Estimating the national logistics outsourcing market size:
A multi-method approach and an application to the Italian context

Prataviera, L.B. [a], Tappia, E. [a], Perotti, S. [a], Perego, A. [a]

[a] Department of Management, Economics and Industrial Engineering, Politecnico di Milano, Milan, Italy

Abstract

Purpose – Today logistics is an ever-growing multi-billion-dollar business, and logistics operations have been increasingly outsourced to specialised players. The intended aim of this paper is to offer a multi-method approach for estimating the size of the national logistics outsourcing market by building upon financial-reporting data of Logistics Service Providers (LSPs).

Design/methodology/approach – The proposed approach is structured into four steps, clustered around two main stages: *framework setting and data collection,* and *processing.* A combination of methods is offered, including a review of academic literature and secondary sources, focus groups, interviews, and data extractions from national databases.

Findings – The proposed approach is meant to be replicable in different countries, thus allowing for comparison among markets. With reference to a specific country and year, the following outputs are provided: market size in terms of the number of players and generated turnover – total and split by LSP type –, and market concentration measures. A practical application of the proposed approach to a specific context, i.e. Italy is finally offered.

Originality/value – The study focuses on the logistics outsourcing market and considers financial-reporting data from LSPs, avoiding the need for introducing assumptions about the value of logistics operations for shippers. The proposed approach can contribute to strengthening the accuracy of LSPs' market analyses, and supporting the development of national policies by local governments. The adoption of multiple methods brings rigor and reliability to the study. Finally, high flexibility is ensured, as the method may be adaptable over time to cope with future changes in the logistics landscape.

Paper type: Research paper

Introduction

To date, logistics is an ever-growing multi-billion-dollar business in almost all countries worldwide, with national expenditures accounting for around 10% of GDP (Solakivi *et al.*, 2018; Langley and Infosys, 2019). To face the increasing complexity of supply chains, companies have progressively perceived logistics outsourcing as a strategic choice, looking for the most efficient and flexible means for moving products (Marasco, 2008; Aguezzoul, 2014). Consequently, the outsourcing level of logistics operations to Logistics Service Providers (LSPs) has increased in recent years (Marchet *et al.*, 2017). The overall logistics outsourcing market generated revenues of 869 billion US$ globally in 2017 (Langley and Infosys, 2019), and it is expected to increase in the next years (BCI, 2020).

The logistics outsourcing industry also presents evolutionary trends driven by the rapidly evolving business landscape (Akbari, 2018; Mathauer and Hofmann, 2019). The scope of logistics outsourcing has broadened from the execution of single logistics services to value-added and advanced services, such as secondary assembly or customer service management (Marasco, 2008; Selviaridis and Norrman, 2015). Different types of LSPs exist, mainly based on the logistics activities they offer and the relationship with shippers (Skjoett-Larsen, 2000; Perego *et al.*, 2011). Moreover, global economic uncertainty put further pressure on the industry, and the growing list of services needed by shippers also offers opportunities for new entrants in the LSP market such as online retailers like Amazon (Marchet *et al.*, 2017).

Such transformation has considerably raised the attention towards the logistics outsourcing industry, whose complexity in terms of types of players and activities requires appropriate measurement methods (Wallenburg *et al.*, 2010; Langley and Infosys, 2019). Such methods can help evaluate and monitor the state of logistics outsourcing on a national level and among different countries, to evaluate and target policy efforts over time and across countries by governments and public institutions (Rantasila and Ojala, 2015), For instance, logistics outsourcing value could affect infrastructure investments that, in turn, may bolster countries' competitiveness and attractiveness for foreign investments (Solakivi *et al.*, 2013). This appears even more valuable to keep up with current market evolution, supporting also market analyses by both LSPs and shippers (Rodrigues *et al.*, 2005).

Heretofore, few studies have addressed the estimation of the national logistics expenditure in different countries, particularly in the case of logistics outsourcing. Previous studies are characterised by heterogeneous methodological approaches (statistics-, survey-, or case-based), offering estimations in terms of percentage of shippers' turnover, the share of GDP, or absolute costs (Rantasila and Ojala, 2012). Statistics-based approaches combine data from different statistical sources (e.g. national accounts, or industrial and commercial databases) to determine logistics costs (Rantasila and Ojala, 2015). However, they strongly depend on LSPs' industrial classification, and this does not always match with the real nature of operations (Engblom *et al.*, 2012). On the other hand, survey-based approaches assess logistics costs from self-reported company data that can be collected from shippers or LSPs (Havenga, 2015), but definitions and research methods are not

standardised, thus making findings uncomparable (Rantasila and Ojala, 2015). Furthermore, other studies have been developed by consultancy companies, which mostly adopt a global perspective without being tailored to specific countries and types of LSPs (e.g. PwC, 2016; Kearney, 2017). While one-dimensional methods have been acknowledged as presenting relevant drawbacks when investigating logistics costs or market size estimation (Engblom *et al.*, 2012; Rantasila and Ojala, 2015), multi-method approaches have been increasingly recommended (Sanders and Wagner, 2011) and developed (Solakivi et al., 2018; Langley and Infosys, 2019). Recently, Solakivi *et al.* (2018) offered a rigorous multi-method approach to estimate the national logistics market size (both in-house and outsourced). However, their approach is based on a shippers' perspective, and assumptions are required about both the logistics costs to turnover ratio and the percentage of the logistics costs outsourced to LSPs.

Given these premises, the purpose of this paper is to offer an original approach to estimate the national logistics outsourcing market size, in terms of both the number of operating companies and related turnover, considering not only the overall market but also splitting the results by type of player. To address this objective, a multi-method approach that builds upon LSPs' financial-reporting data extracted from national commercial databases is adopted. It also includes a review of academic literature and secondary sources, focus groups, and interviews. As the proposed method can be applied to any country, to increase the practical relevance of the study an example of application is also offered with respect to a specific country, i.e. Italy.

The remainder of the paper is structured as follows. The next section summarises the related literature, followed by the research question formulation. The proposed approach and its application to the Italian context are then described. Lastly, discussion and conclusions are presented, as well as limitations and suggestions for further research.

Related literature

Logistics outsourcing industry

Since the end of the 20ᵗʰ century, logistics outsourcing has received considerable attention from logistics scholars (van Laarhoven *et al.*, 2000; Wilding and Juriado, 2004; Aguezzoul, 2014). Various studies have been developed upon the number of activities to be outsourced, the integration of different activities by LSPs, and their involvement in planning/management activities (Razzaque and Sheng, 1998; Marasco, 2008; Akbari, 2018).

A difference between single-activity offerings and advanced services exists (Lieb *et al.*, 1993; Selviaridis and Spring, 2007). The former usually include transport or warehousing activities (Bottani and Rizzi, 2006; Marchet *et al.*, 2017). The latter refers to the provision of management- and information-oriented logistics value-added services, such as secondary assembly, IT services, tracking and tracing, and customer service management (Andersson and Norrman, 2002; Selviaridis and Norrman, 2015). Due to the wide variety of logistics activities to be (potentially) outsourced, different types of LSPs exist (Berglund *et al.*, 1999; Skjoett-Larsen, 2000), including structured Third Party Logistics providers (3PLs), road carriers (truckload or less than truckload), warehousing service providers, couriers and express couriers, freight forwarders, rail and sea carriers, and multi-modal

transport operators (MTOs) (Marasco, 2008; Marchet *et al.*, 2009). 3PLs, freight forwarders, and MTOs have also been categorised as logistics system integrators, being able to orchestrate activities performed by third parties under their guidance and supervision (Perego *et al.*, 2011).

Methods for quantifying the logistics outsourcing market

In recent years the number of academic studies related to measuring logistics costs or national-level logistics performance has progressively increased (Rantasila and Ojala, 2015). Table I provides a summary of the approaches for estimating logistics market size. For a broader overview, refer to Rantasila and Ojala (2012; 2015).

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Table_I
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Logistics market size estimations have been provided according to three main output metrics, i.e. percentage of shippers' turnover, the share of GDP, or absolute costs (Rantasila and Ojala, 2012). Previous studies can be classified according to the methodological approach adopted (statistics-, survey-, or case-based), geographical coverage (national or global) and the thematic broadness (single or multiple themes) (Engblom *et al.*, 2012; Rantasila and Ojala, 2015).

Statistics-based approaches combine data from different statistical sources (e.g. national accounts, or industrial and commercial databases). They propose models to determine logistics costs as either a share of GDP or an absolute value (Engblom *et al.*, 2012). For instance, a method to estimate logistics expenditures for the global economy has been developed, relying on macro-economic data as inputs to feed an econometric model that determines the ratio between national logistics expenditure and GDP (Bowersox *et al.*, 2003; Rodrigues *et al.*, 2005). Nevertheless, the availability and reliability of input data can be critical to correctly estimate the national market size, especially for what concerns developing countries (Rantasila and Ojala, 2012). Another statistics-based study is the one provided by the European Commission (2015), which retrieved financial-reporting data from the Eurostat database to elaborate estimations based upon LSPs' turnover. That study used the statistical classification of economic activities in the European Community (NACE) to extract data and categorise the different types of LSPs (Eurostat, 2008). NACE classification provides a complete framework for collecting and presenting a large range of statistical data. However, NACE classification codes might not be correct, thus leaving out (or improperly including) a relevant portion of logistics operations and potentially involving undercounting, erroneous counting, or overestimation of companies and the related turnover (Solakivi *et al.*, 2018).

Survey-based approaches assess logistics costs from self-reported company data that can be collected from shippers or LSPs (Havenga, 2015; Rantasila and Ojala, 2015). For instance, Engblom *et al.* (2012) assessed logistics costs as a percentage of turnover, considering a sample of 241 Finnish manufacturing and trading companies. However, this kind of assessment might not be representative of an entire population, and low reliability might be driven by aspects such as sample

size, sampling techniques, and the clarity of the questionnaire (Solakivi *et al.*, 2018). Moreover, logistics spans a diverse range of activities, and definitions of logistics costs are many and vary considerably for different shippers (Rantasila and Ojala, 2012).

Lastly, case-based studies have been developed in countries where statistical data were not available, and questionnaires could not be employed due to the challenges of collecting responses (Engblom *et al.*, 2012).

Looking at the geographical coverage, many research institutions and consultancy companies conducted both national and global logistics studies (Rantasila and Ojala, 2012). Rantasila and Ojala (2015) provided a review of the previous literature, highlighting that most studies discussed logistics issues in the context of a single country. Many high-income countries' governments aggregated logistics costs using national accounts data (Rantasila and Ojala, 2012). However, these studies are often contradictory because of the different definitions, measurement techniques, and research methodologies adopted (Rantasila and Ojala, 2015; Solakivi *et al.* 2018).

Finally, looking at the thematic broadness of logistics cost research, a distinction exists between single-theme and multi-theme studies. Many studies discussed several topics in the same research but barely focused on stand-alone logistics outsourcing (Rantasila and Ojala, 2015). Previous contributions mainly focused on questions like 'What logistics activities have been outsourced?', or 'To what extent have logistics functions been outsourced?' (Solakivi *et al.*, 2013; p. 389). Few studies addressed the quantification of the logistics outsourcing phenomenon and, in that case, they included both in-house and outsourced operations.

Solakivi *et al.* (2018) recently offered a multi-method approach to quantify the logistics market at a national level in Finland. The authors combined firm-level survey data with financial-reporting data extracted from the Orbis database developed by Bureau van Dijk, and with official statistics from the Finnish government. Solakivi *et al.* (2018) started by estimating the shippers' overall national turnover and assessed the average logistics cost to revenue ratio. Through a survey submitted to the top 100 largest Finnish manufacturing and trading companies, they then determined the percentage of the logistics costs outsourced to LSPs, and thus the value of the logistics outsourcing market. Besides, consultancy reports have been proposed (e.g. Langley and Infosys, 2019). They were mainly developed as multi-method studies, combining survey-based data with financial-reporting data collected from commercial databases. However, such studies mostly adopted a global perspective, not being able to grasp the entire picture at a national level or consider different types of LSPs. More importantly, they do not offer any common research methodology, thus acting as "black boxes" that make replication difficult in other settings (Rantasila and Ojala, 2015; Solakivi *et al.*, 2018).

Research design

The literature review highlighted that one-dimensional methods present some drawbacks when investigating logistics costs or market size estimation (Engblom *et al.*, 2012; Rantasila and Ojala, 2015). A multi-method approach involving practitioners was thus developed. On the one hand, the proposed approach considers LSPs' financial-reporting data as done by the European Commission

(2015). On the other hand, it integrates such data with a review of academic literature and secondary sources, including data extractions from national databases. Data triangulation (e.g. with primary data collected through interviews) further improves trustworthiness with respect to specific companies. More importantly, focus groups involving industry experts are recommended to corroborate and support the choice of the types of companies to be considered, as well as to further validate results and include original viewpoints.

Multi-method approaches have been increasingly recommended to address contemporary supply chain issues (Wieland *et al.*, 2016). They create complementarity that adds richness to problem understanding and enhances the reliability of findings (Sanders and Wagner, 2011). Sharing research steps and results with practitioners also contributes to disseminating the research in a way that is understandable and applicable in practice (Thomas *et al.*, 2011), thus preventing from being "lost before translation" or "lost in translation" (Stentoft and Rajkumar, 2018).

In this study, rigor pertained to methodological robustness, as the different steps of the proposed approach (e.g. the use of given databases, or the conduction of focus groups) have been supported by the previous literature. Where the latter failed to provide any support, rigor was pursued by validating steps with experts from the industry. This helped increase the study relevance, as it pertains to the usefulness of specific research for both theory and practice (Sanders and Wagner, 2011). Moreover, to further improve practical relevance, the proposed approach was applied to the Italian context as an example. The Italian logistics outsourcing industry as an application arena is interesting for several factors. First, Italy is one of the European countries with the highest traffic volumes, with freight transport over 50 km amounting to 125 billion tons-km/year in 2018 (Ministero delle Infrastrutture e dei Trasporti, 2020). Second, forecasts suggest a further increase in logistics activities in the next few years. For instance, a rising request for logistics facilities has been highlighted, as well as a boost of e-Commerce operations has been experienced whereas last-mile operations are usually outsourced (Marchet *et al.*, 2018). Lastly, Italy results particularly challenging and interesting due to its strong market fragmentation, with multiple levels of sub-contracting and a myriad of small and medium companies (Perotti *et al.*, 2012).

A multi-method approach to estimate the size of the national logistics outsourcing market
The proposed approach (Figure 1) is structured into four steps, clustered around two main stages, i.e. *framework setting and data collection*, and *processing*. The steps include: (1) the identification of the company categories operating in the logistics outsourcing market; (2) the development of a database for limited liability companies (LLCs); (3) the development of a database for general partnerships; (4) data consolidation and visualisation. In line with the study's purpose, it allows for estimating the number of companies operating in the logistics outsourcing market, classifying them, and estimating the value of the national outsourcing market. Results are provided in terms of aggregated data and for each category of LSPs, and considering a specific country and year.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Figure_1

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

STEP 1: Identification of the company categories operating in the logistics outsourcing market

First, a review of the existing literature and secondary sources is recommended to identify the types of companies operating in the logistics outsourcing market. This also allows for gathering additional information on the current status and the recent evolution of the phenomenon worldwide.

Then, focus groups (Morgan, 1998) are to be conducted with a two-fold aim: (1) ratify the types of companies to be considered within the analysis, and (2) determine appropriate criteria to associate companies to the different categories. Focus groups are recommended as they can represent a quite systematic process for reaching a consensus on a complex topic (Krueger, 1998). They allow for taking into account the practitioners' perspective enabling methodological triangulation that improves research credibility (New and Payne, 1995; Sanchez-Rodrigues *et al.*, 2010). Furthermore, they allow for moving beyond just academic conversations, merging the academic vocabulary with the current practice terminology (Stentoft and Rajkumar, 2018). With reference to the LSP industry, focus groups have been previously used by other scholars (e.g. Halldórsson *et al.* 2010; Sweeney *et al.*, 2018), being "a supportive method to achieve industrial relevance without compromising academic rigour" (Sanchez-Rodrigues *et al.*, 2010; p. 76).

Consistently with Krueger (1998), each focus group session should have between 6 and 12 participants, to be selected according to the specific research purpose and based on two criteria: experience in the LSP industry (i.e. working in a company operating in the logistics outsourcing value chain for a number of years); and, representation of different viewpoints (i.e. they should be professionals working for different types of LSPs). Overall, group composition should reflect the mix of expertise required for the research purposes, and a right balance between similarities and differences within the group members is suggested (Krueger, 1998; Sanchez-Rodrigues *et al.*, 2010). To categorise the different types of companies, the use of the NACE classification is proposed (Eurostat, 2008). NACE provides the framework for collecting and presenting a large range of statistical data according to economic activities in the fields of economic statistics (e.g. production, employment, and national accounts) and other statistical domains developed within the European Statistical System. It allows for gathering comparable and harmonised data for any country within the European Union, but it is also part of an integrated system of statistical classifications developed by the United Nations Statistical Commission (UNSTAT), thus offering significant opportunities to link European results to those gathered worldwide (Eurostat, 2008; p. 13-14). In more detail, NACE is derived from the United Nations' International Standard Industrial Classification of all Economic Activities (ISIC), having the same items at the highest levels where NACE is more detailed at lower levels. NACE consists of a hierarchical structure, thus enabling data collection at various levels of aggregation. The first level consists of headings identified by an alphabetical code (sections), followed by a second level identified by a two-digit numerical code (divisions), a third level identified by a three-digit numerical code (groups), and a fourth level identified by a four-digit numerical code (classes).

For instance, transport and storage activities are classified under section code H (first level), including division code (second level) from 49 to 53. Focusing on the division code 49 ("Land transport and transport via pipelines"), further distinctions exist between the two group code (third level) 49.2 ("Freight rail transport") and 49.4 ("Freight transport by road and removal services"). In turn, group code 49.4 can be split into class codes (fourth level) 49.41 ("Freight transport by road") and 49.42 ("Removal services").

In line with previous contributions (e.g. European Commission, 2015), the following division codes can represent the basis for the focus group discussion:

- 49 (Land transport and transport via pipelines)
- 50 (Water transport)
- 51 (Air transport)
- 52 (Warehousing and support activities for transport)
- 53 (Postal and courier activities)

It should be noted that NACE does not provide *per se* categories for specific types of companies. If a company performs more economic activities described into different NACE categories, it is classified according to its principal activity, i.e. the activity that contributes most to the value added by the company itself. Please refer to NACE Regulation (Eurostat, 2008; p. 27-29) for further details. The key role of the focus group is to encourage an open discussion to select the appropriate NACE codes to be associated with each LSP category, and share some techniques to speed up verification procedures. Appropriate keywords and strings can thus be defined to be looked for within company names. For instance, the strings "transp" or "truck" might identify road carriers; "express", "deliver*" or "courier" might identify couriers; "ship*" or "internat*" might identify freight forwarders; "rail" might identify MTOs; "sea" might identify sea carriers and "air" might identify air carriers. Lastly, the focus group can be also useful to discuss and share national peculiarities that might require additional sources of information and specific analyses.

STEP 2: Development of a database for LLCs

STEP 2.1: Data extraction from Bureau Van Dijk databases and LSPs classification

Starting from the NACE categories emerged from Step 1, the list of companies belonging to such categories and the related financial data can be then extracted from Bureau Van Dijk (https://www.bvdinfo.com) databases. Bureau Van Dijk is a major publisher of business information that offers a wide range of databases, covering a large number of countries worldwide. Its product range combines data from regulatory and other sources, including 160 information providers and allowing users for manipulating data referring to LLCs. In the field of logistics, it has been used to collect structured financial data about large companies' samples systematically and rigorously (e.g. Solakivi *et al.*, 2018; Marchet *et al.*, 2018).

The list of information to be extracted is provided in Appendix A, taking into account the last available year. To allow for further longitudinal analysis, data referring to previous years could be also extracted. It should be noted that only companies with a registered office within the country

can be found in the database. Any inactive company (i.e. with the variable "legal status" marked as "dissolved" or "in liquidation") should be removed. As regards the remaining companies, classification should take place separately for each NACE code, identified at a class level (the stricter one) according to what is agreed within the focus groups.

STEP 2.2: Data triangulation and interviews with LSPs

This stage is aimed to help pinpoint the picture of the logistics outsourcing market by removing not relevant companies, checking their turnover and classification into categories, and consolidating turnover for groups of companies.

As claimed in Step 1, the classification according to only NACE codes associated with a given company might be misleading. Therefore, a manual one-by-one check is required by triangulating financial and balance sheet data from Bureau van Dijk databases, and information developed in the previous steps (e.g. LSPs classification) with company websites, industry reports, newspapers, etc. For this purpose, the keywords and strings identified during the focus groups can be used to check and eventually rectify companies' classification. In case of high ambiguity, it could be appropriate to carry out direct interviews with these companies. Interviews can be carried out following the approach proposed by Voss *et al.* (2002). The researchers should guarantee anonymity to each interviewee. The interviews should also be transcribed, and the data collected should be fact-checked by interviewees for final approval.

To reduce the overall effort required, it is suggested to conduct the interviews only for those companies with relevant turnover (e.g. large companies, characterised by yearly turnover higher than 50 € millions).

STEP 3: Development of a database for general partnerships

Bureau van Dijk databases include LLCs, but not general partnerships. Nevertheless, the logistics industry is characterised by strong fragmentation, and the multiple levels of sub-contracting in place entails that a myriad of small and medium companies exists (Ballou, 2007). This is true in particular with respect to transport activities, where the business landscape is plenty of small road carriers that are organised as general partnerships instead of LLCs (Langley and Infosys, 2019). Therefore, the development of a database for general partnerships requires a different method.

STEP 3.1: Data Extraction from the National Register of Road Carriers

To estimate the number and turnover of road carriers (general partnerships), consulting the National Registers or Road Carriers is recommended as they are usually considered by European governments to monitor road carriers. Data to be extracted from these Registers refer to road carriers organised as both LLCs and general partnerships. The latter can be distinguished from the former by excluding the list of road carriers (LLCs) developed in Step 2.

STEP 3.2: Road carriers' turnover estimation

The estimation of the turnover of road carriers (general partnerships) requires additional data and sources, as National Registers do not usually provide full financial data. The following inputs are required:

- Composition of the vehicle fleet in the country operating on behalf of third parties, in terms of light lorries (weight lower than 3.5 tons), medium lorries (weight between 3.5 and 9 tons), heavy lorries (weight higher than 9 tons), and tractor-trailers and b-trains;
- Average turnover per type of vehicle.

Once these data have been collected through secondary sources (e.g. reports developed by National Authorities), the turnover of road carriers (both LLCs and general partnerships) can be obtained by multiplying the average turnover for each type of vehicle times the number of the vehicles of the given type in the country. Then, the estimation of the turnover of road carriers (general partnerships) can be computed as the difference between the total turnover of road carriers and the turnover of road carriers (LLCs) as an output of Step 2.2.

STEP 4: Data consolidation and visualisation

Once completed the previous steps, individual data extracted from different databases can be aggregated into categories, according to the types of LSPs identified in Step 1. The following outputs can be displayed through graphs and tables: total number of LSPs, and overall value of the national logistics outsourcing market; the number of companies, and related turnover, for each LSP category; and Pareto analysis to display the market concentration.

Application of the proposed approach to the Italian market

STEP 1.1: Identification of the company categories operating in the logistics outsourcing market

To classify the different types of LSPs, the previous academic literature was reviewed along with secondary sources. The classification proposed by Marchet *et al.* (2009) has been selected as the most complete to summarise the main types of companies operating in the logistics outsourcing market.

To validate this classification, seven focus groups were conducted, six with 12 participants and one with 11. These focus groups lasted approximately three hours each and took place in the period from February 2019 to January 2020. Each session was recorded and transcribed, and data were collected into short reports which were shared with participants for final approval.

The research team was led by two full professors, among whom one also played the role of moderator and facilitator within the discussions, and included one associate professor, one assistant professor, and four researchers with a more-than-5-years' experience within the logistics field. A pool of 83 experts from 58 LSPs operating in the Italian outsourcing logistics market was involved, including Managing Directors (29%), Business Development Directors (43%), and Marketing Directors (28%) with a thorough knowledge of the industry in Italy. Following the guidelines previously proposed, experts were selected based on: (1) experience in the LSP industry (i.e. working

in a company operating in the logistics outsourcing value chain, and more than 10 years' experience in the logistics outsourcing industry), (2) representation of different viewpoints, i.e. working for different types of LSPs. Personal e-mail invitations were sent out including information about the research project. Participants were then allocated to a specific focus group according to their availability to attend. Participants were mostly known to the research team, and this helped create a constructive environment and increase the willingness to share personal views.

During focus groups, participants initially discussed the types of LSPs that emerged from the literature review. All the experts agreed about the types of LSPs identified. Furthermore, they proposed to apply additional measures to better estimate the market size and to reduce the required effort. Such measures were in line with what was proposed by the European Commission (2015). First, they suggested excluding sea and air carriers from the analysis, because of the operational complexity related to splitting the turnover generated by freight versus passengers' transport, and that such turnover can be generated mostly abroad, thus not contributing to the national market value. Instead, for the other LSPs the assumption was that turnover was predominantly collected in Italy, yet having the opportunity to clean raw data by triangulating with secondary sources. Second, they proposed to take into account only a percentage of the turnover yielded by warehousing service providers, as they often perform not only activities in the logistics industry, but also others related to facility management or cleaning activities.

Participants were also asked to select the appropriate categories to be associated with the types of LSPs starting from the NACE classification. The proposed NACE division codes pertaining to transport and storage activities (i.e. codes from 49 to 53) were found to be appropriate by the pool of experts for the purposes of the present research. Such codes also included systems integrators as 3PLs and freight forwarders, and LSPs offering value-added services such as tracking and tracing, or customer service management. Moreover, they suggested the inclusion of additional NACE codes that were initially excluded from the analysis:

(i)   class code 70.22 ("Business and other management consultancy activities"), as some LSPs may also offer consultancy services related to logistics strategy and operations;

(ii)   division code 77 ("Rental and leasing activities"), as some LSPs classify themselves as companies offering the equipment leasing (e.g. transport equipment);

(iii)   class code 81.20 ("Cleaning activities"), because some warehousing service providers may originate a significant percentage of their turnover from cleaning operations.

To assign LSPs to the most appropriate category, focus group participants associated every NACE code (at a class level) to the corresponding type of LSP. When a given level of the classification (e.g. the division code) is not further detailed, the NACE classification uses a "0" in the code position for the next levels. For example, a company belonging to division code 49 ("Land transport and transport via pipelines") was assigned to class code 49.00. Results are reported in Table II.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
Table_II
XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

To check and improve LSPs' classification, keywords or strings to be identified within company names were also defined during the focus groups. The following terms (mostly in Italian) were considered: "trasp", "transp", "autot", "truck" for road carriers; "express", "delivery", "post", "espres", "courier", "corrier" for couriers; "ship", "sped", "internaz", "internat" for freight forwarders; "rail", "ferro" for MTOs; "sea", "mare" for sea carriers; "air", "aereo" for air carriers; "logi AND coop", "log AND coop", "logi AND consorzio", "logi AND servizi", "deposit" for warehousing service providers; "logistic", "log" for 3PLs.

Lastly, during the focus group, the additional elements required for the estimation of the number and turnover of road carriers (general partnerships) were discussed, including the composition of the vehicles' fleet in the country and the average turnover per type of vehicle (as per Step 3.2).

STEP 2.1: Data Extraction from Bureau Van Dijk databases and LSPs classification

In Italy, the Bureau van Dijk database collecting financial data about Italian companies is called AIDA (Analisi Informatizzata Delle Aziende Italiane). AIDA contains comprehensive information about all the LLCs with a registered office in Italy, with up to ten years of history. The list of variables in Appendix A was extracted for all companies belonging to NACE class codes identified during the focus groups. Data were retrieved in January 2020. Due to the temporal lag between the accounting closing date and the year when data are extracted, the most recent available data referred to the fiscal year 2018. Overall, 166,427 companies were extracted from AIDA. Then, 74,323 inactive companies (dissolved or in liquidation) were removed, and 92,104 LLCs remained.

STEP 2.2: Data triangulation and interviews with LSPs

The 92,104 companies resulting from Step 2.1 were then classified according to corresponding NACE class codes selected within the focus groups. To avoid any potential mistakes, all the extracted companies were checked by triangulating data from AIDA with industry reports, company websites, and newspapers. For instance, one of the largest Italian couriers was associated to 49.41 NACE code ("Freight transport by road") and wrongly classified as a road carrier. Given the high number of companies, having defined during the focus groups keywords to be identified within company names helped accelerate the process.

Data triangulation allowed for:
- Identifying what part of a company's overall turnover is actually due to logistics outsourcing. This was specifically recommended by focus groups' experts for large enterprises (with annual turnover higher than 50 € millions).
- Identifying consolidated turnover for companies belonging to the same group, when the variable "Consolidation description" reported the existence of consolidated financial statements.
- Identifying companies offering logistics outsourcing services that have not been previously extracted, due to their incorrect NACE codes.

- Excluding companies not offering logistics services (e.g. those performing facility management or cleaning activities).
- Excluding companies with null turnover, with the variable "incorporation year" included in the last two years.
- Excluding companies whose variable "Accounting closing date (latest available year)" is equal to four years before or even earlier, despite being active according to the legal status.

155 semi-structured interviews (average duration: 30 minutes) were conducted with all the identified LSPs with 2018 turnover higher than 50 € millions. Some of the interviewees were included within the participants of the focus groups. Others were further included, selected among both the network community of the research team and the personal contacts of focus groups' participants. Most of the interviewees were Managing Directors or C-level employees. In few cases, Sales Managers or Customer Service Managers answered the proposed questions on behalf of their companies. Lastly, all the collected data were condensed and sent back to key informants for fact-checking and accuracy verification. At the end of this step, 22.240 LLCs were identified as LSPs and classified within one of the previously introduced categories. Following the recommendations provided by focus groups, 558 sea carriers and 42 air carriers were excluded from the analysis. As a result, 21.640 companies remained.

STEP 3.1: Data extraction from the National Register of Road Carriers

Focus group participants recommended extracting data from the Italian National Register of Road Carriers to estimate the number of road carriers and the related turnover. Considering the fiscal year 2018, 80,981 road carriers (both LLCs and general partnerships) were overall identified. Given both this figure and the number of road carriers organised as LLCs (13,312), as emerged from Step 2.2, the number of carriers (general partnerships) was then computed as 67,669.

STEP 3.2: Road carriers' turnover estimation

The most recent available study about the composition of the Italian vehicle fleet was a report developed by the Italian General Confederation of Transport and Logistics (CONFETRA) in 2006. The number of overall vehicles in the country in 2018 was retrieved from the Motor Vehicle National Department website. Having the focus group confirmed the current validity of the statistical distribution of the different types of vehicles as reported by CONFETRA in 2006, the 2018 vehicle fleet composition in terms of light lorries (weight lower than 3.5 tons), medium lorries (weight between 3.5 and 9 tons), heavy lorries (weight higher than 9 tons), and tractor-trailers and b-trains was determined. During the focus groups, average turnovers generated by each type of vehicle were estimated. Consequently, the overall turnover of road carriers was obtained. Finally, the estimation of the turnover of road carriers (general partnerships: 15,653 € millions) was computed as the difference between the total turnover of road carriers (41,954 € millions) and the turnover of road carriers (LLCs: 26,301 € millions), as extracted by AIDA in Step 2.1 and furtherly elaborated in Step 2.2.

STEP 4: Data consolidation and visualisation

Data extracted from AIDA were then processed and the individual turnovers aggregated according to the types of LSPs identified in Step 1. As summarised in Table III, regarding the 2018 Italian logistics outsourcing market, it was possible to estimate: (1) the overall number of companies (89,309 companies), (2) the overall value of the market (84,774 € millions in 2018), and for each type of LSPs identified (3) the number of companies and (4) the related turnover.

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

Table_III

XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX

More in detail, the results illustrate the importance of each type of LSP in terms of the overall number of companies and turnover. The majority of players offer transport services and include different types of LSPs, mainly road carriers (approximately 90%) and couriers (around 1%). Among road carriers, more than 80% are organised as general partnerships, thus confirming the considerable market fragmentation and the high number of small and medium companies offering transport services in Italy (Marchet *et al.*, 2017). In terms of turnover, LSPs offering transport services account for almost 60%. In particular, a remarkable percentage is generated by couriers (8%), which highlights the importance of parcel flows (Marchet *et al.*, 2018). Logistics system integrators (i.e. 3PLs, freight forwarders, and MTOs) account for less than 5% in terms of the number of companies but for more than 30% in terms of turnover, as these players can take advantage of direct relationships with shippers to whom they can offer value-added services (Perego *et al.*, 2011). Warehousing service providers represent the 5% in terms of number and about the 10% in terms of turnover, thus suggesting the use of multiple levels of sub-contracting also for warehousing activities, as highlighted by Perotti *et al.* (2011). Finally, market concentration was investigated through a Pareto analysis. Although the high number of LSPs entails market fragmentation, the analysis shows a very concentrated market in terms of turnover. Indeed, only 35 companies (0.04%) generates approximately 20% of the overall market turnover, and around 13% of the LSPs represents around 80% of the market value.

Discussion

This study combines the advantages of previous approaches to estimate the logistics outsourcing market. For this purpose, the approach proposed in this study elaborates financial-reporting data of LSPs. However, when considering only financial-reporting data some criticalities exist (e.g. European Commission, 2015). As such, in line with recent contributions (e.g. Havenga, 2015; Solakivi *et al.*, 2018) a multi-method approach is offered, as it brings along multiple advantages.

First, the extraction of such data from well-established commercial databases as Bureau van Dijk guarantees their reliability. Then, data triangulation (e.g. with primary data collected through interviews) further improves trustworthiness. Moreover, in line with Solakivi *et al.* (2018), multiple

data sources were adopted. For instance, most road carriers are organised as general partnerships instead of LLCs (Langley and Infosys, 2019), thus being excluded from Bureau van Dijk databases. Therefore, the development of a specific database for general partnerships is proposed. This also improves the coverage of the road carriers with respect to the public study by the European Commission (2015), which only considered data from Eurostat.

More importantly, the recourse to focus groups is proposed due to multiple reasons, with the intent of improving the existing approaches, including the one by the European Commission (2015). First, to corroborate and support the choice of the types of companies to be considered. Second, to help determine appropriate criteria to associate companies to the different categories (e.g. NACE codes to be associated with each LSP category). Third, to define techniques to speed up verification procedures that can improve the study's reliability while preserving its manageability. Indeed, a review of the association between each company and the corresponding LSP category is recommended. This review can be performed according to the procedures and keywords shared within the focus groups, which help streamline and accelerate the verification process.

Moreover, this study considers the entire population of LSPs in a given country and suggests performing manual one-by-one examinations of LSPs' classification by triangulating different data sources. It is suggested to carry out interviews only with those LSPs with yearly turnover higher than €50M, and this bias toward large companies might be a concern. However, given that the analysis and results are aggregated on the main industry or national-economy level, the wide coverage could be considered a strength (Solakivi *et al.*, 2018).

As concerns previous contributions in the field, the most recent is the one offered by Solakivi *et al.* (2018). However, they focused on the overall logistics market size (with both in-house and outsourced services included) and did not provide a specific approach for extrapolating the outsourcing logistics market *per se*. Their approach is also based on a shippers' perspective, and assumptions are required about both the logistics costs to turnover ratio and the percentage of the logistics costs outsourced to LSPs. Such assumptions are estimated on a sample basis, and this could be debatable as such percentages may change according to the specific industry being considered (Langley and Infoysis, 2019). Given the ambiguity in the definitions and boundaries of logistics costs, self-reporting surveys always include subjective data, whose aggregation may lead to introducing significant errors due to approximation (Rantasila and Ojala, 2012). Moreover, shippers often struggle to determine the costs related to logistics outsourcing (Solakivi *et al.*, 2013). Differently from Solakivi *et al.* (2018), this study directly adopts an LSPs' perspective. Thus, it overcomes any ambiguity about shippers' logistics costs definition, or the need for any assumption about the average incidence of logistics costs to turnover ratio and the average percentage of outsourced logistics costs. Also, this study not only considers the market as a whole but also specifically contemplates the different types of LSPs.

In the light of the challenges related to measuring logistics market size with NACE codes, including the identification of different types of LSPs, focus groups help improve classification and introduce corrective measures to draw the best picture of the business landscape. With respect to the contribution offered by the European Commission (2015), the proposed multi-method approach

allows for improving raw data trustworthiness and precision. Moreover, that study split turnover by types of LSPs only considering NACE codes, while the approach proposed in this study categorises LSPs not only according to NACE codes but also introducing types of LSPs supported by the literature (Marchet et al., 2009). Additionally, it allows for considering other NACE codes than those exclusively related to transport and warehousing activities. Focus groups can thus allow for promptly update the multi-method approach to cope with the evolution of the competitive scenario. For instance, logistics system integrators can orchestrate activities performed by third parties under their supervision, but their conceptualisation is challenging (Perego *et al.*, 2011). Focus groups can help discuss evolution in the logistics industry, and cope with the need for including specific types of LSPs. For example, this study first considered NACE division codes from 49 to 53, related to transport and warehousing. In the application to the Italian market, the inclusion of additional codes was recommended, and this improved the study's completeness. The same could occur with future applications, both in a longitudinal perspective or in different empirical contexts. The growth of e-commerce challenged most of the previous distribution models, and this could have relevant implications to shape the logistics scenario of the future (Langley and Infosys, 2019). For instance, new types of LSPs or new categories might deserve to be included, as LSPs increasingly offer value-added services such as tracking and tracing, or customer service management (Selviaridis and Norrman, 2015). Nevertheless, thanks to focus groups such players/categories might be identified and discussed, along with the corresponding NACE codes.

Conclusions

In recent years, multi-method approaches have been increasingly recommended (Sanders and Wagner, 2011), and developed (Solakivi *et al.*, 2018; Langley and Infosys, 2019) to address contemporary supply chain issues. This study offers a rigorous multi-method approach for estimating the size of national logistics outsourcing markets, both in terms of the number of companies and overall value. Also, the proposed approach specifically contemplates the different types of LSPs. It builds upon LSPs' financial-reporting data, then integrating them with a review of academic literature and secondary sources, focus groups, interviews, and data extractions from national databases.

Both academic and practical implications stemming from this contribution can be highlighted. From an academic viewpoint, this study offers a replicable approach for the outsourcing logistics market quantification, improving what was proposed by previous studies. To guarantee rigour, the different steps have been supported by the previous literature and validated with experts from the industry, whose involvement also improved the accuracy of the market size estimation. Replicability is also ensured since all the steps are explained in detail and an example of its application is provided. This can stimulate further research on the logistics outsourcing research area, allowing for comparisons among different countries. The proposed approach could thus be applied not only for European countries but for any other country worldwide. Although NACE classification has been developed at the European level, it is also included in the international integrated system of economic classifications based on UNSTAT guidelines. This guarantees the comparability at a global level of

statistics produced based on NACE (Eurostat, 2008; p. 13); for further operational details, please refer to Eurostat (2008; p. 41).

Taking into account the practitioners' standpoint allows for going beyond purely academic conversations, thus increasing its practical relevance. The application of the proposed multi-method approach could be helpful to keep up with current market developments. In particular, it can be used to strengthen the accuracy of LSPs' market analyses (e.g. business plan development, or benchmarking analyses). It can also support the development of national policies by governments, to better shape interventions and measures in line with the current industry requirements. For instance, knowing the number of companies, and for each type of LSP, along with the related turnover can help quantify the logistics relevance in a given country. Moreover, it can provide results that catalyze the attention from public authorities and private investors. For instance, in case of high MTOs turnover, policies by authorities could address the development of intermodal infrastructures and services. In case of an increase in the number and turnover of express couriers, related urban logistics sustainability concerns could raise policy-makers' attention and promote appropriate analysis and action plans.

Despite the academic implications and practical relevance, some limitations should be acknowledged. As the main drawback, the proposed method can be time-consuming because of the effort to collect and analyse data. Considering restricted time resources, the use of NACE classification and the related codes is proposed, thereby trying to balance input and yield. LSPs characterised by other NACE codes than those selected in the analysis might be excluded. However, they can be manually added, or the correspondent NACE codes can be discussed during focus groups to be possibly included. Further limitations could also relate to the potential subjectivity bias deriving from the selection of focus group participants. However, those limitations can be minimised by strictly following literature-based focus group methodological guidelines. Besides, whenever the future logistics industry evolution could require additional elements to be included, these could be rapidly introduced in future applications of this multi-method approach, broadening data extraction with new appropriate NACE codes.

Future researches could integrate this study with the one by Solakivi *et al.* (2018), to simultaneously consider the shippers' and the LSPs' perspectives and further improve the estimation of the value of both in-house and outsourced logistics operations. Other interesting research directions could involve an in-depth investigation of the context-related variables affecting the size of this industry and the shipper's logistics outsourcing decisions. The proposed multi-method approach could also be applied over a certain timeframe, thus enabling a longitudinal analysis to quantitatively scrutinize variables affecting the industry size and the shipper's logistics outsourcing decisions. For instance, it could be helpful to investigate the impact on the logistics outsourcing market size due to the tremendous shock introduced by the Covid-19 pandemic.

References

Aguezzoul, A. (2014), "Third-party logistics selection problem: a literature review on criteria and methods", *Omega*, Vol. 49, pp.69-78.

Akbari, M. (2018), "Logistics outsourcing: a structured literature review", *Benchmarking: An International Journal*, Vol. 25 No. 5, pp.1548-1580.

Andersson, D. and Norrman, A. (2002), "Procurement of logistics services—Minutes work or a multi-year project?", *European Journal of Purchasing & Supply Management*, Vol. 8 No. 1, pp.3–14.

Kearney, A.T. (2017), CSCMP's 28th Annual State of Logistics Report.

Ballou, R.H. (2007), "The evolution and future of logistics and supply chain management". *European Business Review*, Vol. 19 No. 4, pp.332-348.

BCI (2020), "Covid-19: The Future of Supply Chains", available at: https://www.thebci.org/resource/covid19--the-future-of-supply-chain.html (accessed 27 October 2020).

Berglund, M., van Laarhoven, P., Sharman, G. and Wandel, S. (1999), "Third-party logistics: Is there a future?", *The International Journal of Logistics Management*, Vol. 10 No. 1, pp.59–70.

Bottani, E. and Rizzi, A. (2006), "A fuzzy TOPSIS methodology to support outsourcing of logistics services", *Supply Chain Management: An International Journal*, Vol. 11 No. 4, pp.294-308.

Bowersox, D. J., Calantone, R. J. and Rodrigues, A. M. (2003), "Estimation of global logistics expenditures using neural networks". *Journal of Business Logistics*, Vol. 24 No. 2, pp.21-36.

Engblom, J., Solakivi, T., Töyli, J. and Ojala, L. (2012), "Multiple-method analysis of logistics costs", *International Journal of Production Economics*, Vol. 137 No. 1, pp.29-35.

European Commission (2015), "Fact-finding studies in support of the development of an EU strategy for freight transport logistics", Lot 1: Analysis of the EU Logistics Sector.

Eurostat (2008), "NACE rev.2 – Statistical classification of economic activities in the European Community", available at: https://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF (accessed 27 October 2019).

Halldórsson, Á., Kovács, G., Sanchez-Rodrigues, V., Potter, A. and Naim, M. (2010), "The impact of logistics uncertainty on sustainable transport operations", *International Journal of Physical Distribution and Logistics Management*, Vol. 40 No. 1/2, pp.61-83.

Havenga, J. H. (2015), "Macro-logistics and externality cost trends in South Africa–underscoring the sustainability imperative", *International Journal of Logistics Research and Applications*, Vol. 18 No. 2, pp.118-139.

Krueger, R.A. (1998), *Focus groups. A practical guide for applied research*, *2nd ed.*, Sage, London (UK).

Langley, J. and Infosys (2019), *23rd Annual Third-Party Logistics Study: The State of Logistics Outsourcing*, Georgia Institute of Technology, Atlanta, GA.

Lieb, R.C., Millen, R.A. and Van Wassenhove, L.N. (1993), "Third-party logistics services: A comparison of experienced American and European manufacturers", *International Journal of Physical Distribution & Logistics Management*, Vol. 23 No. 6, pp.35–45.

Marasco, A. (2008), "Third-party logistics: A literature review", *International Journal of Production Economics*, Vol. 113 No. 1, pp.127-147.

Marchet, G., Perego, A. and Perotti, S. (2009), "An exploratory study of ICT adoption in the Italian freight transportation industry", *International Journal of Physical Distribution & Logistics Management*, Vol. 39 No. 9, pp.785-812.

Marchet, G., Melacini, M., Perotti, S., Sassi, C. and Tappia, E. (2017), "Value creation models in the 3PL industry: what 3PL providers do to cope with shipper requirements", *International Journal of Physical Distribution & Logistics Management*, Vol. 47 No. 6, pp.472-494.

Marchet, G., Melacini, M., Perotti, S., Rasini, M. and Tappia, E. (2018), "Business logistics models in omni-channel: a classification framework and empirical analysis", *International Journal of Physical Distribution & Logistics Management*, Vol. 48 No. 4, pp. 436-464.

Mathauer, M. and Hofmann, E. (2019), "Technology adoption by logistics service providers", *International Journal of Physical Distribution & Logistics Management*, Vol. 49 No. 4, pp.416-434.

Ministero delle Infrastrutture e dei Trasporti (2020), *Conto Nazionale delle Infrastrutture e dei Trasporti: Anni 2018-2019*, Istituto Poligrafico e Zecca dello Stato, Roma (Italy).

Morgan D.L. (1998), *Focus Group as Qualitative Research*, Sage Publications, Newbury Park, CA.

New, S. and Payne, P. (1995), "Research frameworks in logistics: three models, seven dinners and a survey", *International Journal of Physical Distribution & Logistics Management*, Vol. 25 No. 10, pp.60-77.

Perego, A., Perotti, S. and Mangiaracina, R. (2011), "ICT for logistics and freight transportation: a literature review and research agenda", *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 5, pp.457-483.

Perotti, S., Zorzini, M., Cagno, E. and Micheli, G.J. (2012), "Green supply chain practices and company performance: the case of 3PLs in Italy". *International Journal of Physical Distribution & Logistics Management,* Vol. 42 No. 7, pp.640-672.

PwC (2016), "Shifting patterns: the future of the logistics industry", available at: https://www.pwc.com/gx/en/industries/transportation-logistics/publications/the-future-of-the-logistics-industry.html (accessed 18 February 2020).

Rantasila, K. and Ojala, L. (2012),"Measurement of national-level logistics costs and performance", International Transport Forum Discussion Paper, No. 2012-4, Organisation for Economic Co-operation and Development (OECD), International Transport Forum.

Rantasila, K. and Ojala, L. (2015), "National-level logistics costs: an overview of extant research", *International Journal of Logistics Research and Applications*, Vol. 18 No. 4, pp.313-324.

Razzaque, M.A. and Sheng, C.C. (1998), "Outsourcing of logistics functions: a literature survey", *International Journal of Physical Distribution and Logistics Management*, Vol. 28 No. 2, pp.89–107.

Rodrigues, A.M., Bowersox, D.J. and Calantone, R.J. (2005), "Estimation of global and national logistics expenditures: 2002 data update", *Journal of Business Logistics*, Vol. 26 No. 2, pp.1-16.

Sanchez-Rodrigues, V., Piecyk, M., Potter, A., McKinnon, A., Naim, M. and Edwards, J. (2010), "Assessing the application of focus groups as a method for collecting data in logistics". *International Journal of Logistics: Research and Applications*, Vol. 13 No. 1, pp.75-94.

Sanders, N.R. and Wagner, S.M. (2011), "Multidisciplinary and multimethod research for addressing contemporary supply chain challenges", *Journal of Business Logistics,* Vol. 32 No. 4, pp.317-323.

Selviaridis, K. and Spring, M. (2007), "Third party logistics: a literature review and research agenda", *The International Journal of Logistics Management*, Vol. 18 No. 1, pp.125-150.

Selviaridis, K. and Norrman, A. (2015), "Performance-based contracting for advanced logistics services: Challenges in its adoption, design and management", *International Journal of Physical Distribution & Logistics Management,* Vol. 45 No. 6, pp.592-617.

Skjoett-Larsen, T. (2000), "Third party logistics—From an Interorganizational point of view", *International Journal of Physical Distribution & Logistics Management*, Vol. 30 No. 2, pp.112–127.

Solakivi, T., Töyli, J. and Ojala, L. (2013), "Logistics outsourcing, its motives and the level of logistics costs in manufacturing and trading companies operating in Finland", *Production Planning & Control*, Vol. 24 No. 4/5, pp.388-398.

Solakivi, T., Ojala, L., Lorentz, H., Töyli, J. and Laari, S. (2018), "Estimating the size of the national logistics market: A method to include both market-based demand and in-house services", *International Journal of Physical Distribution & Logistics Management*, Vol. 48 No. 5, pp.488-503.

Stentoft, J. and Rajkumar, C. (2018), "Balancing theoretical and practical relevance in supply chain management research", *International Journal of Physical Distribution & Logistics Management*, Vol. 48 No. 5, pp.504-523.

Sweeney, E., Grant, D. and Mangan, D. (2018), "Strategic adoption of logistics and supply chain management", *International Journal of Operations & Production Management*, Vol. 38 No. 3, pp.852-873.

Thomas, R.W., Defee, C.C., Randall, W.S. and Williams, B. (2011), "Assessing the managerial relevance of contemporary supply chain management research", *International Journal of Physical Distribution & Logistics Management*, Vol. 41 No. 7, pp.655-667.

Van Laarhoven, P., Berglund, M., and Peters, M. (2000), "Third party logistics in Europe – five years after", *International Journal of Physical Distribution & Logistics Management*, Vol. 30 No. 5, pp.425–442.

Voss, C., Tsikriktsis, N. and Frohlich, M. (2002), "Case research in operations management", *International Journal of Operations & Production Management*, Vol. 22 No. 2, pp.195-219.

Wallenburg, C.M., Knemeyer, A. M., Goldsby, T. J. and Cahill, D. L. (2010), "Developing a scale for proactive improvement within logistics outsourcing relationships", *The International Journal of Logistics Management*, Vol. 21 No. 1, pp.5-21.

Wieland, A., Handfield, R.B. and Durach, C.F. (2016), "Mapping the landscape of future research themes in supply chain management", *Journal of Business Logistics*, Vol. 37 No. 3, pp. 205-212.

Wilding, R. and Juriado, R. (2004), "Customer perceptions on logistics outsourcing in the European consumer goods industry", *International Journal of Physical Distribution & Logistics Management*, Vol. 34 No. 8, pp.628-644.

Reference	Type of approach	Data sources used	Adopted perspective	Proposed approach	Geographical coverage	Thematic broadness	Focus on logistics outsourcing	Split by types of LSPs
Bowersox et al. (2003)	Statistics-based	Macro-economic data (total GDP, government-sector production, industrial-sector production and the total trade ratio)	n.a.	Development of an econometric model (ANN) to determine logistics expenditure as a share of GDP	National and global	Single-theme	no	no
Rodrigues et al. (2005)	Statistics-based	Macro-economic data (total GDP, government-sector production, industrial-sector production and the total trade ratio)	n.a.	Development of an econometric model (ANN) to determine logistics expenditure as a share of GDP	National and global	Single-theme	no	no
Engblom et al. (2012)	Survey-based	Firms' data (turnover, numbers of employees, industry, and percentage incidence of logistics costs)	Shippers	Assessment of logistics expenditure as a share of turnover	National (Finland)	Multi-theme	no	no
European Commission (2015)	Statistics-based	Financial-reporting data from Eurostat database	LSPs	Sum of the extracted data at firm level to determine logistics expenditure as an absolute value, and the number of LSPs	National and European	Multi-theme	yes	yes (only considering NACE codes)
Havenga (2015)	Multi-method	Survey-based data, and official government statistics	Shippers	Development of an analytical model to assess logistics expenditure as an absolute value	National (South Africa)	Multi-theme	no	no
Solakivi et al. (2018)	Multi-method	Survey-based data, and official government statistics	Shippers	Development of a multi-method approach that first considers logistics expenditure as a share of turnover at firm level, and then determines logistics expenditure as an absolute value	National (general, and Finland)	Multi-theme	yes (not exclusive)	no
Langley and Infosys (2019)	Multi-method	Survey-based data, and financial-reporting data from commercial databases	Shippers and LSPs	Development of a multi-method approach to determine logistics expenditure as an absolute value	Global	Multi-theme	yes	no

Table I - Summary of main approaches about logistics outsourcing market size estimation

Type of LSP	NACE class codes associated
Road carriers (LLCs)	49.00, 49.10, 49.41, 77.00
Road carriers (general partnerships)	n.a.
Couriers and express couriers	49.00, 49.41, 53.00, 53.10, 53.20
Intermodal terminal operators	49.20, 52.21
Warehousing service providers	52.00, 52.10, 52.20, 52.24, 81.20
Multi-modal transport operators (MTOs)	49.20, 49.41, 52.21
3PLs	49.00, 49.10, 49.41, 52.10, 52.24, 70.22, 77.00
Freight Forwarders	49.41, 52.22, 52.23, 52.29
Sea carriers	50.00, 50.20, 50.40, 52.22
Air carriers	51.00, 51.21, 52.23

Table II – Application results: NACE class codes associated to each LSP's type

Type of LSP	Number of companies	Number of companies (%)	Turnover (2018) - € millions	Turnover (2018) - € millions (%)	Average turnover for company - € millions
Road carriers (LLCs)	13,312	14.9%	26,301	31.0%	1.98
Road carriers (general partnerships)	67,669	75.8%	15,653	18.5%	0.23
Couriers and express couriers	734	0.8%	6,757	8.0%	9.21
Intermodal terminal operators	79	0.1%	654	0.8%	8.28
Warehousing service providers	4,377	4.9%	7,998	9.4%	1.83
Multi-modal transport operators (MTOs)	39	0.1%	1,437	1.7%	36.85
3PLs	913	1.0%	10,775	12.7%	11.80
Freight Forwarders	2,186	2.3%	15,199	17.9%	6.95
Total	89,309	100%	84,774	100%	0.95

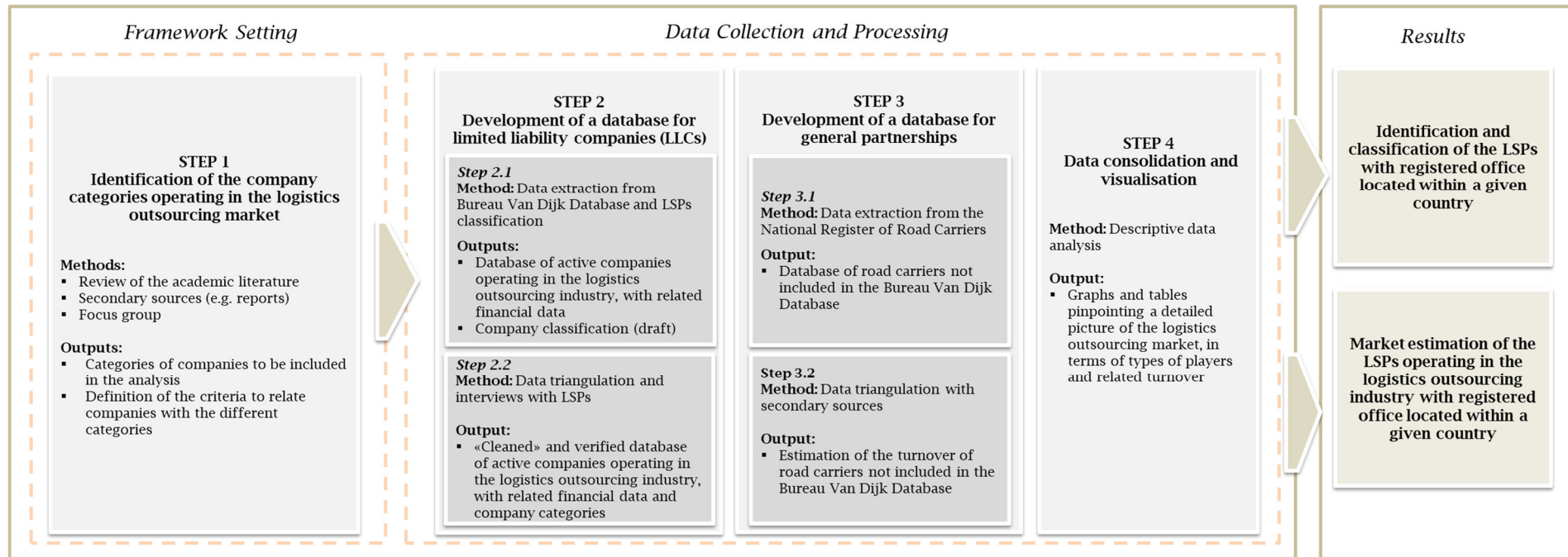**Table III** – Application results: summary of LSPs in terms of number and related turnover

Figure 1 – Proposed multi-method approach to estimate the size of the national logistics outsourcing market

Appendix A

Variables to be extracted from Bureau Van Dijk database	Scope and justification for the inclusion
Company name	Company identification
Company identification number	To associate an univocal code to each company, avoiding double counting
Registered office address	To triangulate data, and to check the existence of a registered office within the considered country
Incorporation year	To triangulate data and to help determine whether the company is active or dissolved
Tax code number	To triangulate data
VAT number	To triangulate data
Legal status	To determine whether the company is active or dissolved
Accounting closing date (latest available year)	To triangulate data and to help determine whether the company is active or dissolved
Consolidation description	To check the consolidated turnover for groups
NACE rev 2 code	To assign a company to a given category of LSPs
Turnover from sales and services	To estimate company's turnover

Table A.I – Variables to be extracted from Bureau Van Dijk database