ISSN 1648-4142 / eISSN 1648-3480

VILNIUS TECH
Vilnius Gediminas Technical University

TRANSPORT

2025
Volume 40
Issue 3
Pages 280–296
https://doi.org/10.3846/transport.2025.22869

Original Article

LOGISTICS OPERATIONS MANAGEMENT IN THE *INDUSTRY 4.0* ERA: A CASE STUDY FOR TRANSITION OF AN AUTOMOTIVE COMPANY'S OPERATIONS TO FOURTH-PARTY LOGISTICS STRUCTURE

Hülya DÖNER[1], Özalp VAYVAY[2,3], Pelin VARDARLIER[4], Zeynep Tuğçe KALENDER[5] ✉

[1] *Dept of Engineering Management, Institute of Pure and Applied Sciences, Marmara University, Istanbul, Turkey*
[2] *Dept of Industrial Engineering, Istanbul Health and Technology University, Istanbul, Turkey*
[3] *Dept of Industrial Engineering, Faculty of Engineering and Natural Sciences, Istanbul Topkapı University, Istanbul, Turkey*
[4] *Dept of Business Administration, Faculty of Economics and Administrative Sciences, Balikesir University, Istanbul, Turkey*
[5] *Dept of Industrial Engineering, Faculty of Engineering, Marmara University, Istanbul, Turkey*

Highlights:

- the study investigates the transition process to a 4PL system in an automotive firm;
- a comprehensive case analysis focuses on the TTM;
- findings show that 4PL transition streamlined logistics operations and improved process efficiency;
- the transition enhanced overall performance and resource utilization efficiency in the selected case;
- results indicate that outsourcing logistics boosted both efficiency and supply chain quality.

Article History:

- submitted 18 June 2022;
- resubmitted 30 December 2022, 26 May 2023;
- accepted 3 August 2023.

Abstract. In recent years, the understanding of minimum inventory and customer satisfaction in the flow of goods and services from manufacturers to end-users is of great importance among the factors that make businesses more interested in outsourcing logistics activities. Additionally, technological transformation and customer requests for complicated technology and services caused the appearance of new circumstances, which is progressively altering the industry. In this regard, choosing, managing and coordinating between multiple vendors become very difficult and time consuming so, companies outsource more functions while supply chain operations getting more complex. Companies generally preferred 3PL providers for their logistics functions including packaging design and management of company-owned assets. On the other hand, with technological transformation in logistic sector, businesses are looking to outsource 4PL more than ever. 4PL system transitions are difficult processes since it requires comprehensive system integration and should be well understood by the company's supply chain team. Today, although the importance of 4PL systems is more understood and this structure is becoming more widespread, many companies still face similar adaptation problems. From this point of view, it is believed that this study creates important insights into the business world. In this study, the transition process of an automotive company is examined which successfully completed after a 5-month project period. As a detailed case study, the Transportation Management Module (TTM) is selected since the whole transition process was very comprehensive and included many dimensions. Study revealed that adaptation of the new system, developed by the partnership of the automotive company and 4PL company, provided several benefits. In this sense, with the transition of Transportation Management (TM), TTM is reduced by 2 days, almost 10% savings are reported in the whole company and only in the Turkey branch, 243311 € cost saving is achieved in the 1st year. The study proves that focusing on the core business via outsourcing supply chain activities not only increases efficiency in the selected automotive company but also increases supply chain quality as well.

Keywords: logistics, fourth-party logistics (4PL), outsourcing, transport management, automotive.

✉ Corresponding author. E-mails: *tugce.simsit@marmara.edu.tr, ztsimsit@hotmail.com*

Notations

1PL – 1st-party logistics;
2PL – 2nd-party logistics;
3PL – 3rd-party logistics;
4PL – 4th-party logistics;
5PL – 5th-party logistics;
ASN – advanced shipping notice;
CTL – capital transportation logistics;
EAT – estimated arrival time;

EDI – electronic data interchange;
EOB – end of business day;
FTL – full truckload;
FM – freight cost management module;
FQ – frequency;
IoT – internet of things;
IS – information system;
IT – information technology;
ITMS – integrated transport management system;
LDM – loading meter;
LODER – logistics association;
LSP – logistics service provider;
LTL – less than truckload;
PO – purchase orders;
RFID – radio frequency identification;
ROI – return on investment;
SaaS – software as a service;
SAP – systems analysis and program development;
SCM – supply chain management;
STM – speed to market;
TM – transportion management;
TMM – TM module;
TMS – transport management system;
TO – transport order;
TTM – time to market.

1. Introduction

Nowadays, the understanding of minimum inventory and customer satisfaction in the flow of goods and services from manufacturers to end-users is of great importance among the factors that make businesses more interested in outsourcing logistics activities (Jharkharia, Shankar 2007). From a general view of point in outsourcing, the focus is on the activities that give enterprises a competitive advantage, and the activities that do not fall within their field of expertise are provided in accordance with the required quality standards through other companies specialized in this field (Mazzanti *et al.* 2007). A partnership is constructed between the company that buys the function or service and the supplier and in this relationship, companies are striving to achieve higher performance and lower cost. The fact that risk is shared distinguishes this relationship from the traditional customer–supplier relationship.

The concept of outsourcing has retained traditional application areas for a long time and has been limited to more construction, transport and generally fewer demanding jobs. However, today the global business process outsourcing market size was valued at 232.32 billion $ in 2020 (Grand View Research 2025). According to the analyses (Grand View Research 2025), market size is expected to grow with a compound annual growth rate of 8.5% from 2021 to 2028 (Grand View Research 2025). This fact points out that application areas of outsourcing have expanded. In recent years, especially in the following areas outsourcing is getting more important:

- logistics-transportation (warehousing, distribution, ISs and operations);
- human resources management (selection, training, performance evaluation, etc.);
- IT (maintenance, training, application, software development);
- customer service (ISs, field services, telephone customer service);
- accounting-finance (payroll, taxation, purchasing and general accounting);
- administrative works (written documents, files, photocopy, etc.);
- sale, marketing, personnel transportation, security, cleaning and car rental services.

Today, the increasing importance of outsourcing has been supporting by the acceptance of information and communication technologies in most industrial activities, particularly in logistics-transportation (Hasan *et al.* 2013). Technological transformation and customer requests for complicated technology and services caused the appearance of new circumstances, which is progressively altering the industry. Changing conditions around the world has led the way to the introduction of more complex networks in logistics (Križman, Ogorelc 2010). This has led the companies to make most of what they already have and begin to outsource what they do not. Complex logistics networks were among the concepts that became too much for a company to perform in-house so, they started being outsourced (Bajec 2013).

In the literature, not only academic studies but also many studies such as surveys and real-life applications show that businesses have outsourced warehousing and fulfilment tasks for years and today, more businesses still rely on 3PLs not only basic transportation activities but also packaging, design and management of company-owned assets that (Bigelow 2019). On the other hand, with technological transformation in logistic sector, businesses are looking to outsource 4PL more than ever before. Baker (2025) stated that day-by-day companies outsource more functions while supply chain operations getting more complex since choosing, managing and coordinating between multiple vendors become very difficult and time consuming. In other words, companies cannot managing the talk with multiple 3PL providers. Therefore, there is vital need to transform the logistics operations to 4PL structure. According to "*Logistics Outsourcing Trends in 2020*" conducted by Bigelow (2019), 42% of respondents looking for providers that can design, build, run and measure logistics functions. Real-time operations technology, STM, and end-to-end visibility are listed just a few of the reasons that executives prioritized logistics outsourcing. Based on this reality these transformations will affect how organizations are managed according to the new business conditions (Barreto *et al.* 2017).

Conducted statistical analysis by Statista (2025), also emphasizes the increase by stating the expected growth of 4PL will be around 86.26 billion $ by 2025. On the other hand, as Ahtamad & Akhsanov (2021) examined that 4PL transitions for companies can be challenging, and during transition, they can face some comprehensive problems. The main underlying reason is why 4PL system transitions

are difficult processes is that these processes require comprehensive system integration and should be well understood by the company's supply chain team. However, today, although the importance of 4PL systems is more understood and this structure is becoming more widespread, many companies still face similar adaptation problems.

In this regard, it is believed that this study creates a contribution to the existing literature with presenting a real life case study in which a successful transition is achieved (Section 2). In the study, initially, literature is reviewed based on the evaluation of LSPs and the advantages of outsourcing logistics operations. Afterwards, 4PL transition of a selected automotive supplier industry company is examined. In the case analyses, firstly, current situation of the company is provided in Section 3.1. then TMM transition is presented as an example process in Section 3.2. The selected factory is a company of foreign origin and 70% of the raw materials are imported abroad. The highest share in logistics costs is caused by import. What is more, company have factories in different regions around the world, especially in Europe. This global structure of the company and the rapid increase in the use of foreign resources in the global markets has increased the demands on the logistics function therefore complex supply chains are developed. On the other hand, SCM employee did not have enough knowledge and experience to carry out this complex structure. Therefore, outsourcing of the logistics operations became vital in time to survive among the rivals. However, current structure of the outsourcing model is also not proper for the company since it depends on manual data gathering. In Section 3.3, results are presented after the TMM transition is completed then in Section 4 further discussions for future steps are made. Study proves that focusing on the core business via outsourcing supply chain activities not only increases efficiency in the selected automotive company but also increases supply chain quality as well. Finally, the conclusions are drawn (Section 5).

2. Literature review

Significant transformations occurred in the logistics industry during the late 1900s and early 2000s, playing a crucial role in enhancing company productivity (Diem *et al.* 2023). In today's global trade arena where production costs converge and price competition alone does not make sense, the importance of logistics services and strategies is still increasing in order to compete. In literature, many authors focused on this issue and developed models to better manage supply chains in order to increase the competitiveness of companies. Key developments included the rise of 3PL, and the emergence of 4PL entities, the establishment of intricate partnerships, the proliferation of multimodal transportation for goods, the reduction of logistics expenses, and the creation of value chains (Li, Shue 2003). In 2022, Zimon *et al.* (2022) reviewed the literature of quality management in SCM and their analysis showed that the main problems are interdisciplinary and complexity. The study also revealed the importance of IT solutions in SCM and highlighted that IT systems are key to increasing efficiency and competitiveness in supply chains. Sharma *et al.* (2023) examined logistics in terms of circular economy adoption and their research stated that companies gained importance advantage by *Industry 4.0* technologies in circular economy adoption and supply chain flexibility have significant effect on the issue. It is seen from the literature that, companies that have moved from transportation to logistics management now have a greater share than international markets. Becket (2022) stated that the 4PL logistics market is expanding rapidly and increasing its value at record-setting rates. Numerous researchers have dedicated their attention to the transformation of 4PL in response to the evolving and demanding logistics market (Li *et al.* 2003; Visser 2004; Gattorna *et al.* 2004; Van Hoek 2006; Vivaldini *et al.* 2008; Win 2008; Ji 2007; Bajec 2009).

In this regard, LSPs offer a variety of logistics innovations, opportunities and different solutions. Basically, the appearance of LSP is caused by the increase in the amount of services companies want to outsource. Initially, LSPs were divided into 2 types: operation and knowledge based. Over time, depending on the diversity of logistic services, it has been subjected to quadruple separation as given below (Razzaque, Sheng 1998):

- ***asset-based service provider***: this type of company provides logistics services especially with its physical assets such as truck, cargo ship and warehouse;
- ***administration-based service providers***: these types of companies, which provide services such as system databases, consultancy and consultancy, generally act as subcontractor transportation department for all or part of their customers' business areas. Such firms do not have their own transport or storage assets;
- ***mixed-type service providers***: these types of companies usually have their own vehicles such as lorry fleet and storage areas. However, they are not limited to using the assets in question and can agree with other vendors to work in the required areas;
- ***management service firms***: these companies are mainly engaged in freight payments, etc., management services related to the management of logistics activities.

Over the course of more than 3 decades, the logistics industry has experienced a profound transformation driven by the relentless pressure of escalating customer expectations and demands (Diem *et al.* 2023). However, with the adaptations to be made on logistics activities and comprehensive logistics strategies, it is becoming clear to the companies that it is possible to get ahead of its competitors. In this sense, as stated before, the effective coordination facilitated by 4PLs between LSPs and their clients in managing overall logistics activities leads to notable benefits for manufacturers and retailers. However, 4PL system transitions are difficult processes since it requires comprehensive system integration and should be well understood by the company's supply chain team. Visser (2004) and Van Hoek (2006) affirmed that the transformation must be started with comprehensive strategies.

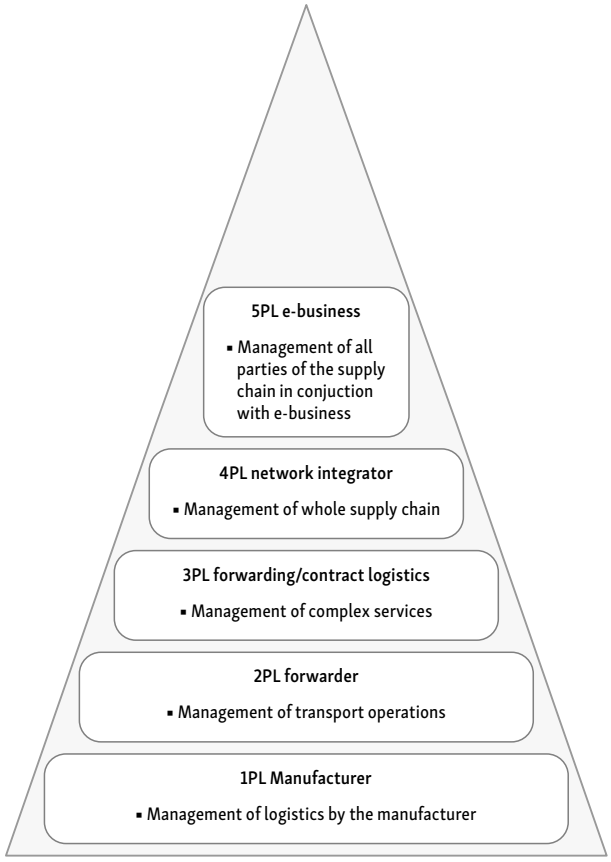

Figure 1. A summary of the main LSP' families – adapted from Fadile *et al.* (2018) and Vasiliauskas & Jakubauskas (2007)

In the following parts, literature is firstly reviewed based on the evaluation of LSP. A summary of the main LSPs' families (Fadile *et al.* 2018) is presented in Figure 1. According to the current literature, there are basically 5 types. In Section 2.1, types of logistics providers and the changes of their structures through time is detailed. Afterwards, in Section 2.2 literature is reviewed in terms of the benefit of logistics outsourcing.

2.1. Types of LSPs

1PL term is used for manufacturers, which carry out their logistic operations by themselves. They own all logistics assets and manage all their logistics operations in-house as shown in Figure 2. An individual that needs to have cargo, freight, goods, produce or merchandise transported from a point A to a point B. The term 1PLs provider stands both for the cargo sender and for the cargo receiver. A 1PL can be a manufacturer, trader, importer/exporter, wholesaler, retailer or distributor in the international commerce field. It can also be institutions such a government department or an individual or family removing from one place to another. Anyone having goods moved from their place of origin to their new place is considered to be 1PL provider.

One disadvantage of 1PL supply is that the provider should use their own transportation. For larger businesses, this might mean owning and managing a whole fleet of trucks, planes, and ships. To avoid the value of getting to run their own fleet, businesses typically herald a 2nd party to ship for them. For a fee, businesses will avoid the large price of keeping each step of the shipping method in-house. This is often associate degree example of 2PL. This type of service supplier has transportation like trucks, ships, and even airlines. In other words, 2PL is any business that focuses on transportation.

Starting with 1980s, service providers have created alternative options in logistics management. 3PL companies specialized in logistics services emerged in the developing process with the companies carrying out their own logistics activities at 1970–80s. According to LODER 3PL company means – the company provides long-term contracts with its customers, providing customized logistics services according to customer requirements in continuous integration with the customer (LODER 2021). More recently, 3PL play crucial role in many supply chains (Kavčič *et al.* 2016). Companies can get services for all logistics activities from companies offering 3PL services; partial service. The 3PL supplier is defined as the 1st party, the buyer 2nd party and the intermediary institution whose services are used to perform the logistics activities between these 2 parties is defined as the 3rd party. In the alliance between the 3PL service provider and the service provider, the parties accept each other as partners. They cooperated to understand and define the logistics needs of customers. Both parties are responsible for the design and development of logistical foundations and set performance measurement criteria. The main objective is to create a relationship that both sides will win. A 3PL supplier is an external entity that manages, controls and, delivers logistics activities on behalf of the shipper. The agreement may be written or verbal. The aim is to achieve an agreement that is mutually beneficial for both parties. The agreement may include all or part of the logistics activities, but should include at least transport management, conduct of operations and storage. The agreements between the 3PL business and its customers have changed over time to the adoption of content as a strategic partnership that is mutually beneficial and mutually beneficial to the parties (Çakırlar 2009).

In the late 1990s, a new concept in logistics, the 4PL, emerged. Another definition used for 4PL is lead logistics provider (Özdemirel 2004). At the core of this concept, unlike the concept of outsourcing, which is dominant in the 3PL concept, it is the case that business processes are organized with the help of outsourcing. 4PL has brought along the inclusion of businesses such as information processing, consultancy and financial services in the 3PL market (Çakırlar 2009). Utilization of traditional external sources, business, duties and responsibilities are based on the principle of referral to an expert institution. In other terms, 4PL companies are intermediary organizations that bring together their own and other businesses' resources, capabilities, and technologies to design, build, and execute supply chain solutions (Rushton *et al.* 2014). Thus, the business focuses on the core businesses that create the main added value. In the 4PL approach, the busi-

ness processes are redesigned and developed by taking the knowledge, experience and technology of the external expert firm. With the understanding of providing 4PL services, companies produce solutions to problems that are unique to each customer.

4PL companies carry out supply chain activities of different customers. The most successful 3PL companies that will provide optimization in the realization of logistics activities are selected and the 4PL company ensures the coordination among them. IT plays an important role in coordination. The success of SCM and coordination and harmony between 3PL companies are based on IT (Atsüren 2007). Thus, 4PL relationships evolve from a 3PL relationship, and have a broader role within the supply chain. 4PL have a much wider responsibility in serving to the client to achieve its strategic goals. 4PL organization acts as a unique interface between the client and the multiple providers of logistics services. All the aspects of the client's supply chain are managed by 4PL organization (Pavlić Skender *et al.* 2017). Moreover, 4PL specialize in delivering value to their clients through the re-engineering of the whole supply chain process and by providing coordinated services through the most applicable supplier (Rushton, Walker 2007). 4PL service providers also undertake the task of integrating all supply chain processes in order to fulfil the needs of customers and suppliers efficiently (Kalkan, Aydın 2019).

5PL is the final family of LSP, which is a new concept in logistics outsourcing, and it is about the management of all parties of the supply chain in conjunction with e-business. 5PL operator takes one-step further and manages an entire network of supply chains for the client. From a general view of point, 5PL is described as providers that focus on strategic SCM through technology solutions (Skender *et al.* 2016). Giusti *et al.* (2019) described 5PL in a similar way and according to their definition 5PL providers use technology solutions to solve logistics and strategic management problems in supply chains with complex networks. The major focus of a 5PL is to offer automated and intelligent systems able to improve the performance of the supply chain and the key of success of this emerged family is the integration of ITs and computer systems. Like the 4PL, a 5PL is virtual (Rajesh *et al.* 2013). In fact, enabling technologies together form a common system in which all partners can benefit entirely from synergy.

This idea is close to the popular SaaS business model, which is presented in Figure 3, according to which software and associated data are centrally hosted on the cloud. This structure allows partners in managing interactions with an access to disruptive technology tools for tracking, using intelligent systems (Giusti *et al.* 2019) and performing data analytics optimization, and simulation. 5PL providers strive to achieve greater efficiency and profit from the beginning of the supply chain through the use of technologies such as blockchain, robotics, automation, RFID, etc. Hofman (2015) stated that around 80% of the logistic market is small companies that have generally very simple technological solutions. Therefore, such service becomes attractive for these small transportation companies and allows outsourcing dispatching functions for large logistics operators (Ivaschenko 2014). The total expression of the 5PL level of service outsourcing has been conceptualized as a totally activated demand-supply logistics model presenting sophisticated, extremely coordinated solutions for an outsourcing logistics (Hosie *et al.* 2012).

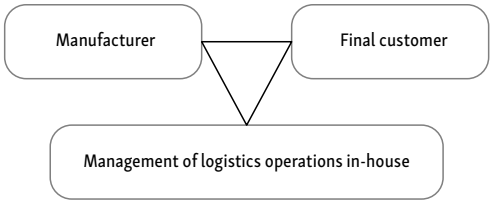

Figure 2. 1PL structure – adapted from Fadile *et al.* (2018)

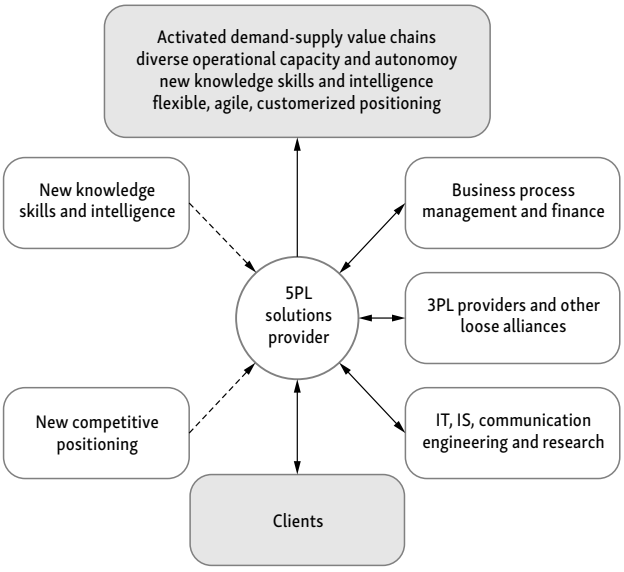

Figure 3. 5PL solutions provider model – adapted form Hamilton (2004)

2.2. Advantages of LSPs

One of the major component of companies' cost structures is logistics and supply chain costs (Orkestra 2022) thus reducing them is often the number one priority. "*CSCMP's 33rd Annual State of Logistics Report*" (CSCMP 2022) showed that there is a constant increase in logistics and transportation costs over the years. In addition to the costs of performing logistics activities, there are costs arise from the inability to implement effective and efficient logistics management as well. From a general perspective, increases in costs mean that companies must continue to innovate and implement strategies that can help reduce. Therefore, in order to eliminate this problem, logistics providers have an important role since; making contracts with organizations providing outsourcing services creates a great advantage. Deloitte's 2020 "*2020 Global Outsourcing Survey*: *Outsourcing Trends and Strategies Shaping the Future*" (Underwood, Stoler 2020) stated that cost reduction is among the top 5 benefits of logistics outsourc-

ing while the others are listed as flexibility, STM, access to tools and processes and finally agility. Kiggell *et al.* (2021) examined on cost reductions obtained by 4PL and results of their study proven a significant cost savings.

Cost savings as a major benefit of logistics outsourcing, has been confirmed by many researchers (Baluch 2005; Capgemini 2016; Godsmark, Richards 2019). Considering only transport operations, it accounts for up to 10% of operational costs, among the burden of all logistics activities. However, a number of current problems, together with security, environment, and energy, can affect the cost and performance of logistics systems. The result of security, environmental, and energy considerations, moreover as ongoing technological innovation, means that SCM is changing into more and more complicated, and hence, much more difficult for managers (Hosie *et al.* 2012).

Bigelow (2019) stated that in their analysis over 80% of professionals, indicate that they plan to increase logistics outsourcing budgets beyond warehousing and fulfilment however this decision is not all about cost optimization. Study revealed that only 34% of survey respondents prioritized saving money as the 1st objective. Instead of this, the underlying reason in the increase in budget is a need to update operations technology and support increasingly complex logistics operations. Clutch's "*Small Business Outsourcing Statistics in 2019*", conducted by Panko (2019) also showed that the main reason small businesses choose to outsource was to increase efficiency. In the survey, 24% of businesses stated that through outsourcing, more projects can managed easily. Study also revealed that cost reduction actually was only a priority for 12% of small businesses at the time. However, Deloitte's 2020 "*2020 Global Outsourcing Survey*: *Outsourcing Trends and Strategies Shaping the Future*" presented that around 70% participant stated that outsourcing was used as a cost-cutting tool. This situation is evident that the pandemic has forced businesses to focus on costs once again (Underwood, Stoler 2020).

In logistics processes provided by outsourcing, there is a significant relationship between the increase in productivity and flexibility and a delivery rate on time (Zenginçelebi 2013). One of the major benefits that can gained with LSP is STM or in other words TTM, which is defined the duration needed to bring a product to fruition. This includes the generation of an idea for the product; its whole design cycle; development, and launch on the market. The more streamlined and effective your company's product development process is, the better you will be able to predict its TTM. It can also assist in making plans on how to roll-out the product at the right place and time. In this regard, considering current business conditions, companies can have great benefits in terms of STM when they outsource their logistics operations. The underlying reason is that TTM concept is one of the prime determining factor in the success of innovation and considering that all competitors are investing in innovations in varying degrees, partnership with LSP will accelerate these processes.

Jiang *et al.* (2006) stated that one of the major advantage of logistics outsourcing is the increase in productivity. Productivity gains in SCM in terms of costs and reliability can be derived from the managerial and IT expertise provided by 4PL. Acartürk & Keskin (2012) emphasizes that companies get maximum efficiency from those working in their fields of expertise. The choice of an experienced transport and logistics operator influences the company's development strategy since 4PLs are more prone to implement novel SCM practices requiring a higher expertise on material flows such as crossdocking and shipment tracking. Therefore, the 4PL provider modernizes the supply chain through good use of resources for IT systems, optimization and coordination of processes. Thus, the ability to adapt plans ensures increased productivity, reduces the risk of failure in emerging markets and shipping costs. As a result, the company's market competitiveness increases.

The flexibility of firms is a critical feature to reduce uncertainty arising from changes in demand. In other terms flexibility is the effort of businesses facing unexpected and unpredictable hazards and problems of an unforeseen future to preserve their existence (Sheffi 2007). The process experienced with the COVID-19 pandemic has shown the importance of this situation much more clearly (Tsai *et al.* 2021). However, Ibrahim & Ogunyemi (2012) stated that flexibility is also the capability to respond effectively to changes in product design, delivery time, delivery volume/quantity and delivery mix/variety. From this point of view, flexibility complicates the inventory policies of the enterprises. Especially, the production of multiple products in facilities makes finding optimal production decisions a multidimensional decision problem. The production of multiple products in each plant causes the number of alternative decisions and stock levels to increase exponentially. In this point another benefit, that can companies have with outsourcing is about inventory management (Kapıcı 2019), which is one of the essential parts of SCM that should be critically taken into account.

The levels of inventory are one of the major concerns of logistics (Bragança 2008). It should be well understood that inventory does not only refer to raw material or finished goods but also the subassembly or work-in-progress inventory buffers. Christopher (2005) points out that it is not unusual that companies tie up approximately fifty per cent of their current assets in inventories. Inventory turnover rate shows how many times the company's stocks are renewed in a period, in other words, how fast they are sold. This ratio is used to find the average stock day. A high stock turnover rate indicates that the company's stock management is very effective, customer demands are accurately predicted, stock levels are adjusted accordingly, and suppliers deliver goods on time. However, holding stocks has a cost to companies and, moreover, stocks held for a long time may suffer from quality problems and become unsold. On the contrary, if keep a very low inventory is kept, the demand from the customer can unmet and turns to lose sales. Therefore, it is aimed to keep stock at

the optimum level, that is, as much as necessary (Dinitzen, Bohlbro 2010). From this point of view, outsourcing order fulfilment and stock control become a strategic way to manage these processes. 4PL partners offer distributors good opportunities to enhance their client expertise and loyalty, likewise as their revenue and operations.

Considering all these mentioned conditions, outsourcing for logistics activities increases the competitiveness of the business since it provides advantage by responding to special requests (LODER 2021). Companies strive to gain a competitive advantage requiring businesses to concentrate on their core talent areas (Karahan 2009; Oğultürk 2011). In today's competitive conditions, each company is in a trend that puts forward its advantages and tries to overcome its disadvantages. The aim of each company is to provide competitive advantages, which are called "competitive edge" as a result of internal activities and cause the company to differentiate both itself and its products. The way to create such competitive advantages is to focus on functions that can be called "core competency" or "value increasing / creative activity". These activities, which bring along the advantage of being easy to imitate as well as differentiation, enable companies to position themselves differently than their competitors in the market. In other words, the company will no longer be making its time and effort to track the import, export business in logistics, to organize a vehicle for them, to find a 3PL company (Çabuk *et al.* 2010). Instead, the person following this operation can be focused on the customer. Customer demands can be examined in more detail. Tunç & Kaya (2016) stated that companies using outsourcing in their logistics services will be able to spend more time with their customers and better meet their demands. Srabotic & Ruzzier (2012) emphasizes that with the use of outsourcing, organizations can move to a business structure that can make more investments focused on areas that provide unique competitive advantage. Therefore, instead of following up the operation in logistics processes, suppliers can deal with more strategic issues. Employees can work on forward-looking forecasts, focusing on more value-added work such as how to make improvements in the supply chain to make production more flexible.

In today's business environment one of the major advantage of 4PL outsourcing is of course the adaption of new technologies. Yüksel & Gerede (2012) state that investments in technology have become risky due to the acceleration of technological developments. By making use of outsourcing, businesses can transfer this risk to the businesses they receive service from and get rid of the costs necessary to monitor technology (Güçlü 2013). Therefore, *Industry 4.0* that has led to a digital overhaul of the producing trade, has paved the manner for 4PL. Today, companies that do not use ITs correctly can face big problems such as inability to control their processes effectively, prolongation or disruption of supply periods, increase in stocks within the system, and failure to ensure integration. The concept of 4PL has emerged on the necessity of information and product flow between 3PL companies and customer companies, integration of ITs and the organization and monitoring of orders. By investing the ability of subtle digital technologies and streamlining supply chain processes, 4PL offers firms a significant competitive edge. By creating use of digital technologies like advanced software system, Big Data, and cloud computing, 4PL's ready to maintain visibility throughout each link within the supply chain and open the lines of communication between firms, facilities, carriers, employees, and different partners – thereby rising visibility, transparency, operations, and productivity. As additional advanced technologies like IoT, automation, robotics, and sensors become additional prevailing within the producing trade, the necessity for a centralized 4PL system can possible become additional acute (Kasperek 2013).

3. Case study of the automotive company's 4PL transition

In this study, transition process of an automotive supplier industry factory is analysed. The analysed automotive company has a global structure since it has warehouses and production centers in different countries in Europe and America. Most of these centers are integrated with each other, that is, a logistics process is followed due to the supply chain between each other. Product and raw material transportation is carried out from common hubs and 70% of the raw materials are imported abroad. In this regard, the highest share in logistics costs is caused by import. This global structure of the company and the rapid increase in the use of foreign resources in the global markets has increased the demands on the logistics function therefore complex supply chains are developed.

However, in the current system, which is 3PLs structure, logistic providers have an interest in utilizing their own equipment and warehousing resources. Company cannot ensure that these providers will choose the most cost and service effective partners. Moreover, SCM employee did not have enough knowledge and experience to carry out this complex structure. Therefore, current system causes some problems in terms of standardization and transparency.

Regarding to the global structure of the company and the problems caused by current state of the system, a transition is needed. It is also aimed to reach reduction in transportation costs by using network synergies and a dedicated planning process. At this point, a switch to 4PL become a strategic decision to be able to manage all logistics costs in a single item and reduce costs by making use of common points. Therefore, outsourcing of the logistics operations became vital in time to survive among the rivals.

In this regard, firstly, current state of the selected automotive company is provided in Section 3.1. Then, the scope of transition with the partnership of 4PL company is clarified. Total transition of the company to 4PL struc-

ture takes 5-months to go live and use it in real terms. For that reason, in this study, as an example of the transition process, TMM and creation of TO are detailed. System changes and transition process of TMM is detailed in Section 3.2. Afterwards, results are presented after the transition is completed with managerial implications in Section 3.3.

3.1. Current state of the company

In the analysed automotive company, currently, production is made in the factory and then shipped to another automotive supplier industry for original equipment manufacturer. The logistics activities are carried out with the forwarder that the company has contracted so; there is no integrated system in between. Current system of the company, which is presented in Figure 4 at "TODAY – as is setup" part of the figure, is basically carried out as follows.

The automotive company sends orders to suppliers via EDI. The suppliers then plan the shipment according to these orders and forecasts. Materials are purchased almost weekly from each supplier but the loading volume of this material may vary. For that reason, the suppliers prepare their materials according to the orders they receive and inform their contracted forwarders. Accordingly, the forwarder finds the necessary vehicle and organizes the shipment. There is no order information for the forwarder. It is obliged to bring only the materials that the supplier has notified. It does not make any optimization. It only organizes shipments according to some predefined master data, including pallet dimensions, stacking rules, and the LDM/barem price ratio, where the LDM represents the floor space occupied by the cargo in the vehicle and the barem defines the corresponding tariff brackets used for pricing. Company is responsible for ordering to supplier, receiving materials from suppliers and performing customs procedures.

However, as stated earlier, current system causes fundamental problems in terms of standardization, transparency, training of employee and costs. For that reason, a model, which is presented in Figure 4 at "FUTURE – central" part of the figure, is formed as a future state via 4PL transition.

In the future state, the customer will be in contact with 4PL company, not with more suppliers. It is the responsibility of 4PL company to receive the materials on time, the necessary vehicle organization and the arrival of the desired EAT. Furthermore, they are responsible for finding and delivering the products in the cheapest and optimal time. 4PL management helps harmonize processes and structure to reduce cost and improve service. In this regard, 4PL company develops TMS in order to coordinate transport as well as accelerate and automate the process of creating TOs for company. The system included both customers (factories, distribution centers, warehouses) and forwarders itself and suppliers, namely the transport companies contracted for individual lines. TMS automatically integrated the customer's order data from SAP into companies' system in certain periods. In this way, the customer's logistics team has neither an extra workforce nor a workload for the supplier. There was no responsibility for the people since the system works automatically, not on contacts.

On the other hand, 4PL transitions are not easy with the users directly provided for the system. Priorities of the 4PL system need to be well understood by the company's supply chain team. Therefore, it is very important to assimilate the difference between the existing system and the new future. In this regard, not only the steps of process but also responsibilities during partnership should be determined initially.

In the Figure 5, everyone's responsibilities in the future state are clearly shown. With this figure 5, the case study has been made to determine the general responsibility framework of individuals and organizations, upon mutual agreement between the selected automotive company and the 4PL company. 4PL company offers:

- integrates IS with logistics activities;
- provides comprehensive services that the customer needs;
- makes outsourcing while providing logistics services;
- selects suppliers and makes agreements;
- improves supply chain processes;
- designs and manages the supply chain and determines supply chain objectives.

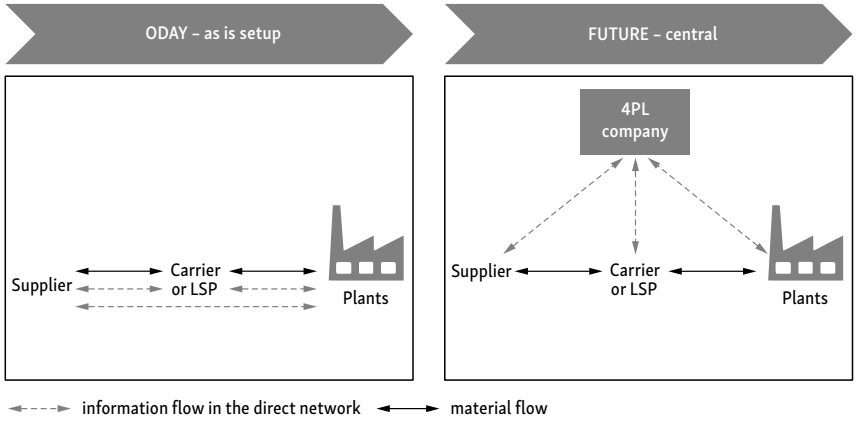

Figure 4. The current operation of the factory and the structure to be formed with 4PL

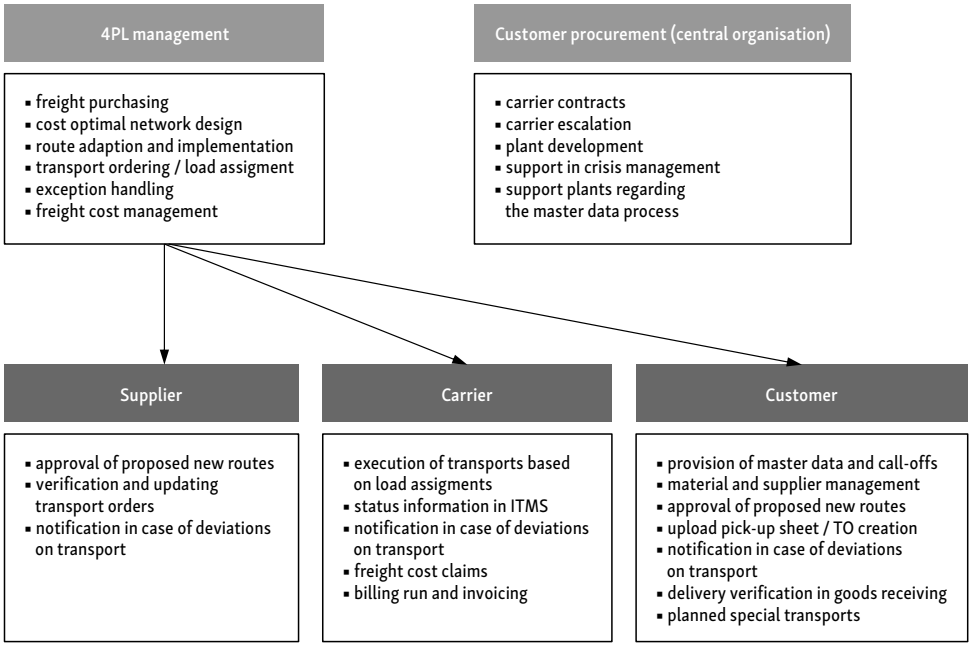

Figure 5. Roles and responsibilities within the ITMS process

In other words, 4PL company is capable of planning, organizing and reporting. Therefore, it shares logistics and cost analysis, provides logistics solutions and consultancy services, examines inventory costs and transportation-related data, improves supply chain processes and analyses, makes recommendations and negotiates in supplier selection.

3.2. Transition steps for TMM

4PL company developed TMS by considering the points where its business partner have problems. The ITMS, which is an IT system with a web-based user interface, consists of a TMM, FM modules but also, the company's plants, suppliers, carriers work with the ITMS. It is a well-known fact that system integration is always one of the biggest challenge in every transition. Therefore, the transition process was comprehensive with many dimensions and the total transition of the company to a 4PL structure took 5-months to go live and use it in real terms. However, in this study, TMM and creation of TO are detailed as an example of the transition process. In a general view of point, initial, scope of the process is determined as follows:

- ***transportation scope***:
  - 135 million € freight spend (2017);
  - ~70 companies location across Europe;
  - FTL, milk runs, intermodal, consolidation network and less than FTL;
  - in-and outbound transports;
  - minor share for overseas shipments;
- ***services scope***: services covering all relevant TM activities, e.g.:
  - network and transport optimization;
  - execution management;
  - cargo claims management;
  - freight purchasing and billing;
  - controlling and reporting;
- ***system scope***:
  - 4PL management with ITMS to support the TM with core modules *4flow Vista®*;
  - internet-based transportation management and freight management;
  - *4flow Vista®* analytics.

In TMM, creation of TOs, release of loads to carrier and documentation of transport status activity are carried out. The main functions of a TMS in terms of TMM are:

- ***order consolidation***: the order management system identifies which PO are often shipped and also the TMS cluster these orders to come up with a consolidated TO;
- ***TO***: the TMS is capable of making and managing TO, which includes all necessary information to plan transports, i.e., article information, packaging, pick-up and delivery location, dates and times, transportation volume in [m^3] as well as weight. It could include inbound transportation demands of a plant for defined business cases. TO can be assigned to multiple loads;
- ***3PL rates storage***: this perform permit service level versus price comparison between totally different suppliers for one transport route, allowing the choice of the foremost price effective service provider;
- ***event and exception management***: to manage events and exceptions on transport standing execution;
- ***key performance indicators***: management reports issuing mensuration 3PL suppliers' performance;
- ***ASN***: containing real quantity info and actual pick-up date.

Order process is presented in Figure 6 below and it is started with entering and order to TMS. This entry should include the date supplier, weight and container information as well. System can be monitored by 4PL company

who can open tenders to other transporters from outside. Therefore, after opening the order a tender is being made in another interface.

An order placed by a client is sent within the TMS system to a transport specialist, identifies the parameters for the supposed "Letter of orders". After, the operator evaluates whether or not the order is standard or customized. 4PL company estimates that 90% of orders received are standard, and thus are assigned automatically to the contracted transport companies in the tender. After assigning to the transport company, appropriate information is sent to it. TMS sends it on to the interface placed at a transport company and as a pdf attachment to email messages within the mailbox of the carrier. On this basis, the carrier delivers the order.

The remaining 10% of orders are known as non-standard cases. Associate example of such an order is also, among others: remarkably large cargo, non-full pallet packaging, and shipping samples to a new client. During this case, the order goes to the inner transport exchange and could be a subject to an extra tender. A unique approach is applied within the case once there are alternative necessities for transportation than those outlined in the tender (e.g., shorter delivery time, another form of movement and others). During this state, a relevant worker contacts a transport company and renegotiates the speed for transport. If negotiations persuade be not pleasing the order goes onto the transport exchange (Underwood, Stoler 2020).

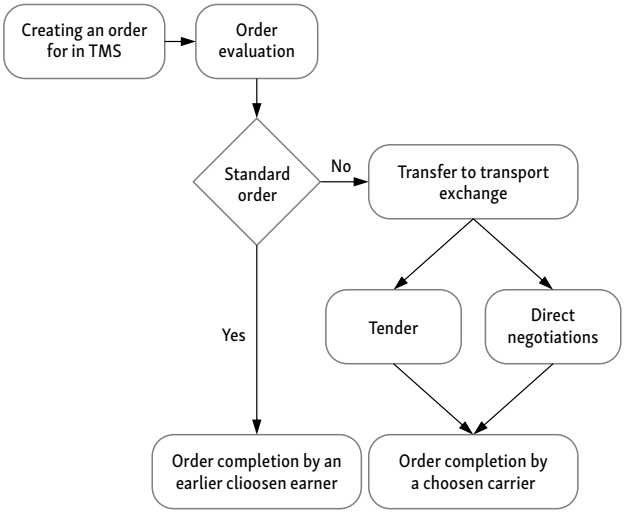

Figure 6. The process of completing an order in 4PL

TMS relies on a dedicated database. This information supports the implementation of every tender. This information provision this database is exported as a file or *Microsoft Excel* file so checked for correctness by the regional operational teams that own the data. Afterward, once verified, the data are foreign into another application – trade extensions, which handles tenders. When the tender method data are re-downloaded to the trade extensions in the form of *Microsoft Excel* file and sent to the finance department. Then following the verification of compliance by the finance manager passed to the TMS team so as to update the information.

The steps in the Figure 7 should be followed to create a TO in the TMS system now. That is, an order-collection order must be given to a system until 11:00 AM at day 2 days prior to collection (48 h) to create a TO. Then a tender is made within 5 h. Then the appropriate shipper is determined within the same day up to 4:00 PM. After 2 days, the products are going to the shipper supplier to gather.

Figure 8 shows how the transactions are step-by-step and who has the responsibilities. There is a pick-up sheet that is uploaded when opening to the system. This file has some required fields to be filled in. These are product code, weight, number of pallets, supplier, information, total day and EAT information, etc.

At the beginning of this project, the client was uploading the pick-up sheet file to the system. In this case, the customer is given authority to those responsible for this work. However, in the later stages of the program, it is actually the responsibility of the suppliers. Because already suppliers can see the customer's orders from the system.

In TMS, they can create an interface within the suppliers and enter the collection information directly from the system. It can of course also be used in another automated system. There will be an inter-system integration.

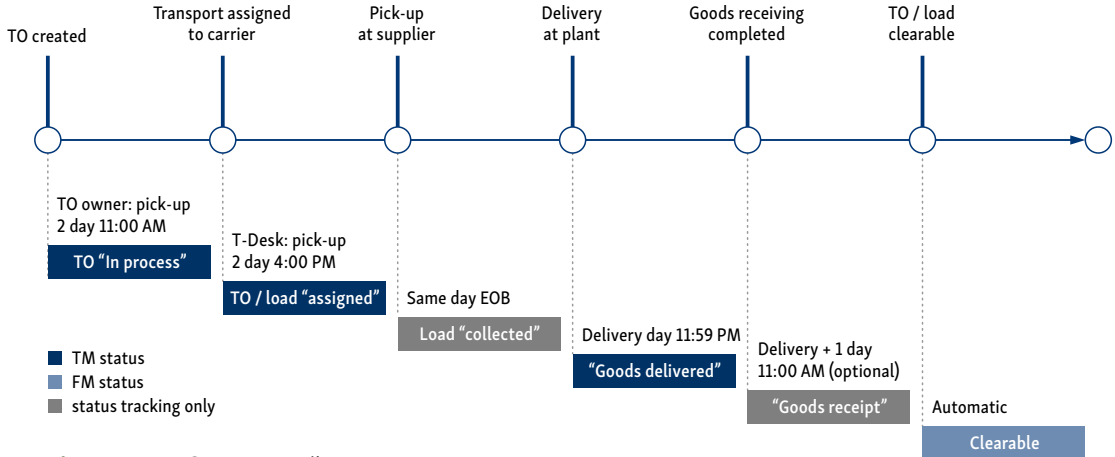

Figure 7. ITMS Process milestones

TO / load status	Status description	Mandatory – process [Y/N]	Mandatory – system [Y/N]	When?	Status trigger	Responsible
TO "In process"	TO has been created and finalized within cut-off time	Y	Y	Pick-up 2 day 11:00 AM	TO finalized	TO owner
TO / load "assigned"	Load has been assigned to the carrier	Y	Y	Pick-up day 2 day 4:00 PM	Transport / load assignment in TMS completed	T-Desk
Load "collected"	Loas has been collected at the cosigner	Y	N	Pick-up day 11:59 PM	Physical pick-up of goods at consignor (e.g., supplier)	Carrier
"Goods delivered"	Load has been delevered at plant	Y	Y	Delivery day 11:59 PM	Physical pick-up of goods at recipient (e.g., plant)	Carrier
"Goods receipt"	Goods receiving at recepient completed (quantity / quality check)	Y	N	Delivery day +1 day 11:00 AM	Goods receiving completed	Plant
Billing case created	TO / load is now available in the FM module	Y	Y	Automatic	Triggered by "Load assigned" status set T-Desk	T-Desk
Attached	TO / load is now available in the FM module	Y	Y	Automatic	Triggered by "Load assigned" status set by carrier	T-Desk
Priced	The price of the TO / load has been calculated	Y	Y	Automatic	Triggered by "Load assigned" status set by carrier	T-Desk
Clearable	The TO / load can be created in the next billing run	Y	Y	Automatic	Fulls: triggered by "Load assigned" Eniplites: set by "Load assigned" status	Fulls: Plant Entities: T-Desk
Carrier	A billing run has been conducted	Y	Y	Automatic	Triggered bu billing run start through carrier	Carrier

TM status FM status status tracking only

Figure 8. Table of steps and responsible for creating TO

The company uses SAP and controls its orders and materials on the way through this system. An integration between SAP and ITMS is established, the order to suppliers is automatically transferred to the ITMS system, the message from which supplier how much material is received and the automatic TO is created.

3.3. Results

In a general manner, using a 4PL lowered transportation cost as it provides with warehouse space and transportation. It regulated global shipping logistical tasks like customs, freight forwarding, and consolidation, which not only saves money in the long run but saves time as well. In a more detailed way, adaptation of an ITMS provide several benefits to the company, which can be sum up as follows:

- standardization of transport ordering by using new ITMS:
  - includes all relevant functionalities for transport ordering;
  - one solution for all transports going to company;
  - easy to use;
- standardization of transports by using defined routes that all parties agreed upon (increased reliability);
- transparency of TOs / loads for company plants, suppliers and carriers;
  - overview of all TOs / loads;
  - search, filter functions, order history;
- exception management coordinated and reported by the t-desk:
  - single point of contact;
  - solution oriented.

In addition to these improvements, company also gains advantages in the rival business environments as follows:

- ***reducing TTM***: in this 4PL implementation, LSP firm is working on optimization completely. In other words, 2 suppliers that are close to each other can be able to plan partially loaded loads as fully loaded trucks. In this case the products are actually normally while partial loading normally in 9 days, this optimization is no longer able arrivals to Turkey with 7 days. Because before, partial loading was done. In partial loads, the products are taken from the supplier 1 or 2 days before loading and collected in a hub warehouse in the middle. Then the truck moved when the truck was full on the shipper's side. Now only the vehicle goes to these 2 designated suppliers. Thus, only one FTL cost is paid instead of 2 separate parcels;
- ***cost savings***: cost reducing is one of the most important reasons for many companies to benefit from outsourcing practices. Since the outsourcing companies provide the same type of service to their existing customers, they can provide that service at lower costs than the businesses in their own business, and this is reflected to the customers at lower costs. In addition, these businesses can receive substantial discounts to their suppliers, as they do a high amount of work annually. By 4PL, costs such as merging orders from multiple companies, transport, customs clearance, material handling, and use resources are managed more efficiently as presented in Figure 9. Sample projects, which are listed in Figure 9, were obtained by changing the stack ability of products and the FQ of ordering. Others are with an FTL loading, which is achieved by combining 2 suppliers that are partially loaded. These projects started using 4PL for the 1st year and already the company's one-year earnings are 243311 €;
- ***productivity***: in this study, the aim of the company in passing 4PL is that they will be able to use their ware-

houses and production centers in the most efficient way by eliminating some logistics processes by using common hubs. To use the existing factory or warehouse and the normally planned shipment with a fuller capacity. That is, to completely fill the transported volume;

- ***inventory turnover ratio***: 4PL partners offer distributors with good opportunities to enhance their client expertise and loyalty, likewise as their revenue and operations. This will be the benefit of using the common hubs mentioned above. That is, moving the stocks in these hubs while shipping them to the requested points, the number of days is no longer the stock, on the contrary, it starts to prepare for the other hub to which it will be shipped when it is out of production or while it is in the warehouse;
- ***ROI***: one of the best ways to evaluate the efficiency of an investment or compare the efficiency of a number of different investments is ROI in which the amount of return on a particular investment, relative to the investment's cost is measured. Basically, to calculate ROI, the benefit (or return) of an investment is divided by the cost of the investment. The result is expressed as a percentage or a ratio (Fernando 2025). In this automotive company in reality, the actual savings and return tend to be closer to 10%, reports Inbound Logistics. Company have an annual income of 243311 €, which is only happens in Turkey is profitability. In fact, when the big picture is examined, the earnings in the global level is more. As stated before, the selected automotive company is a global company. 4PL project actually has not been implemented for only Turkey factory. This project was implemented simultaneously for companies located in all European locations. In this application, the company has a Global freight cost of 135 million € in 2017. (~70 different locations in Europe) The objective of the 4PL company is to determine and realize the cost saving potential of 6.6 million € in 2018 fiscal year. However, this cost include for all European plants of company;
- ***talent management based on competencies***: in literature there are many studies focusing on the positive increases in core competencies of companies with logistic outsourcings (NRC 2000; Patel, Aran 2005; Acartürk, Keskin 2012, König, Spinler 2016). In this case study, after the transition to 4PL structure is completed, the company will no longer be making its time and effort to track the import, export business in logistics, to organize a vehicle for them, to find a 3PL company. Instead, the person following this operation can be focused on the customer thus; customer demands can be examined in more detail. Instead of following up the operation in logistics processes, suppliers can deal with more strategic issues. Employees can work on forward-looking forecasts, focusing on more value-added work such as how to make improvements in the supply chain to make production more flexible.

4. Discussions

In literature, there are many studies that show cost savings by the introduction of a logistics outsourcing as mentioned in Section 2.2. These reductions can depend on various factors such as labour cost reduction, infrastructure investments, variable cost structure or efficiency, etc. In 2017, *Arysta LifeScience Corporation*, a leading agrochemical company (now part of UPL, *https://www.upl-ltd.com*), a leading agrochemical company partnered with CTL to optimize its transportation network and reduce costs. Today, CTL handles *Arysta's* truckload activity around 50...60%

Project	Current stale	Future stale	Plants affected saving – yearly
1	Two single LTL transports	Change to a milkrun with a FQ of 1 per week	
	Current price / transport yearly	Potential price / transport. Potential price per year	
	226476 €	**118800 €**	**107676 €**
2	LTL with a FQ of 1.25 per week and stackability of 1 per week	LTL with a FQ of 1 per week and stackability of 2 per week	
	Current price / transport yearly	Potential price / transport. Potential price per year	
	45300 €	**25284 €**	**25284 €**
3	FTL loading	LTL loading with same carrier	
	Current price / transport yearly	Potential price / transport. Potential price per year	
	124800 €	**103026 €**	**103026 €**
4	LTL with stackability of 1 per week	LTL with stackability of 3 per week	
	Current price / transport yearly	Potential price / transport. Potential price per year	
	14437 €	**7112 €**	**7325 €**
		Total	**243311 €**

Figure 9. Initial savings status and projects planned for the 1st year of the company using 4PL

and over the past year, the provider has helped to optimize inter-plant transfers, resulting in a greater reliance on cost-saving truckload carriers. CTL helped *Arysta* to identify more than 100000 $ in potential savings, including a reduction of 20...25% in truckload expense, and nearly 70000 $ in cost avoidance through better freight auditing (SCB 2017). In another example, Philipp Plein (*https://www.plein.com*), one of Europe's most distinguished and innovative luxury fashion brands, collaborated with 7 bridges that provides an artificial intelligence-driven logistics platform. In 2022, company stated that through their partnership so, the system has saved more than 2 million € a year, approximately 17 times its investment (SCB 2022). Similar real life case studies also provided proof of cost reductions around 10...15% in transportation costs. The successful transition presented in this study is also showed that transition of logistics operations to 4PL structure lowered transportation cost as it provides with warehouse space and transportation. The transition regulated global shipping logistical tasks like customs, freight forwarding, and consolidation, which not only saves money in the long run but saves time as well.

Nowadays, it a well-known fact that advances in science and technology increase the pace of complex supply chain processes and bring about coordination and standardization requirements (Križman, Ogorelc 2010). Enterprises operating in the national and international arena benefit from external sources on more than one subject for their logistics activities. According to Tanyeri & Fırat (2005), most of the businesses meet 60% of their activities and needs from external sources, thus increasing their business efficiency. The activities they receive the most services from; transportation, customs operations, procurement and storage. In this regard, valuing factors such as focusing on their core skills, cost savings, quality service delivery, creating a strategic partnership with the supplier, increasing efficiency and flexibility on processes, providing a competitive advantage, and being able to respond quickly to customers are among the reasons why they prefer logistic outsourcing.

Benefiting from external sources in this field is advantageous for a business that does not see logistics as one of its main activities; achieving customer satisfaction and sustainable competitive advantage depending on the realization of the applications to be carried out both economically and by a more knowledgeable and experienced company. It is also seen from this case study, selected company started to play more active and focused role in the determination of price, mode and offer type of transport as a decision center. This result is in line with the findings in the literature as presented in Section 2.2, that emphasizes the importance of focusing on companies own capabilities with outsourcing.

Wang *et al.* (2021) stated that many consulting companies such as *Deloitte* (*https://www.deloitte.com*) and *Accenture* (*https://www.accenture.com*) provide 4PL services focusing on the mastery of standardized processes and integrating IT into supply chains. In this study, it is also showed that new opportunities for the development started to be identified in a better way in the selected company. After the transition is completed it is seen that managers started to focused on more strategic movements since planning activities are designed and execution of transportation from route planning to loading, to manage all the moving processes of the equipment, to follow the confirmation process, freight inspection and payments is standardized. Therefore, observability and reporting efficiency increases directly, which in turn affects the productivity.

When literature is examined, it is seen that 4PL is especially gained more importance with the global development of e-commerce. Amazon, as one of the world's largest e-commerce platforms, is also one of the most well-known examples of 4PL. Amazon offers a comprehensive 4PL solution, including warehousing, transportation, and inventory management, all under one umbrella. However, unlike Amazon, this expansion in e-commerce also results the emergence of many large and small companies that do not have logistics possibilities and experience and need high-level logistics services in terms of customer satisfaction. Considering the benefits, that outsourcing would provide as mentioned in literature review Section 2.2, 4PL become more important than ever.

In this case study, after the transition is completed processes related to the transport company is optimized and automated. However, as Aydın (2007) stated that companies using outsourcing have chance to change their suppliers as new and more cost-effective technologies develop. In this point, 4PL provides a great chance to companies as stated in Section 2.2. Both 3PLs and 4PLs are often powerful enablers of logistics and supply chain innovation. However, 4PL is one-step further in terms of providing new technological solutions. In this new industrial era, more recently, innovation and new technologies-oriented trends in the logistics sector have started to come to the fore. The main and most popular of them are: IoT, artificial intelligence, robotics, warehouse automation, blockchain, big data and data analytics, cloud computing, autonomous vehicles, elastic logistics. These technologies are created new opportunities not only for the industry but also for logistics operations. The underlying reason is that the success of a company in terms of *Industry 4.0* directly related with its logistics operations since logistics meets the main requirement of industry. From this point of view, innovation management in logistic operations is more important than ever. It is very important to ensure and maintain integration with customers with innovative approaches, whether 3PLs or 4PLs.

In this study, in addition to these improvements, company also gains advantages as mentioned in the results part, which in turn creates a great advantage in the rival business environment. The in-house system is developed by 4PL company and created a great success for company as can be seen from the results. However, company started to invest innovation in fields such as technology and engineering to follow the developments in the automotive industry. The local factory decided to buy a software pro-

gram to request the box inventory at the warehouse in the company with what it won. In addition, the necessary terminal of the warehouse and box, cardboard, etc., decided to spend on packaging materials.

It should be noted that, there are a number of problems faced by businesses in the process of utilizing external resources for their logistics activities. Enterprises may face problems such as loss of control of some jobs (Richardson 2005), increased dependency on outsourcing, conflicts of interest with the supplier, and failure to protect the confidentiality of trade secrets. However, in this study, company already had the 3PL structure thus logistic providers have an interest in utilizing their own equipment and warehousing resources. What is more, in the beginning of the transition process, system is designed to include both customers (factories, distribution centers, warehouses) and forwarders itself and suppliers, namely the transport companies contracted for individual lines. In this way, the customer's logistics team has neither an extra workforce nor a workload for the supplier. There was no responsibility for the people since the system works automatically, not on contacts. Additionally, not only the steps of process but also responsibilities during partnership is determined initially to make system more understandable by the company's supply chain team. Everyone's responsibilities in the future state were clearly shown as stated in Figure 5 and general responsibility framework of individuals and organizations, upon mutual agreement between the selected automotive company and the 4PL company was determined.

5. Conclusions

Nowadays, logistics operations are seen as one of the vital components of the competition. When the factors that are effective in obtaining and maintaining competitive power in the market are analysed, it is seen that the most important factor that is to deliver the product and service to the customer on time. Then the products and services, in turn, have significant effects on the increase of quality, speed, flexibility and efficiency in the logistics operations of the products, and provide benefits in meeting the urgent orders.

The most common type of application observed in providing logistics services from the outside is that the main companies sign contracts with 3PL companies, with performance criteria and standards. In addition, manufacturer companies and 3PL companies can develop their business relationship only by creating a separate company to carry out logistics services. The main reasons for providing logistics services from the outside are reducing costs, focusing on main activities, having advanced logistics opportunities, saving resources, insufficient logistics facilities, development of e-commerce and sharing of risk. However, especially with the global development of e-commerce, the emergence of many large and small companies that do not have logistics possibilities and experience, but need high level logistics services in terms of customer satisfaction, triggered the demand for logistics services and increased the need for 4PL services. In this regard, 4PL concept enabled IT, consultancy and financial service to companies to enter the market. Although the concept of 4PL is relatively new, it offers firms an effective way to manage their supply chains.

In this study a transition steps for transport management is presented as an example of successful 4PL transition of an automotive company. Adaptation of TMS and its interface version ITMS, supported many operations in the company such as transport application, planning, execution and finally reporting. There is an important cost reduction in the company but it is also necessary to consider productivity-enhancing advantages such as route optimization and discounts from large scales. Accessing real-time transport information status, cost analysis, post-transport analysis are increased the observability and reporting of main operations including follow-up processes as well.

It is believed that, this study will be a source for more innovative studies in this field in the future. Moreover, transition to 4PL will be a step to the future studies. It is aimed to focus on 5PL concept in the future studies with investigating the transition of a company to better analyse the advantages of outsourcing logistics operations in *Industry 4.0* era. Recent studies show that, new technologies-oriented trends will create more rapid developments and more widespread usage in outsourcing the logistics operations, since globalization, competitiveness and the international trade created a great impulse in logistic flow.

Acknowledgements

We would like to express our gratitude to the company that carried out the study.

Funding

This research received no external funding.

Author contributions

Conceptualization – *Hülya Döner*, *Özalp Vayvay*, *Pelin Vardarlier* and *Zeynep Tuğçe Kalender*.

Methodology – *Hülya Döner* and *Özalp Vayvay*.

Validation – *Hülya Döner*, *Özalp Vayvay*, *Pelin Vardarlier* and *Zeynep Tuğçe Kalender*.

Writing (draft preparation) – *Hülya Döner* and *Zeynep Tuğçe Kalender*.

Review and editing – *Hülya Döner*, *Özalp Vayvay*, *Pelin Vardarlier* and *Zeynep Tuğçe Kalender*.

Supervision – *Pelin Vardarlier* and *Özalp Vayvay*.

All authors have read and agreed to the published version of the manuscript.

Disclosure statement

The authors declare no conflicts of interest.

References

Acartürk, E.; Keskin, S. 2012. Türkiye'de sağlık sektöründe dış kaynak kullanımı, *Finans Politik ve Ekonomik Yorumlar* 49(574): 109–118. Available from Internet: https://dergipark.org.tr/en/pub/fpeyd/article/607709 (in Turkish).

Ahtamad, M.; Akhsanov, M. 2021. Barriers to the implementation of 4PL in developing countries, *Proceedings of the Hamburg International Conference of Logistics* (*HICL*) 32: 291–315. https://doi.org/10.15480/882.4007

Atsüren, K. 2007. *Lojistik faaliyetlerden depolama alanında dış kaynaklardan yararlanma*. Yüksek lisans tezi. İstanbul Üniversitesi, Türkiye. 179 s. Available from Internet: https://nek.istanbul.edu.tr/ekos/TEZ/43131.pdf (in Turkish).

Aydın, S. Z. 2007. *Tedarik zinciri yönetiminde stratejik ittifak olarak üçüncü parti lojistik*. Doktora tezi. Süleyman Demirel Üniversitesi, Isparta, Türkiye. 194 s. (in Turkish).

Bajec, P. 2009. Evolution of traditional outsourcing into innovative intelligent outsourcing – smartsourcing, *Promet – Traffic & Transportation* 21(2): 93–101.

Bajec, P. 2013. The possibility of developing intelligent logistics outsourcing in Slovenia, *Transport* 28(3): 244–255. https://doi.org/10.3846/16484142.2013.829520

Baker, S. 2025. *The Ultimate List of Outsourcing Statistics*. Available from Internet: https://www.microsourcing.com/learn/blog/the-ultimate-list-of-outsourcing-statistics

Baluch, I. 2005. *Transport Logistics*: *Past*, *Present and Predictions*. Winning Books. 309 p.

Barreto, L.; Amaral, A.; Pereira, T. 2017. *Industry 4.0* implications in logistics: an overview, *Procedia Manufacturing* 13: 1245–1252. https://doi.org/10.1016/j.promfg.2017.09.045

Becket, M. 2022. Why the rise of 4PLs is important to you, *Supply Chain Management Review* 16 September 2022. Available from Internet: https://www.scmr.com/article/why_the_rise_of_4pls_is_important_to_you

Bigelow, L. 2019. *Logistics Outsourcing Trends in 2020*. Available from Internet: https://www.gartner.com/smarterwithgartner/logistics-outsourcing-trends-in-2020

Bragança, P. 2008. *Fouth-Party Logistics*: *a Study on Modern Logistics*. BSc Thesis. Umeå University, Sweden. 80 p. Available from Internet: https://urn.kb.se/resolve?urn=urn:nbn:se:umu:diva-20918

Capgemini. 2016. *2017 Global State of Logistics Outsourcing Study Reveals Evolving Role of Shippers and Logistics Providers*. Capgemini Consulting, Paris, France. Available from Internet: https://www.capgemini.com/us-en/news/2017-global-state-of-logistics-outsourcing-study-reveals-evolving-role-of-shippers-and-logistics-providers

Christopher, M. 2005. *Logistics and Supply Chain Management*: *Creating Value-Adding Networks*. FT Press. 320 p.

CSCMP. 2022. *CSCMP's 33rd Annual State of Logistics Report*. Council of Supply Chain Management Professionals (CSCMP), Washington, DC, US. Available from Internet: https://cscmp.org/CSCMP/Educate/State_of_Logistics_Report.aspx

Çabuk, S.; Demirci Orel, F.; Nakıboğlu, G. 2010. İşletmelerin lojistik süreçlerinde diş kaynak kullanimlari: ISO 500 işletmelerinde bir araştirma, *Fırat Üniversitesi Sosyal Bilimler Dergisi* 20(2): 253–268. Available from Internet: https://dergipark.org.tr/en/pub/firatsbed/article/565860 (in Turkish).

Çakırlar, H. 2009. *İşletmelerin lojistik faaliyetlerinde dış kaynak kullanımı*: *Trakya Bölgesinde faaliyet gösteren işletmeler üzerinde bir inceleme*. Yüksek lisans tezi. Trakya Üniversitesi, Türkiye. (in Turkish).

Diem, T. L. T.; Chromjaková, F.; Quang, V. D. 2023. Transformation into 4PL: the case of local logistics service providers in Vietnam, *Journal of Eastern European and Central Asian Research* (*JEECAR*) 10(2): 311–325. https://doi.org/10.15549/jeecar.v10i2.1018

Dinitzen, H. B.; Bohlbro, D. 2010. *Value-Added Logistics in Supply Chain Management*. Academica. 254 p.

Fadile, L.; El Oumami, M.; Beidouri, Z. 2018. Logistics outsourcing: a review of basic concepts, *International Journal of Supply Chain Management* 7(3): 53–69. Available from Internet: https://ojs.excelingtech.co.uk/index.php/IJSCM/article/view/1907

Fernando, J. 2025. What is return on investment (ROI) and how to calculate it, *Investopedia* 9 June 2025. Available from Internet: https://www.investopedia.com/terms/r/returnoninvestment.asp

Gattorna, J.; Ogulin, R.; Selen, W. 2004. An empirical investigation of 3rd and 4th party logistics provider practices, in *Proceedings of the 2nd ANZAM Operations Management Symposium*, 17–18 June 2004, Melbourne, Victoria, Australia, 1–23.

Giusti, R.; Manerba, D.; Bruno, G.; Tadei, R. 2019. Synchromodal logistics: an overview of critical success factors, enabling technologies, and open research issues, *Transportation Research Part E*: *Logistics and Transportation Review* 129: 92–110. https://doi.org/10.1016/j.tre.2019.07.009

Godsmark, J.; Richards, G. 2019. *The Logistics Outsourcing Handbook*: *a Step-by-Step Guide from Strategy Through to Implementation*. Kogan Page. 384 p.

Grand View Research. 2025. *Business Process Outsourcing Market* (*2025–2030*). Grand View Research, Inc. Available from Internet: https://www.grandviewresearch.com/industry-analysis/business-process-outsourcing-bpo-market

Güçlü, A. 2013. *Dış Kaynak Kullanımı* (*Outsourcing*) *ve Vergilendirilmesi*. Seçkin Yayıncılık. 216 s. (in Turkish).

Hamilton, J. R. 2004. E-logistics comparative positioning model: a multi-national enterprise airline study, in *Proceedings of the Fourth International Conference on Electronic Business* (*ICEB2004*), 5–9 December 2004, Beijing, China, 93–100. https://aisel.aisnet.org/iceb2004/28

Hasan, S. F.; Siddique, N.; Chakraborty, S. 2013. *Intelligent Transport Systems*: *802.11-Based Roadside-to-Vehicle Communications*. Springer. 152 p. https://doi.org/10.1007/978-1-4614-3272-2

Hofman, W. 2015. Towards a federated infrastructure for the global data pipeline, *Lecture Notes in Computer Science* 9373: 479–490. https://doi.org/10.1007/978-3-319-25013-7_39

Hosie, P.; Sundarakani, B.; Tan, A. W. K.; Koźlak, A. 2012. Determinants of fifth party logistics (5PL): service providers for supply chain management, *International Journal of Logistics Systems and Management* 13(3): 287–316.

Ibrahim, S. E.; Ogunyemi, O. 2012. The effect of linkages and information sharing on supply chain and export performance: an empirical study of Egyptian textile manufacturers, *Journal of Manufacturing Technology Management* 23(4): 441–463. https://doi.org/10.1108/17410381211230394

Ivaschenko, A. 2014. Multi-agent solution for business processes management of 5PL transportation provider, *Lecture Notes in Business Information Processing* 170: 110–120. https://doi.org/10.1007/978-3-319-06065-1_7

Jharkharia, S.; Shankar, R. 2007. Selection of logistics service provider: an analytic network process (ANP) approach, *Omega* 35(3): 274–289. https://doi.org/10.1016/j.omega.2005.06.005

Ji, G. 2007. Closed-loop supply chain system performance evaluation by using exergoeconomics and extenics, in *2007 International Conference on Service Systems and Service Management*, 9–11 June 2007, Chengdu, China, 1–7. https://doi.org/10.1109/icsssm.2007.4280244

Jiang, B.; Frazier, G. V.; Prater, E. L. 2006. Outsourcing effects on firms' operational performance: an empirical study, *International Journal of Operations & Production Management* 26(12): 1280–1300. https://doi.org/10.1108/01443570610710551

Kalkan, B.; Aydın, K. 2019. Dördüncü parti lojistik hizmet sağlayıcılarının yetenek boyutlarına ilişkin bir çalışma, *Alphanumeric Journal* 7(3): 59–70. https://doi.org/10.17093/alphanumeric.504416 (in Turkish).

Kapıcı, S. 2019. *Tedarik zinciri yönetiminde dış kaynak kullanımının işletmeler üzerine etkileri*: *İzmir ilinde bir araştırma*. Doktora tezi. İnönü Üniversitesi, Türkiye. (in Turkish).

Karahan, A. 2009. Diş kaynak kullaniminin verimlilik üzerine etkisi hastane yöneticileri üzerine bir araştirma, *Balıkesir Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 12(21): 185–199. Available from Internet: https://dergipark.org.tr/en/pub/baunsobed/article/648007 (in Turkish).

Kasperek, M. 2013. Operating model of a 4PL provider, *Journal of Economics & Management* 12: 23–44.

Kavčič, K.; Suklan, J.; Milost, F. 2016. Outsourcing logistics activities: evidence from Slovenia, *Promet – Traffic & Transportation* 28(6): 575–581.

Kiggell, L. S.; Kilbourn, P. J.; Heyns, G. J. 2021. Sustainable cost reductions obtained by using a fourth party logistics provider, *Journal of Transport and Supply Chain Management* 15: a606. https://doi.org/10.4102/jtscm.v15i0.606

Križman, A.; Ogorelc, A. 2010. Impact of disturbing factors on cooperation in logistics outsourcing performance: the empirical model, *Promet – Traffic & Transportation* 22(3): 209–218. https://doi.org/10.7307/ptt.v22i3.277

König, A.; Spinler, S. 2016. The effect of logistics outsourcing on the supply chain vulnerability of shippers: development of a conceptual risk management framework, *The International Journal of Logistics Management* 27(1): 122–141. https://doi.org/10.1108/ijlm-03-2014-0043

Li, S.-T.; Shue, L.-Y. 2003. A study of logistics infomediary in air cargo tracking, *Industrial Management & Data Systems* 103(1): 5–13. https://doi.org/10.1108/02635570310456841

LODER. 2021. *Logistics Terms*. Lojistik Derneği (LODER), Istanbul, Turkey. Available from Internet: https://www.loder.org.tr

Mazzanti, M.; Montresor, S.; Pini, P. 2007. Outsourcing and innovation: evidence for a local production system of Emilia-Romagna, *Innovation*: *Organization & Management* 9(3–4): 324–342. https://doi.org/10.5172/impp.2007.9.3-4.324

NRC. 2000. *Outsourcing Management Functions for the Acquisition of Federal Facilities 2000*. National Research Council (NRC). National Academies Press. Available from Internet: https://www.nationalacademies.org/publications/10012

Oğultürk, M. C. 2011. Lojistik hizmetlerin özelleştirilmesi kapsamında Türk Silahlı Kuvvetleri'nde dış kaynak kullanımı ve özel askerî şirketler, *Güvenlik Stratejileri Dergisi* 11(22): 167–194. Available from Internet: https://dergipark.org.tr/tr/pub/guvenlikstrtj/article/614272 (in Turkish).

Orkestra. 2022. *Cost Savings in Logistics & Supply Chain by Leveraging Visibility Platforms*. Orkestra SCS Inc., Toronto, Canada. Available from Internet: https://www.orkestrascs.com/blogs/how-to-achieve-sustainable-cost-savings-in-logistics-through-technology

Özdemirel, B. 2004. *Lojistik hizmetlerinin dişaridan sağlanmasi ve 4PL kavrami*. PhD Thesis. İstanbul Teknik Üniversitesi, Türkiye, 149 s. Available from Internet: http://hdl.handle.net/11527/5955 (in Turkish).

Panko, R. 2019. *Small Business Outsourcing Statistics in 2019*. Clutch, Washington, DC, US. Available from Internet: https://clutch.co/resources/small-business-outsourcing-statistics-in-2019

Pavlić Skender, H.; Mirković, P. A.; Prudky, I. 2017. The role of the 4PL model in a contemporary supply chain, *Pomorstvo* 31(2): 96–101. https://doi.org/10.31217/p.31.2.3

Patel, A. B.; Aran, H. 2005. *Outsourcing Success*: *the Management Imperative*. Palgrave Macmillan. 203 p.

Rajesh, R.; Ganesh, K.; Pugazhendhi, S. 2013. Drivers for logistics outsourcing and factor analysis for selection of 3PL provider, *International Journal of Business Excellence* 6(1): 37–58.

Razzaque, M. A.; Sheng, C. C. 1998. Outsourcing of logistics functions: a literature survey, *International Journal of Physical Distribution & Logistics Management* 28(2): 89–107 https://doi.org/10.1108/09600039810221667

Richardson, H. 2005. What are you willing to give up?, *Material Handling & Logistics* (*MH&L*), 15 March 2005. Available from Internet: https://www.mhlnews.com/transportation-distribution/article/22038559/what-are-you-willing-to-give-up

Rushton, A.; Croucher, P.; Baker, P. 2014. *The Handbook of Logistics and Distribution Management*: *Understanding the Supply Chain*. Kogan Page. 720 p.

Rushton, A.; Walker, S. 2007. *International Logistics and Supply Chain Outsourcing*: *From Local to Global*. Kogan Page. 424 p.

SCB. 2022. Enhancing the customer experience while boosting cost savings, *Supply Chain Brain* (SCB), 8 August 2022. Available from Internet: https://www.supplychainbrain.com/articles/35458-enhancing-the-customer-experience-while-boosting-cost-savings

SCB. 2017. How *Arysta LifeScience* got control of its spiraling logistics costs, *Supply Chain Brain* (SCB), 16 August 2017. Available from Internet: https://www.supplychainbrain.com/articles/26589-how-arysta-lifescience-got-control-of-its-spiraling-logistics-costs

Sharma, M.; Luthra, S.; Joshi, S.; Kumar, A.; Jain, A. 2023. Green logistics driven circular practices adoption in *Industry 4.0* era: a moderating effect of institution pressure and supply chain flexibility, *Journal of Cleaner Production* 383: 135284. https://doi.org/10.1016/j.jclepro.2022.135284

Sheffi, Y. 2007. *The Resilient Enterprise*: *Overcoming Vulnerability for Competitive Advantage*. MIT Press. 352 p.

Skender, H. P.; Host, A.; Nuhanović, M. 2016. The role of logistics service providers in international trade, in *Proceedings of the 16th International Scientific Conference Business Logistics in Modern Management*, 13 October 2016, Osijek, Croatia, 21–37. Available from Internet: https://ojs.srce.hr/index.php/plusm/article/view/4667

Srabotic, A.; Ruzzier, M. 2012. Logistics outsourcing: lessons from case studies, *Managing Global Transitions* 10(2): 205–225.

Statista. 2025. *Fourth-Party Logistics* (*4PL*) *Market Size from 2018 to 2027*. Available from Internet: https://www.statista.com/statistics/992952/fourth-party-logistics-market-size-worldwide

Tanyeri, M.; Fırat, A. 2005. Rekabet Değişkeni Olarak Dış Kaynak Kullanımı (Outsourcing), *Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 7(3): 268–279. (in Turkish).

Tsai, C.-A.; Ho, T.-H.; Lin, J.-S.; Tu, C.-C.; Chang, C.-W. 2021. Model for evaluating outsourcing logistics companies in the COVID-19 pandemic, *Logistics* 5(3): 64. https://doi.org/10.3390/logistics5030064

Tunç, H.; Kaya, M. 2016. İşletmelerin dış satım faaliyetlerini artırmada lojistikte dış kaynak kullanımının rolü: bölgesel bir uygulama, *Mehmet Akif Ersoy Üniversitesi Sosyal Bilimler Enstitüsü Dergisi* 8(15): 357–368. Available from Internet: https://dergipark.org.tr/tr/pub/makusobed/article/260832 (in Turkish).

Underwood, M.; Stoler, M. 2020. *2020 Global Outsourcing Survey*: *Outsourcing Trends and Strategies Shaping the Future*. Deloitte Touche Tohmatsu Limited (DTTL). Available from Internet: https://www.deloitte.com/global/en/services/consulting/perspectives/gx-global-outsourcing-survey.html

Van Hoek, R. I. 2006. Foreword, *International Journal of Physical Distribution & Logistics Management* 36(6): 417–417. https://doi.org/10.1108/ijpdlm.2006.00536faa.001

Vasiliauskas, A. V.; Jakubauskas, G. 2007. Principle and benefits of third party logistics approach when managing logistics supply chain, *Transport* 22(2): 68–72. https://doi.org/10.3846/16484142.2007.9638101

Visser, E. J. 2004. Developing 4th party services: empirical evidence on the relevance of dynamic transaction-cost theory for analysing a logistic system innovation, in C. J. Ruijgrok, R. H. J. Rodenburg (Eds.), *Bijdragen Vervoerslogistieke Werkdagen* 1: 61–86.

Vivaldini, M.; Pires, S.; De Souza, F. B. 2008. Collaboration and competition between 4PL and 3PL: a study of a fast-food supply chain, *Journal of Operations and Supply Chain Management* 1(2): 17–29. https://doi.org/10.12660/joscmv1n2p17-29

Wang, H.; Huang, M.; Ip, W. H.; Wang, X. 2021. Network design for maximizing service satisfaction of suppliers and customers under limited budget for industry innovator fourth-party logistics, *Computers & Industrial Engineering* 158: 107404. https://doi.org/10.1016/j.cie.2021.107404

Win, A. 2008. The value a 4PL provider can contribute to an organisation, *International Journal of Physical Distribution & Logistics Management* 38(9): 674–684. https://doi.org/10.1108/09600030810925962

Yüksel, S.; Gerede, E. 2012. Türkiye'de havaaracı bakım faaliyetlerinde dış kaynak kullanımı üzerine bir araştırma, *Eskişehir Osmangazi Üniversitesi İktisadi ve İdari Bilimler Dergisi* 7(1): 121–153. (in Turkish).

Zengingelebi, Ö. 2013. *Lojistik dış kaynak kullanımının işletmenin rekabet gücüne etkisi*. Yüksek lisans tezi. Maltepe Üniversitesi, Türkiye. (in Turkish).

Zimon, D.; Urbaniak, M.; Madzík, P.; Prokopiuk, I. 2022. Supply chain quality management (SCQM) literature review and model proposal in the era of *Industry 4.0*, *International Journal for Quality Research* 16(4): 1283–1296. https://doi.org/10.24874/ijqr16.04-21