and the hypotheses derived therefore, the data-filtering procedure was conducted taking into account only the selected variables (or items) in the model; when the amount of data missing from the survey exceeded 15% for any observation, said observation was typically removed. Finally, when running the PLS-SEM, a technique known as 'mean value replacement' was employed for every indicator (or item) provided there were fewer than 5% values missing per indicator (Hair *et. al.*, 2013). When this was completed, 93 plants remained as valid observations. Table II summarizes the distribution of firms by country and sector.

Table II: Companies sorted by Country and Sector

The part of the survey related to transport services outsourcing in the 93 plants contains 49 questions, which are those related to the different items mentioned when explaining the constructs in the model (see Section II and Appendix A). The specific items measuring the latent constructs along with their values are presented in Appendix A. Multidimensional perceptual measures were used. These have been stated to be a viable alternative in large sample studies providing rigorous examinations of reliability are performed (Ketokivi and Schroeder; 2004), as is shown in the next section. Measures were on a five point Likert scale (according to the rule: 1 = not at all, 5 = to a large extent).

Authors like Roberts *et al.* (2010) indicate that although most of the research studies conducted in Operations Management use Structural Equation Modelling (SEM) modeled their constructs as reflective, this implies the under-representation of the true theoretical nature of constructs. In this line, Podsakoff *et al.* (2006) indicates that a construct such as firm performance should be conceptualized as formative. The present study makes some progress in this direction by modelling and providing theoretical justification for all the constructs in the model as formative constructs. Before this, it is important to point out that as the proposed model is formative, the criterion for retaining a construct (or an item in a construct) is not based on "Weight", but depends on its variance inflation factor (VIF), which determines the degree of correlation. Only when it is found to be high, the construct (or item) is eliminated (Roberts and Thatcher, 2006). This will be addressed in the next section together with validity and reliability of the constructs and the results of the research.

5. Data analysis and hypothesis testing

The research model (see Figure 1) shows the relationships between constructs. However, there are two types of construct in the diagram. Those inside a square represent ordinal constructs, which depend on observable items, whereas those inside an ellipse depend on other latent variables. These are called aggregated multidimensional constructs (Polites *et al.*, 2012). In these cases that is a parsimonious model and handles collinearity issues well (Hair *et al.*, 2013). Particularly, the model used has a formative-formative configuration, which means that both the high-order and low-order constructs are formative in nature (Wetzels *et al.*, 2009). A *two-stage approach* will be used in the estimation procedure (Wright *et al.*, 2012). This approach records the latent variable scores of low-order constructs in a first stage PLS regression without high-order constructs. They are then used as if they were observable variables that explain the high-order constructs in a second stage PLS regression using solely high-order constructs. This overcomes the problems associated with the other HCM approach, the *repeated indicator approach* (Ringle *et al.*, 2012; Wetzels *et al.*, 2009; Becker *et al.*, 2012).

Since a formative specification has been proposed for all constructs, an extended rule is that the minimum number of observations needed to perform the PLS regression is the

larger of: (1) the result of multiplying by 10 the highest number of structural paths directed towards a specific endogenous construct in the structural model, or (2) the result of multiplying by 10 the highest number of formative indicators used to measure a single construct (Barclay *et al.*, 1995). Taking into account the conceptual model established for the study, Process Outcomes is the construct that possesses the greatest number of formative indicators, namely 7, as a result of which the minimum number of plants required following the mentioned rule is 70. As we have a total of 93 plants available, the present study complies with this requirement.

5.1. Measurement model

Evaluating PLS-SEM involves the evaluation of both the measurement and the structural model. Contrary to reflective models, it is not necessary to validate formative models in terms of validity (such as convergent and discriminant validity) and reliability (such as individual item and construct reliability), but rather in terms of item-level contribution and construct-level validity (Peng and Lai, 2012). Given that the formative measurement scheme requires the consideration of all the different aspects that define an unobservable variable, it would be misleading to consider only one particular aspect through the usage of many correlated, but semantically different, indicators. Ignoring this correlation leads to a destabilization of the model (Roberts and Thatcher, 2006). Formally, a higher correlation between indicators evidences a problem known as multicollinearity. This is addressed by inspecting the variance inflation factor (VIF) between the construct and associated items obtained with the ordinary least squares (OLS) regression. Multicollinearity is a concern if the VIF is higher than 5 (Hair *et al.*, 2013; Henseler *et al.*, 2016). According to the results of this research (Appendix A), no multicollinearity issues were recorded for any of the indicators as all have a VIF below 5.

Also, the weights of the different structural dimensions indicate that *Buyer's critical capabilities* (0.542****) are the most important aspect in the model in the case under study. This is in line with De Toni and Nasamabini's (1999) statement that collaboration is a critical factor for obtaining good supply chain performance. Despite being identified as a relevant factor in logistics services outsourcing (Deepen *et al.*, 2008), *Supplier's critical capabilities* (0.224**) are third in importance, as it seems that they are less important than buyer capabilities. They are preceded by *buyer's representatives* in BS outsourcing (0.338***), while in last place are *supplier's representatives* in BS outsourcing (0.160). This all indicates that, within the importance of collaboration between parties stated by various authors (Lai *et al.*, 2005 Fugate *et al.*, 2009; Gligor and Holcomb, 2013), the greatest responsibility for involving appropriate people in the area of the supply chain falls to the customer.

5.2. Structural model

Once the measurement model has been verified as satisfactory with respect to the established criteria, the next step is to assess the structural model. This involves examining the model's predictive power and the strength of the relationships between constructs. As can be seen in Figure 2, the three research hypotheses are confirmed with high significance levels. In addition, the explanatory power of the overall model is remarkable, as all the endogenous constructs have an R^2 coefficient above 0.1 and a coefficient above 0, which means that the model has adequate predictive power (Chin, 1998). The obtained R^2 values show that the structural dimensions characterized by the proposed of structural dimensions have an explanatory power of practically 19% of process success and 45% of outcome success. This shows that the proposed ideal structural dimension patterns are relevant for achieving successful transport services outsourcing, which could be considered a contribution to the field. In addition, the fact that the Q^2 values > 0 afford a degree of predictive relevance to the proposed model, indicating that it could be valid in other situations (Chin, 1998). It is therefore essential to know which aspects lead to successful outsourcing results (Deepen *et al.*, 2008). However, the difficulty of this task has also been recognized and, despite its importance, there is a gap in the empirical research (Wallenburg *et al.*, 2010) that the present research seeks to mitigate.

Figure 2: PLS-SEM results

The present research has focused on aspects of interaction interface design and their effects on the success of transport outsourcing. Its aim has been to verify if *ideal patterns of structural dimensions* (representatives involved in the interaction and critical capabilities) has a positive and significant effect on the success of the corresponding interaction's process and outcome, as various authors claim for business services (Wynstra *et al.*, 2006; van der Valk *et al.*, 2008 and 2009; van der Valk and Wynstra, 2012). Results indicate that the structural dimensions of interaction have a significant effect on *process outcome* (0.435; $p<0.001$) and *outcome success* (0.718; $p<0.001$). Thus, H1 and H2 are confirmed. So, as previously stated, it has been recognized that buyer-supplier relationships play a key role in the results that come from this interaction and that the design and management of the interfaces between companies and their logistics providers are critical (e.g., Sampson, 2000; Hertz and Alfredsson, 2003).

In addition, the influence of risk on process dimensions is significant (0.763; $p<0.001$), which confirms H3. This is confirmed to be a predictive variable of compliance with structural dimensions and means that when outsourcing transport services is considered a high-risk activity, the design of the interaction interface with suppliers is more explicit than in the case of low-risk perception. These results support studies by van der Valk *et al.* (2008 and 2009). Finally, as other authors also state, these findings point to perceived risk being explained by the importance, complexity and novelty of the outsourced service (McQuiston, 1989; Gelderman and Van Weele, 2002).

6. Discussion and Conclusions

This research represents the first survey-based empirical evidence on the topic, having used a sample of 93 plants belonging to as many different companies in 5 European countries. All the proposed hypotheses have been validated statistically with high levels of significance, which demonstrates that when companies possess the proposed *ideal patterns for the structural dimensions*, this brings with it positive effects on both the process success and the outcome success of the final results obtained by the outsourcing plants.

Thus, this research makes several contributions. First, within the general field of business services it provides broad empirical evidence of the important role plaid by the structural dimensions as determinants of the success of the interaction. Our study thus contributes to knowledge of the aspects that positively impact the results of outsourcing (Deepen *et al.*, 2008). This is heightened by the predictive relevance that the Q^2 values seem to afford the proposed model, the results of which could be extrapolated to other cases. This will be further tested in future research.

Second, in the specific field of logistics, this study empirically supports the literature by demonstrating, as mentioned above, that the design and management of the company-logistics provider interfaces (represented here by the structural dimensions) are critical for obtaining successful outsourcing results. And the greater the buyer perceived-risk, the more critical they become.

Third, the present research contributes to the literature on transport research by specifically establishing *ideal interaction patterns for the structural dimensions* that buyer and suppliers companies need to consider for successful transport services outsourcing to be achieved. It also shows that special attention should be paid to the buyer side, especially with respect to critical capabilities. It is also demonstrated that, despite our starting point being the conceptual framework initiated by the Wynstra *et al.* (2006) study, the interaction patterns that this study proposes have been adapted and expanded for the specific case of transport outsourcing, and this study is unique in focusing on this field.

Fourth, this research makes a contribution to methodology by providing the first survey-based empirical evidence on the topic with its empirical comparisons of a broad 5 country / 3 industrial sector samples. It is therefore distinct from earlier research that has always used case research methodology and in which some studies, such as de van der Valk and Wynstra (2012), have focused on a single country, which can lead to bias and makes extrapolation of the results difficult. Although all the companies in the present research are located in Europe, northern, central and southern European plants have all been considered, embedding their respective cultural contexts and making the results more generalizable for the European context at the very least.

The final contribution made by the present research is a focus on the measurement of outcome success that combines major aspects of strategic, operational and financial outputs. This meets the need stated by some authors (Krizman, 2009) for this type of construct to be measured multidimensional. This is a new development in both the transport outsourcing literature and in the broader business services literature. This is especially important if it is taken into account that the proposed model shows that the

ideal proposed patterns have a high explanatory power for outcome success and that, moreover, it may have predictive relevance.

6.1. Managerial implications

The obtained results are of use to buyer companies and transport service suppliers alike, and both of these should be aware that if they use interaction patterns that approximate to the ideal patterns for the structural dimensions proposed herein and these patterns are complied with, there is a high likelihood that they will achieve process and outcome successes, most especially, the latter, which is of great managerial importance. It has also been shown that the greater the perceived risk of the outsourcing, the greater the care that should be taken over the design and management of the interaction, affording greater importance to implementing the proposed ideal patterns for the structural dimensions. In addition, the aspects that need to be taken into consideration when defining the risk have been indicated.

All this is especially important in the field of logistics, which is regarded as a challenge as it does not always afford the expected benefits (Deepen, 2007; Krakovics *et al.*, 2008). Managers would be able to use the present research findings to prepare an appropriate interaction design with the representatives and capabilities that enable the service outsourcing to be successfully achieved.

6.2. Limitations and further research

Although the present study makes several contributions, it is not without its limitations, and these present opportunities for further research. First, although the aspects of both the buyer and the supplier of transport services have been taken into account, the information has been collected from a survey of buyer companies alone. Although this was not an optimal solution, it was considered preferable to the option of not having any information on suppliers, as this would have resulted in a part of the interaction being disregarded. It was also stated that this approach is common practice in Operations Management. Nevertheless, there would be an improvement if information could be included in the future that was directly collected from supplier companies.

Second, although, as indicated, the sample complies with the requirements for using the PLS-SEM model, it would be interesting to extend the present research to a larger sample. This would enable new aspects to be tested that have not been tested here due to the sample size, which could lead to some of the effects among the variables not being detected. The new sample that we will use in the near future will contain a larger number of countries and will also include Asia. This will also enable us to examine whether any differences in the effects of the patterns exist as a result of their being implemented in different cultural and organizational contexts.

Third, although the use of three industrial sectors in this study is a step forward in the existing literature, and although our model displays predictive power, it would be

interesting to investigate other types of companies in order to generalize our findings even further.

Fourth, the research focuses only on transport services, which is only one part of logistics, and it cannot be guaranteed that the results and conclusions can be generalized to logistics as a whole. Future research will address other aspects of logistics, such as warehousing, to determine whether the same conclusions are reached. Once again, the predictive relevance demonstrated by the proposed model is promising in this respect. The survey of this study has been designed for any type of transport service provider. However a step forward for further research could be to take into account the possible influence of the kind of provider of the transport services (3PL, carriers, etc.) in order to test empirically if this is or not an influencing factor in the results.

Fifth, this study has only considered one side of the dyadic relationship. Although this is a common practice in supply chain management (e.g., Bode and Wagner, 2015; Whitehead *et al*., 2016), collecting data from both sides would be an interesting and potentially fruitful task for future research. Finally, the research focuses on a specific type of instrumental business service and it cannot be guaranteed that the results and conclusions can be generalized to other service types. Thus, another possible line of future research would be to conduct similar studies of other instrumental services to determine whether it is possible to extrapolate the conclusions reached here to instrumental services as a whole.

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Appendix A: Measurement model evaluation

Figure 1: Conceptual Model

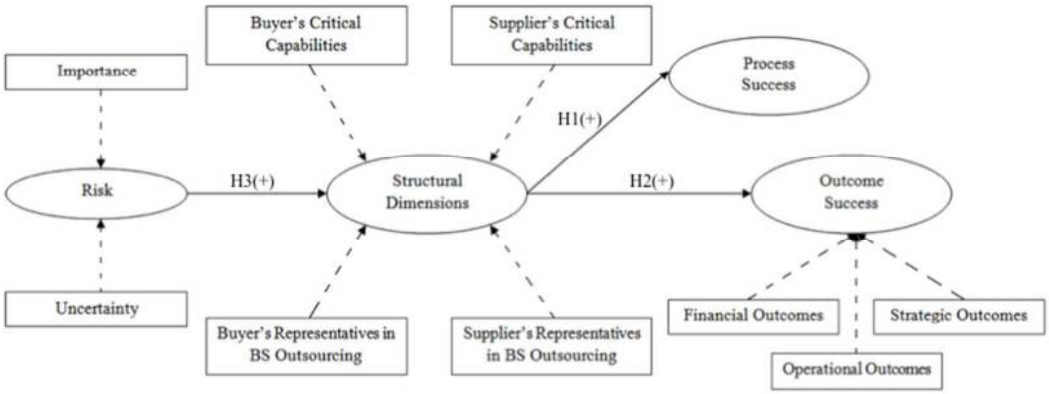
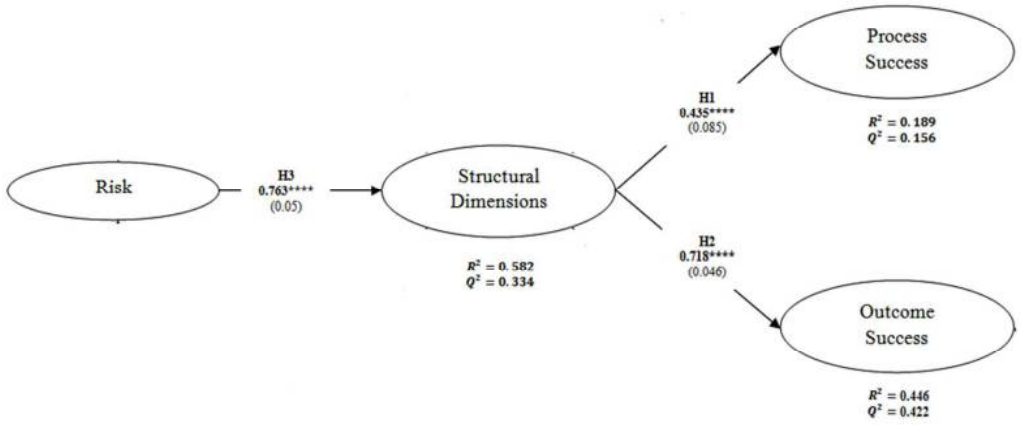


Figure 2: PLS-SEM results



Notes: The arrows → are hypothesized relationships linking constructs in ellipses otherwise they reflect conceptual relationships. Bold values may be path coefficients for hypothesized relationships or weights for conceptual relationships. Values in brackets are standard errors. Significance levels are given by the following rule for p-values: ****p<0.001. R^2 reflects the predictive power for every endogenous construct while Q^2 reflects the predictive relevance.

Table I: Relational antecedents in logistics services outsourcing

	Yang *et al.* (2016)	Huo *et al.* (2015)	Gligor and Holcomb (2013)	Lai *et al.* (2012)	Wallenburg *et al.* (2011)	Hofenk *et al.* (2011)	Tiant *et al.*, (2010)	Hofer *et al.* (2009)	Tiant *et al.*, (2008)	Knemeyer *et al.* (2003)	Moore and Cunningham (1999)
Solidarity	x			x							
Information exchange	x			x							
Flexibility	x			x							
Dependence		x						x		x	
Commitment		x			x	x	x		x	x	X
Personal relationships			x								
Trust				x	x	x	x	x	x	x	X
Uncertainty	x			x							
Relationship quality				x							
Co-operation								x			
Communication										x	
Reciprocity										x	
Equity											x

Table II: Companies sorted by Country and Sector

	Sector				
Country	**Electronic**	**Machinery**	**Automotive**	**Total**	**Percentage**
Scandinavia	8	8	6	22	23.66%
Germany	6	10	7	23	24.73%
Italy	6	16	5	27	29.03%
Spain	7	7	7	21	22.58%
Total	27	41	25	93	100.00%

***Note**: Scandinavia group plants in Sweden and Finland together in the HPM survey as representative countries of said geographical area due to their similar features.*

Appendix A: Measurement model evaluation

Construct/Dimension/indicator		VIF	Weight
Structural dimensions			
Buyer's Representatives		**1.24**	**0.338*** **
Please indicate the extent to which representatives from the following areas in your plant are involved in transportation services outsourcing. (1=Not at all, 5=Highly involved)			
BTBSOX01	Upstream supply chain management (e.g., buyer specialists, purchasing manager, materials manager, etc.)	1.06	
BTBSOX02	Downstream supply chain management (e.g., sales manager, materials manager, etc.)	1.23	
BTBSOX03	Production/operations management	1.05	
BTBSOX04	Marketing	1.22	
Supplier's Representatives		**2.3**	**0.16**
Please indicate the extent to which representatives from the following areas of your transportation suppliers participate in the services provided to your plant. (1=Not at all, 5=Highly involved)			
BTSINX01	Marketing	1.2	
BTSINX02	Production/operations management	1.39	
BTSINX03	Downstream supply chain management (e.g., sales manager, materials manager, etc.)	1.62	
BTSINX04	Service specialists	1.38	
Buyer's Critical Capabilities		**2.27**	**0.542****
To what extent does your plant have each of the following capabilities? (1=Not at all, 5=To a very great extent)			
BTINTN01	Communicating the demands of our external customers to our providers of transportation services.	1.96	
BTINTN02	Optimizing the fit between our operations and those of our suppliers of transportation services.	1.84	
BTINTN03	Specifying desired changes to our suppliers of transportation services.	2.52	
BTINTN04	Communicating our plant's needs to our suppliers of transportation services.	3.41	
BTINTN05	Tracking user satisfaction associated with transportation services.	1.67	
Supplier's Critical Capabilities		**1.68**	**0.224****
Please indicate the extent to which your transportation services providers have each of the following capabilities. (1=Not at all, 5=To a very great extent)			
BTCRTN01	Production capabilities	2.1	
BTCRTN02	Development capabilities	2.9	
BTCRTN03	Innovation capabilities	3.3	
BTCRTN04	Process design capabilities	1.87	
BTCRTN05	Adaptation capabilities	1.95	
BTCRTN06	Quality capabilities	1.87	
Buyer-Percibed Risk			
Importance		**1.1**	**0.382****
Please indicate your opinion about the following statements. (1=strongly disagree, 5=strongly agree)			

Construct/Dimension/indicator		VIF	Weight
BTIMPN01	The amount that we spend on transportation services is high, compared with the amount spent on other purchases.	1.02	
BTIMPN02	Transportation services are important for the satisfaction of our customers.	1.39	
BTIMPN03	Transportation services are important for the continuation of our daily operations.	1.51	
BTIMPN04	Transportation services are important because of regulations imposed on our company.	1.1	
Uncertainty		**1.1**	**0.816******
Complexity		**1.17**	**0.730******
Please indicate the extent to which your outsourced transportation services… (1=Not at all, 5=To a very great extent)			
BTCLXN01	Are highly specialized, in terms of their content	1.83	
BTCLXN02	Are highly customized	1.73	
BTCLXN03	Have characteristics that are nearly impossible to evaluate	1.08	
BTCLXN04	Require integration with existing processes and systems	1.2	
BTCLXN05	Require the involvement of our customers	1.13	
Novelty		**1.17**	**0.459******
Please indicate the extent to which your plant has previous experience with the following: (1=Not at all, 5=To a very great extent)			
BTNOVN01	Using transportation services.	1.81	
BTNOVN02	Integrating transportation services with our plant's operations.	1.54	
BTNOVN03	Purchasing transportation services.	1.73	
BTNOVN04	Evaluating transportation services.	1.41	
Outcome success			
Strategic Outcomes		**2.37**	**0.123**
Please indicate your opinion on the extent to which your providers of transportation services have achieved each of the following outcomes for your plant. (1=Not at all, 5=To a very great extent)			
BTOTCX02	Innovative ideas	1.49	
BTOTCX08	Stronger focus on our core competencies	1.33	
BTOTCX10	Access to state-of-the-art techniques and expertise	1.69	
Operational Outcomes		**1.99**	**0.616******
Please indicate your opinion on the extent to which your providers of transportation services have achieved each of the following outcomes for your plant. (1=Not at all, 5=To a very great extent)			
BTOTCX04	High perceived quality of our products	1.28	
BTOTCX05	Greater manufacturing flexibility	1.81	
BTOTCX06	Reduced delivery time	2.17	
BTOTCX07	Better service to our customers	2.01	
Financial Outcomes		**1.87**	**0.396****
Please indicate your opinion on the extent to which your providers of transportation services have achieved each of the following outcomes for your plant. (1=Not at all, 5=To a very great extent)			
BTOTCX01	Value creation	1.36	
BTOTCX03	Cost savings	1.37	
BTOTCX09	Improved return on assets	1.53	

Construct/Dimension/indicator		VIF	Weight
Process Success		**1**	**1**
Please indicate your opinion on the following statements. (1=strongly disagree, 5=strongly agree)			
BTSUCN01	Our suppliers of transportation services meet the targets agreed upon in the service agreement.	2.19	
BTSUCN02	Critical issues are satisfactorily resolved by our suppliers of transportation services.	1.79	
BTSUCN03	Managing our suppliers of transportation services in their daily operations requires more effort than we had expected.	1.28	
BTSUCN04	Our suppliers of transportation services understand what we expect.	2.91	
BTSUCN05	Collaboration with our suppliers of transportation services is satisfactory.	3.16	
BTSUCN06	Our suppliers of transportation services provide us with the competencies that we require.	3.23	
BTSUCN07	Communication between our plant and our supplier is effective.	1.63	