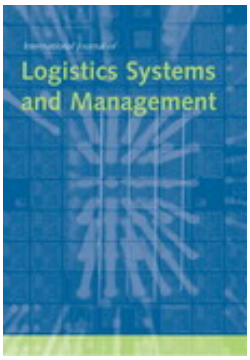

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Logistics service system: review, case study, and framework

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Logistics service system: review, case study, and framework

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Abstract: More and more companies are outsourcing their logistics services to logistics service providers (LSPs). Many such companies request customised solutions, which can be highly resource-demanding for an LSP to accommodate. To minimise such costs, LSPs could apply a systematic approach to define and optimise their services, namely, a logistics service system (LSS) framework. The literature on this topic is, however, sparse. This study uses existing studies to describe different LSS-related research areas, which are used to conduct a case study of a large LSP firm resulting in an LSS framework. The LSS framework highlights the connections between the different aspects of an LSS. It adds a logistics service platform and logistics service management, allowing an organisation to operate efficiently. It contributes to the field of logistics services by offering a practical framework to facilitate the implementation of an LSS to improve the competitive advantage of an LSP.

Keywords: logistics service providers; LSPs; logistics service framework; digitalisation; supply chain management; logistics service system; LSS.

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1 Introduction

More and more companies are outsourcing their logistics services to a logistics service provider (LSP). This increased outsourcing has been a positive development for LSPs. However, an organisation's structure often needs to be prepared to handle increased complexity and higher customer expectations (Wallenburg, 2009). Today, LSPs' customers have new requirements, for example, the constant tracking of orders and customised packaging or to know the level of CO_2 emissions at every stage of the supply chain (Premkumar et al., 2021). The LSP industry has yet to address these new challenges. Many companies request product-specific services that fit their particular needs, which often require customised solutions because of limited resources. However, offering such customised solutions can be highly resource-demanding for an LSP. Thus, to minimise such costs, LSPs can apply a systematic approach to define, sell, and perform their services, that is, a logistics service system (LSS) framework.

Despite the relevance of LSSs to LSPs and to some manufacturing firms, as shown by the systematic literature review conducted in the present study, there are no detailed definitions of the concept, although it is mentioned in several papers. The conceptualisation of LSSs is, however, highly relevant. Several characteristics of the logistics service industry render an LSS framework necessary, including complexity,

digitisation, automation, and competitive advantage. The increased complexity of the services offered in the logistics industry makes it essential to be agile and structured in implementing complex services in an LSP organisation. Experts argue that technology has tremendous potential to benefit complex services; thus, new technology needs to be implemented in a structured manner throughout an organisation (Wallenburg, 2009). It has been suggested that applying a platform structure to logistics services can enable customisation based on modules (Pekkarinen and Ulkuniemi, 2008; Lin et al., 2010; Brax et al., 2017). In the service and product industry, the implementation of platform and architecture to implement modularisation is another well-documented approach (Meyer and Lehnerd, 2011; Kjærgaard, 2013; Løkkegaard et al., 2016). The second area focuses on the digitalisation of the logistics service industry. Digitalisation is essential to align (Coyle et al., 1996) with customer requirements for LSPs to connect with and integrate into customer systems and will only become more critical in the future (Cichosz et al., 2020; Kucukaltan et al., 2022). While the need to implement automated solutions in the logistics industry depends heavily on the actual industry in which the LSP is working and the products it is handling, many types of automation, ranging from drones and robots to fully automated solutions, are in the interest of most LSPs (Kucukaltan et al., 2022). Digitalisation and automation can both affect the competitive advantage of LSPs. However, the effect heavily depends on the collaboration between the different parts of the organisation on the decision to adopt and implement new innovative areas, such as digitalisation and automation, to improve the service offerings. In conclusion, LSPs need to adopt a more systematic approach to meet customer requirements and secure a competitive advantage (Karia, 2018).

The present study offers a coherent framework for an LSS, fostering a shared comprehension of what constitutes an LSS and how to facilitate its development in the industry and the literature. The development of the LSS framework involves using the existing literature to construct an understanding of the research topics within the LSS. We conducted a case study of a large LSP firm to develop an LSS framework. The framework highlights the most relevant aspects of an LSS and adds a logistics service platform and logistics service management as important elements within the LSS to ensure an LSP's competitive advantage in the fast-changing logistics service industry.

Logistics services have evolved since the 1960s, progressing from first party logistics (1PL) to fifth party logistics (5PL), showcasing the ability to offer services at various levels (Hosie et al., 2012). This paper uses LSP as a general term for the industry that offers logistics services to customers with products that need, as a minimum, transportation and warehousing. It should also be noted that the rapid implementation of different types of technology is changing both possibilities and expectations in the logistics service industry (Kucukaltan et al., 2022; Nour, 2022; Da Silva et al., 2023). The connections between different organisational departments are critical for new technology to work efficiently (Da Silva et al., 2023). This paper focuses on the organisational perspective of providing logistics services as a system.

The remainder of the paper is organised as follows. First, the literature review brings forward the available research related to LSS. Second, a case study is conducted to understand an LSP's view of the possibilities of improving its service offering through a system approach. The findings provide a framework that can be applied in the industry. Based on the framework, a definition of LSS is presented. The discussion and conclusion evaluate the potential, relevance, and limitations of an LSS framework.

2 Literature review

The literature comprehensively defines ‘logistic services’ and ‘logistic service providers’. Specifically, logistic services encompass the delivery of products and may also involve adding value to the product within this process (Mentzer et al., 2001). Meanwhile, experts define LSPs as entities that perform logistics functions on behalf of their clients (Negri et al., 2017). However, the initial search did not yield detailed definitions of a ‘logistic service system’. A search conducted in Clarivate Analytics’ Web of Science (WoS) and Elsevier’s Scopus databases using the term ‘LSS’ generated 95 articles. When duplicates were removed, 73 articles were available in June 2023. Although the term ‘logistic service system’ is used in various contexts, only some articles provide a sound or concrete definition of it. The earliest article dates to 1974, but the next was not written until 2002. Notably, 88% of the articles have been published since 2009.

As an example of the lack of a detailed definition of LSS in the literature, the 1974 paper describes an LSS as:

> “Basically, a logistic service system which is characterized by stochastic demand within a geographically defined territory in which one desires to minimize costs of resource allocation subject to some predefined level of customer population satisfaction (such as the operation of: a taxi fleet, an emergency ambulance service, an equipment maintenance service or a salesman deployment system).” [Dzubow, (1974), p.159]

Besides being relatively unspecific, this definition is outdated, as there is a more specific use of logistics services focusing on transportation and warehousing (Wallenburg and Lukassen, 2011). A more recent example of using the term LSS is given by Shen (2023, p.182): ‘the LSS has the problems of long time-consuming and high transportation and management costs’. The paper, however, does not provide information about the system boundaries or what it contains (Shen, 2023). Similarly, Qina et al. (2020) use the term ‘LSS’ 37 times without providing a definition. However, it indicates that an LSS refers to an IT system that controls the service platform: ‘recently, the e-commerce market has emerged with a new trend of business-to-business logistics service sharing – the platform shares its LSS with the seller’ (p.1). The findings of this literature search indicate no standard understanding of an LSS in the literature.

The lack of a sound definition of LSS indicates a missing link between the literature and the industry. Hence, it is necessary to understand what is happening in the logistics service industry and how the latter is adapting to changes to understand if a shared terminology could improve the link between research and practitioners. To delve further into this subject, we conducted a systematic literature review. To ensure the reproducibility of the review process (Elo et al., 2014), we followed four steps: collecting materials, descriptive analysis, category selection, and material evaluation (Seuring and Gold, 2012). These steps are described in the following subsections.

2.1 Material collection

Two academic search engines, WoS and Scopus, were used to gather literature. These databases were chosen for their inclusion of high-quality literature relevant to this study, namely, system engineering and logistics management. Table 1 displays the search strings used for both databases. The search strings were crafted broadly to encompass research within logistics services. However, they were restricted to articles published in

engineering and business, focusing solely on journal articles to streamline the review process.

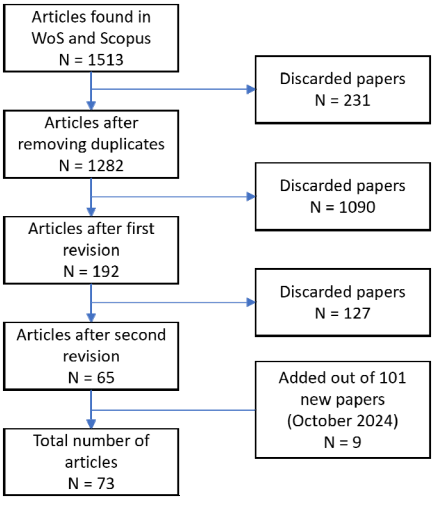
Table 1 Search strings

Database	*Search string*
WoS	(TS=('logistics service system' OR 'logistics service platform')) OR (TS=('logistics service' AND 3pl)) OR (TS=('logistics service provider')) AND (SU=('business economics' OR Engineering)) AND (LA='english') AND (DT='article' OR DT='review article')
Scopus	TITLE-ABS-KEY ('logistics service system' OR 'Logistics service platform' OR ('logistics service' AND ('3PL'OR'logistics service provider'))) AND (LIMIT-TO (SUBJAREA, 'BUSI') OR LIMIT-TO (SUBJAREA, 'ENGI')) AND (LIMIT-TO (LANGUAGE, 'English')) AND (LIMIT-TO (DOCTYPE, 're') OR LIMIT-TO (DOCTYPE, 'ar'))

Source: The authors

The search was carried out in June 2023. The search in WoS produced 413 articles, and that in Scopus yielded 1,100 articles. Combined, the two searches resulted in a total of 1,513 papers; removing 231 duplicates left 1,282 papers for review. The first review consisted of reading the titles and abstracts of the 1,282 papers and was based on the findings from the state of the art to enable a focus on those papers that would help us build on the current knowledge within LSS and logistics services and changes in the industry. The aim was to find papers that did not focus on specific problems (i.e., a single route or a single warehouse) but on the bigger perspective of LSPs operating in multiple warehouses in a changing environment with multiple customers. The first revision (i.e., title and abstract reading) removed 1,090 papers, leaving 192 papers for the second round. The second round consisted of a full read of the remaining papers to decide if they contributed to a greater understanding of the topics. After the full read, we discarded 127 papers, leaving 65 relevant papers.

Figure 1 Paper selection process (see online version for colours)



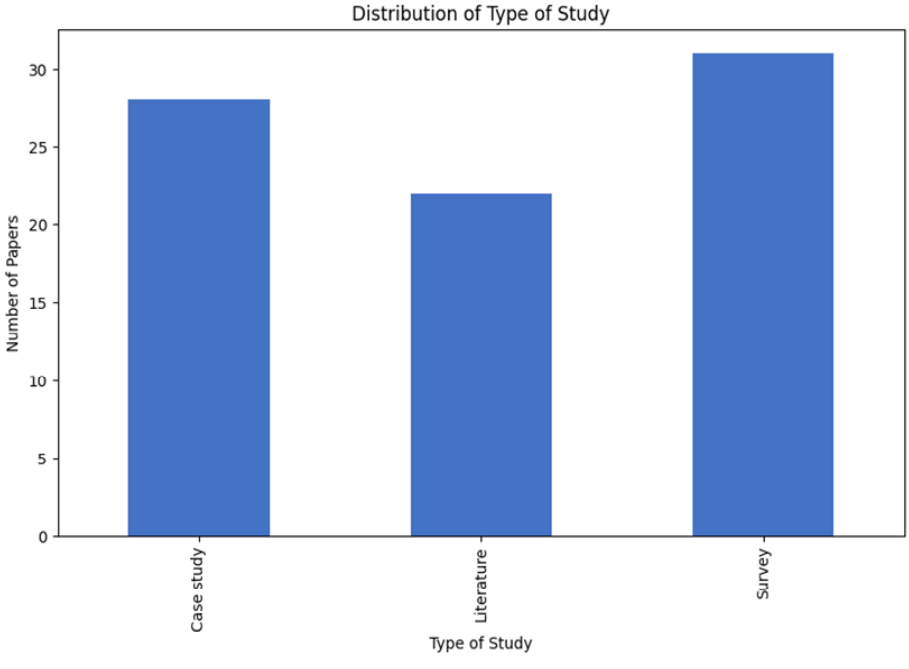
Source: The authors

In October 2024 an additional search was made with the same search strings to include relevant papers that had been published since the first search was carried out. This resulted in additionally eight papers being added to the structured literature review. A total of 73 articles were included in the literature review. Figure 1 illustrates the selection process.

2.2 Descriptive analysis

A Microsoft Excel workbook was created to list the 65 selected papers and their respective details, such as title, year of publication, author, journal, abstract, and number of citations. Additionally, the type of study was determined after the articles were read. Figure 2 illustrates the distribution of papers categorised by the study type outlined in the paper. Some papers include multiple layers for example, both a structured literature review and a case study.

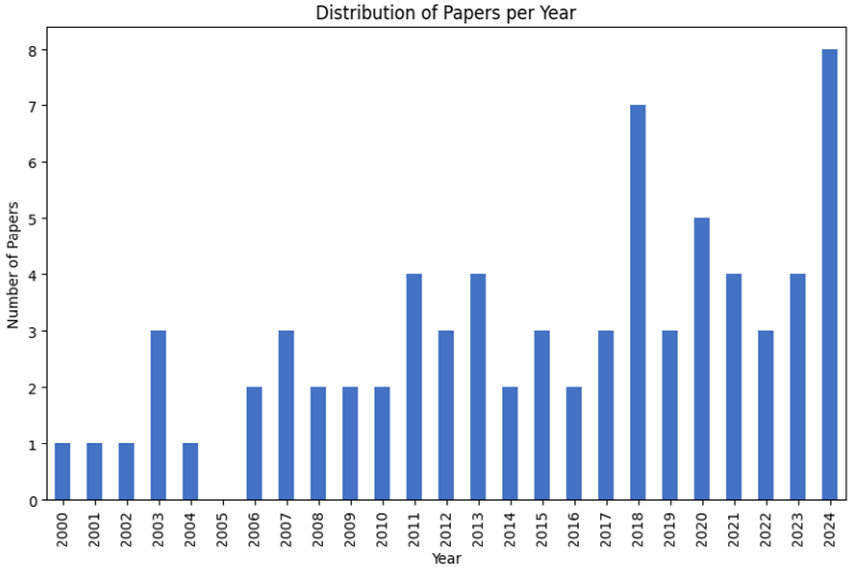
Figure 2 Distribution of type of study (see online version for colours)



Source: The authors

Figure 3 shows the distribution of papers published yearly from 2000 to 2023.

Figure 3 Distribution of papers per year (see online version for colours)



Source: The authors

Table 2 shows the number of articles per journal outlet.

Table 2 Number of articles in the journals with more than one article

Journal	*Number of articles*
International Journal of Logistics Management	11
International Journal of Physical Distribution and Logistics Management	5
International Journal of Logistics Systems and Management	4
Journal of Cleaner Production	3
Asia Pacific Journal of Marketing and Logistics	2
Business Strategy and the Environment	2
Journal of Business Logistics	2
Journal of Manufacturing Technology Management	2
Logistics Research	2
Production Planning and Control	2
Supply Chain Management	2
Transportation Research Part D: Transport and Environment	2
Transportation Research Part E: Logistics and Transportation Review	2
Other journals	32

Source: The authors

Table 3 LSS-related topics identified in the literature review

Categories	*Topics related to LSS in literature*	*Description*	*Sources*
Sustainability	Circular economy	Transforming the logistics industry into a circular economy	Jayarathna et al. (2023)
	Environmental parameters	These articles focus on the increased customer demand for specific parameters of providers' environmental performance.	Evangelista (2014), Centobelli et al. (2017), Colicchia et al. (2013), Abbasi and Nilsson (2016), Marchet et al. (2014), Venus Lun et al. (2015), Björklund and Forslund (2013, 2018), Froio and Bezerra (2021), Zailani et al. (2010), Liu et al. (2010), Wehner et al. (2021), Tran et al. (2019), Kumar et al. (2017), Shaharudin et al. (2018), Nilsson et al. (2017) and Evangelista et al. (2018)
	Triple bottom line (TBL)	Focusing on the application of the TBL: environmental, economic, and social dimensions of logistic services.	Kumar et al. (2017) and Nitisaroj and Liangrokapart (2020)
	Green initiatives	Focusing on different overall initiatives to improve the environmental impact of logistics services.	Sureeyatanapas et al. (2018), Venus Lun et al. (2015), Froio and Bezerra (2021), Björklund and Forslund (2018), Tran et al. (2019), Jayarathna et al. (2023), Kumar et al. (2017), Nitisaroj and Liangrokapart (2020) and Roy and Mohanty (2024)
Standardisation	Standardisation of service offering	Standardisation of systems and processes can have a positive impact on the service offering.	Zimon and Madzík (2020), Cabigiosu et al. (2015), Pohjosenperä et al. (2019), Tran et al. (2019) and Alkaabi (2024)
	Mass customisation of services	Mass customisation of logistics services and the products being handled can be applied by LSPs.	Van Remko (2000), Rajahonka et al. (2013) and Gupta et al. (2022)
	Modularisation of services	The ability to split services into modules and have a more standardised service offering.	Lin and Pekkarinen (2011), Cabigiosu et al. (2015), Rajahonka (2013), Pohjosenperä et al. (2019), Rajahonka et al. (2013) and Wehner et al. (2021)
	Flexibility in service offering	Flexibility in the LSP industry is important to be able to react to changes and stay competitive.	Chou et al. (2018)
Service offering	Complex logistics services	Increased complexity of logistics services to fulfil customer requirements.	Wallenburg (2009), Abbasi and Nilsson (2016), Lin and Pekkarinen (2011), Cabigiosu et al. (2015), Gunasekaran and Ngai (2004), Liu and Lai (2016), Rajahonka (2013), Rajahonka et al. (2013), Shaharudin et al. (2018), Evangelista et al. (2018) and Mutke et al. (2012)
	Value-adding services (VAS)	An LSP offering different types of 'extra' services that can add value to the product for the final customer.	Wagner (2008) and Rajahonka (2013)
IT	Digitalisation in the logistics industry	Digitalisation has advanced, and it is substantially changing the logistics service industry	Cichosz et al. (2020), Kucukaltan et al. (2022), Senthil et al. (2020), Premkumar et al. (2021) and Mvubu and Naude (2024)
	Information and communication technology (ICT)	ICT's possibilities to improve the LSP industry	Evangelista and Sweeney (2006), Centobelli et al. (2017), See (2007) and Evangelista et al. (2018)
	IT systems	The use of IT systems is influencing the performance of LSPs	Evangelista et al. (2012), Zimon and Madzík (2020), Karia (2018), Rae-Smith and Ellinger (2002), Chen and Hsiao (2008), Shen (2023), Nour (2022) and Tan et al. (2024)

Source: The authors

Table 3 LSS-related topics identified in the literature review (continued)

Categories	*Topics related to LSS in literature*	*Description*	*Sources*
Industry 4.0	Industry 4.0	An overall term for the new technology being applied in the LSP industry	Mathauer and Hofmann (2019), Nagariya et al. (2021), Karia (2018), Kucukaltan et al. (2022), Da Silva et al. (2023), Nand et al. (2023), Nour (2022), Baglio et al. (2024), Tiwong et al. (2024) and Tan et al. (2024)
	Internet of things (IoT)	IoT technology to control warehouses and communicate with customers	Wang et al. (2020), Senthil et al. (2020) and Shen (2023)
	Radio frequency identification (RFID) technology	Implementation of RFID technology in the logistics industry and its effect on performance.	Lin and Ho (2009), Zailani et al. (2010) and Senthil et al. (2020)
	Simulation of services	Application of simulation in the planning phase of logistics services to improve decision making.	Mutke et al. (2012)
Innovation	Innovation of logistics services	Innovation in the LSP industry is increasing competitive advantage and an important strategy to follow new trends.	Wagner (2008), Wallenburg (2009), Selviaridis and Spring (2007), Mathauer and Hofmann (2019), Wallenburg and Lukassen (2011), Bellingkrodt and Wallenburg (2015), Hosie et al. (2012), See (2007), Durst and Evangelista (2018), Björklund and Forslund (2018), Da Silva et al. (2023), Nand et al. (2023), Premkumar et al. (2021), (Busse and Wallenburg (2011) and Abbasi et al. (2024)
Supply chain	Collaboration in the supply chain	How different parts of the supply chain collaborate to provide logistics services.	Stefansson (2006), Panayides (2007), Wallenburg (2009), Abbasi and Nilsson (2016), Rollins et al. (2011) and Chou et al. (2018)
	Globalisation of the supply chain	The impact of the dynamics of globalisation on the LSP industry	Lemoine and Dagnæs (2003) and Hosie et al. (2012)
	Supply chain integration	The importance of integrating the different parts of the supply chain with the LSPs' systems.	Lin and Ho (2009), Evangelista et al. (2012), Bolumole (2004), Rollins et al. (2011), Björklund and Forslund (2013), Liu and Lai (2016), Hosie et al. (2012), Senthil et al. (2020), Premkumar et al. (2021) and Mutke et al. (2012)
Customers	Customer loyalty	Relationship between the LSP and the customer and their loyalty to each other.	Wallenburg and Lukassen (2011), Bellingkrodt and Wallenburg (2015), Gupta et al. (2022) and Stank et al. (2003)
	Customer needs	Increased needs of different types of customers	Sureeyatanapas et al. (2018), Wallenburg (2009), Abbasi and Nilsson (2016), Gunasekaran and Ngai (2004), Rajahonka (2013), Pohjosenperä et al. (2019), Gupta et al. (2022), Rollins et al. (2011) and Alkaabi (2024)
	E-com customers	The number of e-com customers has increased, and they are affecting the services needed in the industry.	Rae-Smith and Ellinger (2002)
Employees	Quality of human resources	Implementing complicated processes requires high-quality human resources.	Shaharudin et al. (2018)
	Employees' ability to change	The ability of the employees to adapt to new ways of working	Bolumole (2004)
Organisation	Organisational change	How organisational change is needed to follow the changing requirements in the logistics industry.	Selviaridis and Spring (2007), Persson and Virum (2001), Zailani et al. (2010), Durst and Evangelista, (2018) and Sumantri et al. (2024)

Source: The authors

2.3 Category selection

The 65 papers identified in the literature review are not all directly related to an LSS. However, these articles cover different aspects of the logistics service industry that could intersect with LSS. Summarising the identified topics related to LSS using descriptive coding enabled us to encapsulate the topics in words or short phrases (Saldaña, 2013). The categorisation of the identified topics aimed to outline the diverse research types and pinpoint the primary areas of a logistics service organisation. Table 3 presents the LSS-related topics and categories from the 65 papers.

2.4 Material evaluation

As previously mentioned, very few articles focus on the system aspect of logistics provision. A system approach to optimising products and manufacturing is well-documented (Cochran et al., 2001). Other articles argue that the service management industry has much to learn from manufacturing companies' operations management (Johnston, 1994; Bowen and Youngdahl, 1998). The logistics service industry is constantly under development, and the fast-changing environment requires a framework that enables the different parts of an organisation to react to new requirements and changes (Mentzer et al., 2001; Suvittawat, 2020). The competitive market with high customer expectations results in challenges between customers and the LSPs to align on expectations (Alkaabi, 2024). The category of standardisation includes several articles that focus on the implementation of modularisation and service platforms to create a shared understanding of what the company can offer its customers (Van Remko, 2000; Lin and Pekkarinen, 2011; Rajahonka, 2013; Rajahonka et al., 2013; Cabigiosu et al., 2015; Pohjosenperä et al., 2019). Digital transformation and Industry 4.0 are highlighted in newer literature as key components to achieving success as an LSP. However, due to the highly customised and complex nature of logistics services, it is challenging to implement these new technologies in the logistics service industry (Mvubu and Naude, 2024; Tan et al., 2024).

Our literature review revealed some references describing different areas of an LSS and general challenges in the LSP industry. However, these articles do not specify how the different topics of an LSS could be aligned in an organisation, and none of the reviewed papers offered a clear LSS framework.

3 Methodology

A case study was undertaken within an LSP to investigate the development and implementation of an LSS framework. The case study enabled a deeper understanding of how the LSS related framework can be developed and applied in the industry (Meredith, 1998; Iacono et al., 2011). This study used a single case company to develop the LSS framework, allowing for an in-depth analysis of interviews and observations with different stakeholders in the organisation (Voss et al., 2002).

3.1 Case company

The company selected is an international transportation and logistics company operating in over 80 countries. For anonymity reasons, the company is referred to as TransLog. The company employs over 75,000 employees, and its headquarters are in Denmark. This study focuses on the division operating the warehouses, and the interviews focus on the operations in Denmark. The focus aimed to restrict the project's scope and enable discussions with individuals across diverse areas of the organisation involved in operations. The people interviewed included different directors, managers, and shop-floor workers.

3.2 Research process

The case study consisted of three phases. In the first phase, we examined the company case and its perspective on providing logistics services as an LSS, which involved extensive observation of the company and mapping its commercial operations and logistics service tasks. The second phase consisted of interviews with employees at TransLog to understand their views of an LSP and to identify the essential areas of the logistics service offering with an LSS. The interviews categorised the main findings according to interview-based definitions, establishing connections between these identified categories. The third phase was to build the framework and describe the alignments between the different resources and areas of the organisation.

3.3 Data collection

Observations and semi-structured interviews with diverse individuals in the case company were carried out to gather data. To mitigate bias, two researchers from the project attended observations and interviews. The observations in phase one were made in March 2022 across six different warehouses, where various warehouse employees were observed handling interactions with 20 different customers. The observations of the processes conducted by the sales manager were collected by investigating the sales process together with the latter and having every step of the sales process for different customer types described.

Phase two consisted of 17 semi-structured interviews with five employees in the case company over six months, from January 2022 to June 2022. The sales manager participated in five interviews, which centred on the company's sales process and evolution over the past few years. The team lead for e-commerce customers was interviewed twice during the six-month study period. The interviews focused on the increased need for automation to fulfil the high demand from e-commerce customers. They also focused on the need for a more modularised and customised warehouse operational strategy. The quality manager participated in five interviews, offering insights into warehousing practices and specific customers. Additionally, two interviews were held with the team lead responsible for managing pharmaceutical clients, emphasising standards and value-adding services (VAS) for this segment. Another interview was conducted with the site manager of a significant warehouse site, concentrating on overarching warehouse operational principles and potential standardisation through a systematic approach aligning different organisational aspects. Finally, two interviews

took place with the supervisor overseeing multiple team leads, focusing on the manual invoicing process that necessitates standardisation of IT systems across customers and various warehouses. Table 4 outlines the observations and interviews conducted, the number of sessions conducted with each employee, and the total duration. The high number of observation and the duration of the case study is a result of the customised approach forcing the researchers to follow multiple different types of customers to understand to most common warehouse processes.

Table 4 Collected data: observations and semi-structured interviews

	Job title	*Focus*	*No. of interviews/ observations*	*Total duration*
Observation #	*Phase one*			
1	Warehouse employees from six different warehouses	Map the inbound and outbound processes and resources in the warehouse	10	50 hours
2	Sales manager, quality manager, site manager	Map the commercial operations between the customers and different warehouse managers	6	20 hours
Interview #	*Phase two*			
1	Sales manager	Current sales process, future sales process	5	Six hours
2	Team lead – e-com	VAS, customer needs, automation	2	Two hours
3	Quality manager	Data management, people management, general warehouse management	5	Five hours
4	Team lead – pharma	ISO standards, VAS	2	1.5 hours
5	Site manager	Customer needs, automation	1	Two hours
6	Supervisor	Invoicing process, people management	2	Two hours

Source: The authors

3.4 Data analysis

The observations conducted during the first phase involved categorising the findings into two distinct flow diagrams. One diagram delineates the inbound and outbound processes observed among warehouse employees. The mapping detailed the sub-processes and necessary resources required to execute logistics services. Additionally, observations of the sales manager, quality manager, and site manager contributed to mapping the commercial operations performed within sales, contracts, implementation, and invoicing.

During phase two, the researchers compiled the data from each interview into summaries, emphasising the main findings relevant to the research. The initial coding involved creating an extensive list of all focus areas identified during the interviews. A

table was then generated, presenting all categories and examples from one or two interviews, using content analysis (Elo et al., 2014). The areas identified in the interviews in this way were subsequently categorised into distinct themes representing various organisational facets. The categories drew inspiration from the findings in Table 3 of the literature review and of phase one, which centred on commercial operations and logistics service delivery.

Phase three combined the findings from phases one and two to form an LSS framework. The framework consists of the different elements and the alignments between them.

4 Results and analysis

This section first outlines the current application of LSS in TransLog, then analyses the collected data and develops an LSS framework.

4.1 LSS in TransLog

TransLog personnel perceive LSS as a modern approach to logistics services and recognise that merely moving boxes from A to B is no longer sufficient. Customers expect a full service with many customised choices and shorter delivery times and have high expectations of how LSPs offer and execute logistics services. In the case company, a relatively new trend is the increasing number of e-commerce customers that not only require a faster exchange of data to ensure the stock count is up to date but also a faster delivery time, constant tracking, multiple carriers, and fast-changing stock keeping units. These are just a few examples of the challenges that are forcing the case company to rethink how it is currently providing its warehouse services. TransLog sees the LSS as a tool to increase collaboration between the different departments to meet fast-changing customer requirements in the future.

The LSS in TransLog involves two significant activities:

1 commercial operations

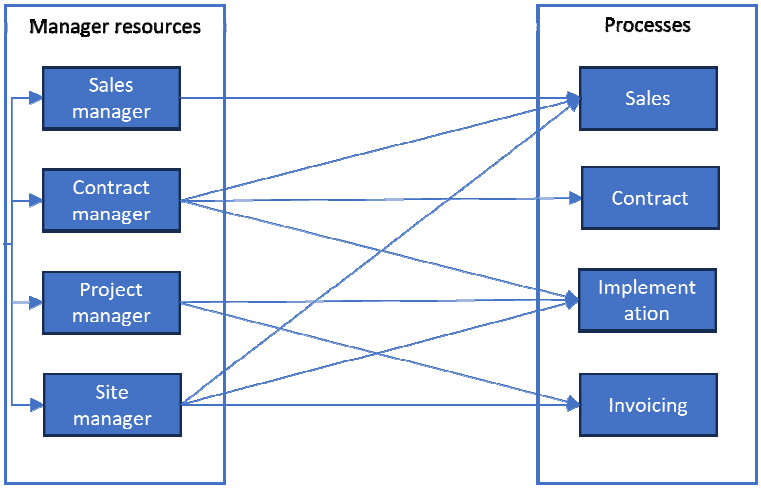
2 logistics service delivery.

The commercial operations of the company are mapped in Figure 4 to give an overview of the company's current ways of working. The figure shows an overlap between departments, as multiple managers are involved in the different processes. The overlap in responsibilities creates complexity, and the structure of each specification process depends on the specific manager handling the customers, resulting in increased customisation and time spent on each customer.

Second, the logistics service delivery at TransLog consists of inbound and outbound processes. Within these processes, companies can perform various sub-processes and VAS determined by the customer's scope outlined in the sales and contract processes. To understand logistics service delivery, the core flow of inbound and outbound processes, excluding the VAS and extra services, is mapped based on observations in multiple warehouses. The flows are simplified only to contain the overall sub-processes. To deliver the logistics service tasks, the infrastructure of how to offer and execute the service, the IT systems to control all the processes, the humans working in the

warehouse, and the facilities of the actual warehouse must be present. These four elements describe the core structure of TransLog warehouses. Figure 5 shows the sub-processes of the inbound and outbound processes, and the bottom of the figure represents the complexity of delivering a logistics service, as the different warehouse resources all play a role in each step of the delivery process. At the very least, delivering a logistics service requires understanding the service delivery methods and the involvement of technology and IT, identifying capable individuals to manage the process, and determining the facilities available for specific customers. Figure 5 is a simplified figure to show the complexity of delivering a logistics service. However, the reality is complex, and currently many of the services provided in the warehouses are customised to meet the specific needs of different customers. Therefore, service offerings for different customers can look completely different.

Figure 4 Commercial operations mapping (see online version for colours)



Source: The authors

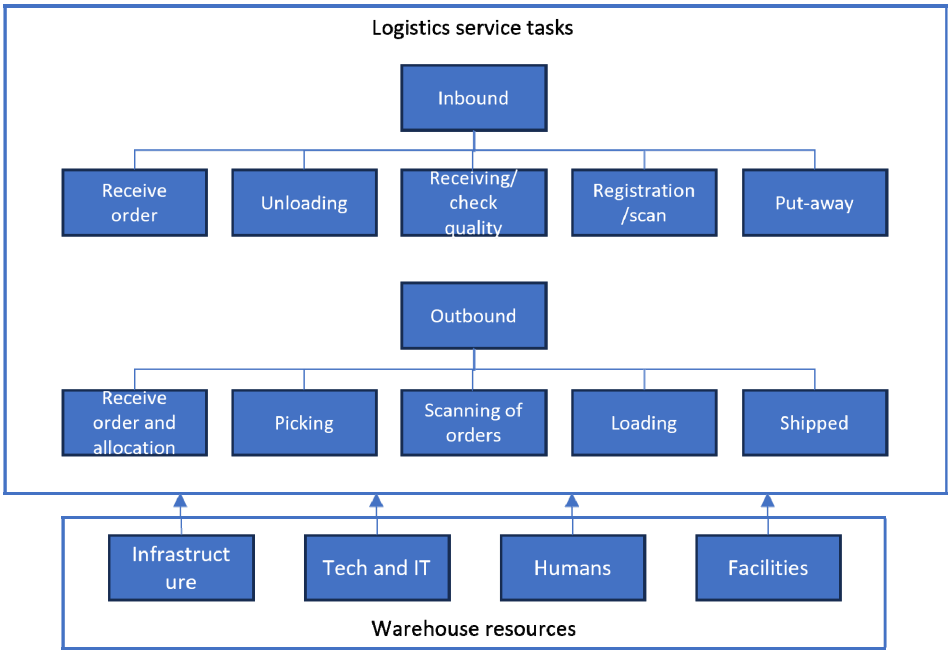
4.2 Towards an LSS framework

The interviews presented in Table 4 were analysed using coding, which enabled us to identify several themes related to LSS. Table 5 presents an overview of the output and provides examples of phrases sourced from various interviews used to code the findings. All the identified topics were categorised into eight specific categories, drawing inspiration from the findings of the literature review and the observations within the case company:

- Commercial operations: internal processes that involve the customers.
- Logistics service delivery: processes to handle the customers' products as requested.
- Infrastructure: describes how the logistics services are offered.
- Tech and IT: the setup and development of technology and IT in the organisation.
- Humans: human resources that are part of the handling process.

- Facilities: the facilities to store and provide the logistics services.
- Customers: the constantly changing needs and requirements of the customers.
- Disruptive events: unforeseeable external events that require consideration despite being unpredictable.

Figure 5 Logistics service delivery mapping (see online version for colours)



Source: The authors

4.3 The LSS framework

The interviews conducted in the case company formed the basis for identifying the categories in Table 5. Two additional categories emerged from the findings and the literature review study.

- Logistics service platform: an overall mapping of logistics services and how they can be delivered at different warehouses. The logistics service platform should describe the infrastructure, tech and IT, humans, and facilities.
- Logistics service management: this function will align the customers' needs and changing trends in the market and the logistics service platform to ensure the LSP is offering the proper logistics services.

These two categories are part of the new solution to create an LSS framework.

Table 5 Categories and themes emerging from single-case analysis

Categories	*Themes*	*Excerpt (interview #)*	*Mentioned in interviews*
Commercial operations	Invoicing process	"The invoicing process is hard to control, and in the future, it should be more integrated with the IT systems" (3)	(3), (6)
	Sales process	"Right now, we ask the customers what they want, and then we make it happen. In the future, we should tell them what we can offer" (5)	(1), (5)
Logistics service delivery	Standard tasks	"Standard tasks for the different segments, like e-com, could help to increase sales" (2)	(1), (3), (5), (6)
	VAS	"The VAS are an important part of the relationship with the customers as this is where we can offer a unique service to the specific customer" (4); "For e-com customers, the VAS allow us to help the customers to deliver a more customised product" (2)	(1), (2), (4)
Infrastructure	Collaboration in the organisation	"To be able to change the way of working, the collaboration between departments needs to be increased" (5)	(1), (3), (5)
	(Mass) customisation	"Each customer is special, and they are treated that way. Changing to mass customisation would change the entire organisation's sale, IT, and warehouse processes" (1)	(1), (2), (4), (5)
	Modularisation	"Implementing modularity in our logistics service offering could be used for a percentage of our customers, maybe 80%" (1)	(2), (3), (5)
Tech and IT	Automation/ industry 4.0	"Automation changes the way warehouse services are provided, as customisation becomes more expensive and challenging" (3); "Industry 4.0 can be anything ranging from drones to automated machines to close a box. Implementing different automation solutions requires a level of standardisation" (6)	(2), (3), (5)
	Digitalisation	"Increased data requirements from the customers are forcing logistics companies to increase digitalisation" (6)	(3)
	Global IT systems	"IT systems deployed globally are important to increase standardisation between warehouses" (3)	(3), (5)
Humans	Retaining employees	"To be able to provide the best possible service with complex processes, it is important to retain employees as they know their customers and their specific requirements" (4)	(2), (5)

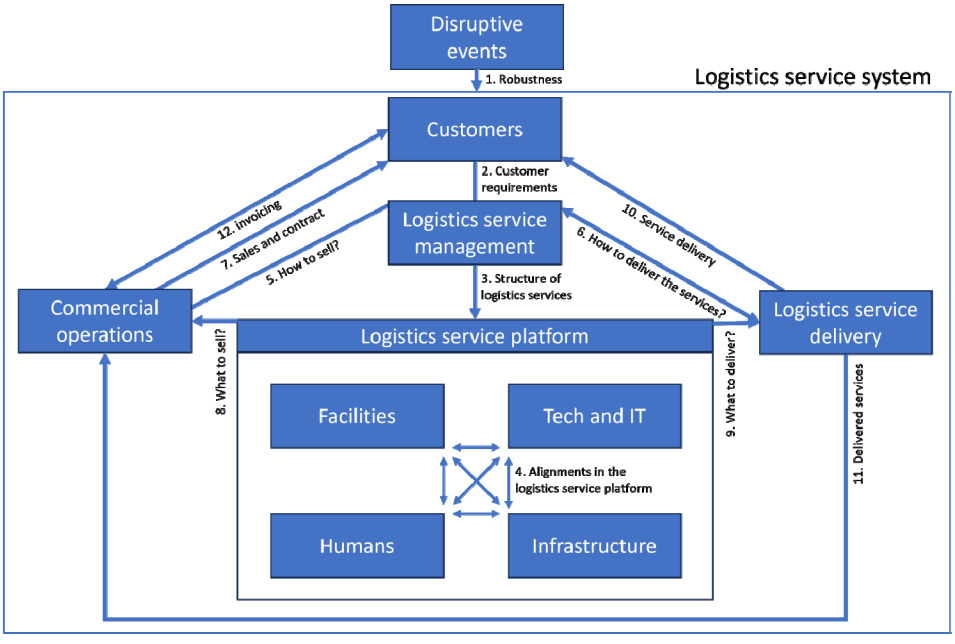
Source: The authors

Table 5 Categories and themes emerging from single-case analysis (continued)

Categories	*Themes*	*Excerpt (interview #)*	*Mentioned in interviews*
Humans	Skilled employees	"Skilled employees are necessary to control and work with the automation solutions to fully use their potential" (1)	(1), (3)
Facilities	Structure of warehouses	"The structure of all the warehouses is quite different, and this changes the customers and the products that each warehouse can store. Some are prepared for pharma customers, and some have a lot of automation and are better fitted for e-com customers" (4)	(4), (5)
	Location	"The location of the warehouses is important for some customers, as it can have an impact on the delivery time and the CO_2 footprint" (1)	(1)
	Transportation abilities	"The possibilities for different types of transport in each warehouse are important to know before making a contract with a new customer" (1)	(1), (4)
Customers	Customer requirements	"Over the past 5–10 years, the requirements of the customers have changed a lot. The service we offer went from moving and storing boxes to being an active part of the customisation of products and organising the last-mile delivery" (5)	(1), (2), (5)
	Length of contract	"Most contracts are between three and five years, which makes it hard to implement automation without a big risk of losing the customer" (3)	(1), (3)
	Sustainability	"There is a high request from customers to improve emissions" (1); "By giving the customer the overview of the emission for their service choices, they can make sustainable choices" (3)	(1), (3)
Disruptive events	Supply chain disruptions	"The evergreen incident is a good example of how disruptions in the supply chain can affect many aspects of the business, and something we need is to ensure slack in our systems to be able to handle such events" (3)	(1), (3)
	War	"War in the world has an enormous impact on the supply chains; however, this cannot be controlled by us, a 3PL company. This will, however, impact the business, and it is important to be ready to adapt accordingly" (3)	(3)
	Weather	"Weather is one of the factors that we in the logistics industry cannot control, but we just need to react when it affects our business" (6)	(6)

Source: The authors

Figure 6 LSS framework (see online version for colours)



Source: The authors

The LSS framework in Figure 6 presents the suggested structure of an LSS. Implementing a shared logistics service platform structures the organisation as a system, providing a comprehensive overview of the logistics services that various warehouses can offer. This approach will limit the resources spent on back-and-forth communication between different departments which is a well-known problem in TransLog. What follows describes how the framework for an LSS can improve the alignments in a logistics service company based on learning's from the interviews in TransLog. Each of the arrows in Figure 6 symbolises the alignments between the different parts of the LSS. Descriptions for each alignment are given below.

1 Different types of disruptive events will always impact the offering of logistics services. The LSS framework creates robustness, as the common platform will ensure the LSP knows what it can and cannot deliver. In the past, TransLog experienced difficult times; for example, when COVID-19 broke out, the company needed to adjust, and at a certain point, it ended up saying yes to customers that it would not be able to make a profit on. A robust logistics service platform can minimise the impact of disruptive events.

2 The most important task of the logistics service management team is to understand what type of services the different customer types require. Customer requirements can change, and it is therefore essential that the team is always up to date with the current customers' requirements and those of potential new customers and markets. In TransLog, there needs to be a dedicated team to understand its customers' changing needs, as its current way of working can lead to missed sales opportunities.

3 The logistics service management team collects and analyses information to maintain the alignment between what the company offers and the market's requirements, ensuring the logistics service platform is updated accordingly. TransLog is encountering problems acquiring new types of warehouse customers as it needs the data foundation to analyse its service offerings and performance for different customer types. The lack of this data foundation could lead to missed sales opportunities and non-profitable sales.

4 The logistics service platform is a data foundation of the different warehouse facilities, tech and IT, humans, and infrastructure. In TransLog, an overview and data foundation of what the company can offer its customers currently need to be made available. The logistics service platform aims to describe what services the LSP can deliver to different customer types and in which warehouses. All four elements in the logistics service platform must be aligned to provide logistics services.

5 The logistics service management team provides a structured sales process for the sales department. This process is aligned between the different warehouses to ensure that customers involved in multiple warehouses experience the same structured process. A structured sales process will allow the other departments to be involved only in the agreed steps of the process. The current process in TransLog requires many back-and-forth steps between different departments, as they are not required to follow a specific process.

6 The logistics service management team is also responsible for a structured approach to deliver services to different customer types in different warehouses. The connection also goes the other way; if the logistics service delivery team is experiencing a customer or warehouse change, it will inform the logistics service management team, which will update the logistics service platform accordingly. Currently, TransLog lacks an overview of how it delivers different services. This absence results in sales personnel continuing to sell what they have always done even though the delivery team might have changed processes.

7 The customers will contact the sales department and request several services based on their needs. This request process will be unchanged; the main differences are in the offers and contracts the customers will receive back. Offers will rely on the logistics service platform instead of engaging in multiple iterations with different departments to discuss how the company can fulfil customer requests, as is currently the practice in TransLog.

8 The information within the logistics service platform details the available services and their locations for diverse customer types across various warehouses. By exploiting this information, the sales team ensures the promotion of only those services available in specific warehouses. Additionally, the platform may include the costs of different services in the future. The sales team can generate offers that align with customer requests by using the platform. In TransLog, the sales process frequently relies on assumptions and past offers to different customers. This result in inconsistencies during the implementation process, where some services may need to be changed from the initial agreement provided in the sales process and contract.

9 The logistics service delivery team collects information from the platform on what services to provide to different customer types. In TransLog, the warehouses

currently customise services for numerous customers, but no structure outlines how to provide a specific service for a particular customer type. This results in specific instructions for each service, requiring expert knowledge and less flexible handling in the warehouses.

10 The logistics service delivery team in different warehouses provides the required services to handle the customers' goods. Customers may require unforeseen services in this process; for example, last-minute requests may not be part of the agreed contract based on the logistics service platform. Unagreed services should be allowed to the extent that they can be handled in the warehouse and added to the invoice as extra tasks. This process is similar to the process at TransLog today. However, standardising service processes and naming across different warehouses ensures uniformity. Standardising the services enhances data quality for the future analysis of different customer types.

11 The logistics service delivery team provides the invoice data for commercial operations. The structure and naming of the logistics service platform form the basis for each service listed on the invoice. In the future, this could be done automatically in an IT system. At TransLog, each invoice for the customer contains customised names for most of the services. The customised approach makes it challenging to compare customers, and to assess the profitability of different services.

12 Upon receiving the invoice, the commercial operations team will verify it and send it to the customer. Currently, the logistics service delivery team in TransLog manages this process, resulting in customised categories on the invoice that make it impossible to compare invoices across different customers.

As the case study made evident, an LSS requires a logistics service platform and a logistics service management team to ensure that the commercial operations and logistics service delivery are aligned with each other and changing market and customer requirements. The logistics service management team will maintain the logistics service platform and provide standard processes for commercial operations and logistics service delivery.

5 Discussion and conclusions

This study investigated the application of LSS in an empirical setting and explored the potential to describe an LSS framework. To investigate LSSs, a literature review and a case study were conducted. The unique contribution of the paper is the developed framework and definition which could serve as a practical guide for improving an LSP's competitive advantage, focusing on the entire LSS and suggesting an alignment of different parts of the organisation.

The framework presented in Figure 6 authorises us to propose the following definition of LSS.

> "A logistics service system aims to improve and align commercial operations and the delivery of logistics service tasks, based on customer requests, with a logistics service platform to ensure alignment. The logistics service platform improves and aligns infrastructure, tech and IT, facilities, and human resources while considering robustness when facing disruptive events."

5.1 Implications for research

The contributions of this study are twofold:

1 it presents an LSS framework that can work as a blueprint to fill gaps in the literature and as an overarching flowchart that can be adopted by LSPs.

2 The study underscores the need for a logistics service platform and logistics service management team, which in turn handle and ensure the alignment between commercial operations and logistics service delivery.

The LSS framework and definition offer a clearer understanding of what an LSS involves. The framework and definition of LSSs in this paper serve as a starting point to collect all the research within the modern LSP industry under one term focusing on the system and the organisation. The present study thereby contributes to the logistics service literature through concept development based on previously published papers (Pekkarinen and Ulkuniemi, 2008; Lin et al., 2010; Liu et al., 2010; Rajahonka, 2013; Cabigiosu et al., 2015; Abbasi and Nilsson, 2016).

Second, the study illustrates the need for a logistics service platform and logistics service management team to handle and ensure the alignment between commercial operations and logistics service delivery. As shown in the study, the company case faced several challenges that could have been avoided by focusing more on developing such resources. For example, the development of logistics service platforms could increase the understanding between departments and ensure a balanced task attribution. The literature review highlighted articles successfully applying a modular approach to offer logistics services, which supported the decision to include the logistics service platform and logistics service management team in the LSS framework (Lin and Pekkarinen, 2011; Rajahonka, 2013; Rajahonka et al., 2013; Cabigiosu et al., 2015; Pohjosenperä et al., 2019). The specific term ‘service platform’ has previously been used as a successful approach to minimise complexity in the service industry (Pekkarinen and Ulkuniemi, 2008; Lin et al., 2010).

Furthermore, the shared terminology and logistics service platform can ensure a standard approach throughout an organisation, enabling it to stay competitive and improve the logistics services it provides. Through these findings, the study advances the logistics service literature with a management focus (Persson and Virum, 2001; Busse and Wallenburg, 2011).

5.2 Implications for practice

The LSS framework offers a structured overview of an organisation providing clarity to remain competitive in the logistics service industry. The case study approach enables transferability of the findings in the real world, making the framework easy to understand and employ in the industry (Voss et al., 2002). The identified categories in the combined framework are mainly based on the case study findings to facilitate framework’s applicability and a shared terminology with the industry in which it could be applied. The framework ensures a clear split of tasks between commercial operations and logistics service delivery processes. Since the implementation of the LSS framework, the case company has changed its organisation and integrated a new team to develop and handle the logistics service platform. This is managed with the standard services offered in all

the Danish warehouses from which at least 50% of its customers can choose services during the sales process.

5.3 Limitations of research

Development and application of the framework were limited to one case company. Although the case study was successful, with the company changing their organisation according to the framework, it could have been beneficial to develop and test the framework on multiple LSP companies (Meredith, 1998; Voss et al., 2002).

5.4 Future research

This article does not investigate the development of a logistics service platform, but it uses existing literature suggesting platform and modularisation techniques to improve logistics service offerings (Brax et al., 2017; Rajahonka, 2013; Rajahonka et al., 2013; Cabigiosu et al., 2015). It is advisable to conduct further research to develop and use a logistics service platform and logistics service management team in an LSS context. Future research could focus on the benefits and challenges of applying the LSS framework, e.g., sustainability, digitalisation, and customisation (Alkaabi, 2024; Mvubu and Naude, 2024). Finally, the real potential of the findings in this study lies ahead, as the shared definition of an LSS framework is expected to show in the coming years, both in the literature and in industry, how the definition can standardise the terminology in academia and help companies to have common understanding of terms and notions.

Data availability statement

The participants of this study did not give written consent for their data to be shared publicly, so due to the sensitive nature of the research supporting data is not available.

Declarations

The authors report there are no competing interests to declare.

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