



# Real-Time Shipment Tracking through IT-Enabled Systems and Electronic Logistics Marketplaces

**Andreja Habjan**

*NOA School for transport and logistics, Slovenia*

## Abstract

**Background:** This case study illustrates the journey of a medium-sized transport firm in improving cross-organizational processes within a demand-driven supply chain through automated information exchange, connected IT-enabled systems, and the Electronic Logistics Marketplace (ELM). **Objectives:** Both parties (carrier and manufacturer-shipper) experienced positive changes reflected through a decrease in loading and unloading waiting times, better organization of processes in the client's warehouse, less workforce needed to handle loading and unloading, decreased workload for dispatchers in the Transport Department, better management of the COVID-19 restrictions, etc. **Methods/Approach:** This research uses a case study approach. Within a single case study, evidence is gathered from multiple internal and external sources. A thorough case study protocol was also developed to ensure a transparent chain of evidence. **Results:** This case study illustrates the critical role of IT-enabled information systems and ELMs in connecting cross-organizational processes to enable real-time shipment tracking. The study highlights the optimization of invoicing and document handling processes. The study also emphasizes the increased flexibility that logistics companies can achieve when equipped with real-time data. Finally, the study advocates greater investment in integrating demand-driven supply chain processes with available IT infrastructure. **Conclusions:** This in-depth case study underscores the critical roles of process transformation and the strategic deployment of IT-enabled information in facilitating enhanced collaboration with business partners in a demand-driven supply chain.

**Keywords:** IT-enabled information; electronic logistics marketplace; transportation; cross-organizational processes

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## Introduction

Transportation is a cornerstone of European integration and vital to the free movement of individuals, services, and goods. Transport is also a major contributor to the economy, representing more than 9% of EU gross value added (the contribution to the economy). In 2022, 6.1 million people in the EU worked in the transport sector. Nine in every ten (89.6 %) people employed in transport worked in land transport (such as road or rail), 5.6 % in air transport, and 4.8 % in water transport (European Commission, 2021). Due to globalization, road freight logistics has become an essential part of the supply chain, and many freight logistics service providers have realized the importance of IT-enabled information that can help manufacturers, warehouses, shippers, carriers, and retailers to communicate with each other more efficiently (Orji, Kusi-Sarpong, Huang, & Vazquez-Brust, 2020). By enabling improved information availability, information sharing, and control of the transport service, transport companies invest heavily in Information technologies (Yu, Huo, & Zhang, 2021). Industrial marketing studies have long emphasized the positive impact of utilizing IT-enabled information in customer-provider relationships (Kim, Pae, Han, & Srivastava, 2010). Information-focused capabilities, such as information sharing and information usability, appear to shape long-term supply chain relationships (Zhao et al., 2001).

Many scholars have demonstrated the importance of IT-enabled information in coordinating planning and control activities to deliver effective logistics services between supply chain partners (Asamoah, Agyei-Owusu, Andoh-Baidoo, & Ayaburi, 2021). For example, the use of Electronic Data Interchange (EDI) in logistics has been found to improve efficiency, service quality, and reduce costs (Zhao et al., 2001). Additionally, the deployment of the right IT systems may enable agile processes in customer interactions with firms, thereby helping proactively manage customer information (Sambamurthy, Bharadwaj, & Grover, 2003). Moreover, firms with better IT planning and integration are more effective at managing IT to improve customer service and, thus, at managing customer relationships (Foltean, Trif, & Tuleu, 2019). IT-enabled information provided by logistics providers can also influence customer perceptions of logistics service quality (Gunasekaran, Subramanian, & Papadopoulos, 2017).

In a demand-driven supply chain, where transport is a cornerstone, firms invest heavily in IT-enabled information systems, with Global Positioning Systems (GPS) as the core system supporting business processes. The integration of GPS technology into transportation has significantly enhanced efficiency, safety, and real-time decision-making. Recent scholarly work highlights GPS as a foundational information technology in this sector. For instance, a 2023 study by Spravil et al introduced a method for detecting maritime GPS spoofing attacks based on NMEA sentence integrity monitoring, underscoring the critical role of GPS in ensuring navigational safety. In the realm of intelligent transportation systems (ITS), GPS enables real-time data acquisition, which is essential for traffic management and infrastructure planning. An overview by researchers on innovative transportation technologies emphasized the pivotal role of GPS in enabling applications such as traffic management, logistics, parking systems, and safety measures (Oladimeji, Gupta, Kose, Gundogan, Ge, & Liang, 2023). In public transportation systems, the use of artificial intelligence highlights how GPS data, combined with AI, can improve efficiency and user satisfaction by optimizing routes and schedules (Jevinger, Zhao, Persson, & Davidsson, 2024). Additionally, GPS data is instrumental in transportation research, enabling the detection of commuting patterns and transportation modes (Tzika-Kostopoulou, Nathanail, & Kokkinos, 2024). Finally, integrating GPS-enabled information with a transport firm's Transport Management System (TMS) (spanning

operational planning, statistics, and personnel management) enables more accurate and timely operational decisions (Habjan, Andriopoulos, & Gotsi, 2014).

In demand-driven supply chains, the use of Electronic Logistics Marketplaces (ELMs) has spread over the last decade. The growing complexity of supply chains demands real-time shipment tracking to enhance visibility and decision-making (Ivanov, Dolgui, & Sokolov, 2019). ELMs, supported by IT-enabled systems, serve as platforms for integrating participants, yet their adoption remains inconsistent across organizations (Verdouw et al, 2016). This inconsistency stems from a limited understanding of their operational dynamics and the benefits they offer. ELMs enable resource sharing, freight matching, and communication among logistics partners, which are crucial for real-time shipment tracking (Núñez-Merino et al, 2020). However, studies often analyze ELMs in isolation rather than as part of a larger IT-enabled ecosystem (Kamble, Gunasekaran, Gawankar, 2020). Data security and trust are significant barriers to the adoption of IT-enabled systems and ELMs, particularly in real-time tracking (Tijan et al, 2019). While some studies address technical aspects of data protection, the role of trust in cross-organizational collaboration remains underexplored (Reis et al, 2018).

Theoretical frameworks dominate research on IT-enabled logistics and ELMs, but empirical studies demonstrating their real-world application remain scarce (Jahani, Jain, & Ivanov, 2023). This is particularly evident in case studies that illustrate how these technologies transform cross-organizational processes. Additionally, there is a lack of longitudinal studies that capture the evolving roles of IT-enabled systems and ELMs in addressing real-time tracking challenges in a demand-driven supply chain. Moreover, insights into how IT-enabled systems and ELMs can be strategically deployed to achieve real-time shipment tracking across organizations (Kamble et al, 2020) are also sparse. This case study, thus, serves as a critical example to address the outlined research gaps by addressing the following research question:

- RQ1. How do IT-enabled systems and Electronic Logistics Marketplaces (ELMs) support the integration of cross-organizational processes for real-time shipment tracking in a demand-driven supply chain?

By exploring aspects such as interoperability, trust, and strategic alignment, future research can generate practical insights to enhance logistics efficiency and transparency.

The remainder of the paper is structured as follows: Section 2 provides an overview of the literature about the role of ELMs in Transportation and the use of IT-enabled information in Demand-Driven Supply Chain Management. Section 3 outlines the measures implemented to transform the transport process. Section 4 presents the outcomes of integrating with the ELM and GPS technologies. Finally, Section 5 offers a reflective analysis of the key insights and lessons derived from this case study.

## Literature review

This section reviews the relevant literature on IT-enabled logistics, electronic logistics marketplaces (ELMs), and cross-organizational integration in demand-driven supply chains. The aim is to contextualize the research within existing theoretical and empirical frameworks.

### *Role of electronic logistics marketplaces in transportation*

Electronic Logistics Marketplaces (ELMs) have become integral to modern supply chain management, serving as digital platforms that connect shippers, carriers, and other stakeholders to facilitate efficient logistics operations (Wang et al, 2007). Over the past two decades, significant research has been conducted to understand the

development, functionalities, and impact of ELMs on the logistics and transportation industry (Wang et al, 2009; Loro & Mangiaracina, 2022).

According to Zhang, Yu, and Liu (2008), ELMs are Internet-based platforms that facilitate transactions and interactions between logistics buyers and sellers. Furthermore, Wang et al (2007) add that ELM is a specific EM model that acts as an intermediary facilitating the exchange of logistics services. Finally, Andres Figliozzi, et al. (2003) state that ELM is a specific business-to-business electronic marketplace (EM) model applied to the logistics industry. Linking shippers and carriers across the country in real time and expanding market reach, transportation marketplaces bring logistics parties closer together to assure optimal market conditions. The ELM establishes a structured environment with clear rules and parameters, facilitating information exchange and seamless transactions between carriers and shippers (Andres Figliozzi et al, 2003). Early Electronic Logistics Marketplaces (ELMs), such as [www.teleroute.com](http://www.teleroute.com), initially operated as open platforms, exhibiting characteristics similar to generic open Electronic Marketplaces (EMs). These platforms facilitated many-to-many transactions and employed both fixed and dynamic pricing models (Gosain & Palmer, 2004). While open ELMs offered advantages such as reduced search and coordination costs, there has been a growing need—particularly among shippers—to maintain established relationships with preferred business partners (Qizhi Dai, 2002). In response, the development of closed ELMs has emerged, shifting the focus away from high transaction volumes toward fostering long-term relational networks and enhancing service offerings.

Wang et al (2007) conducted a comprehensive evaluation of ELMs, focusing on closed systems based on long-term relationships between shippers and carriers. Their study identified key attributes related to processes, relationships, and technology, emphasizing the potential of ELMs to optimize supply chain networks and enable tailored logistics solutions. In a subsequent study, Wang et al (2009) assessed the role of ELMs within supply chains, discussing their influence on transaction methods, relationship formation, and supply chain structuring. Additionally, Zhang et al (2008) highlighted that ELMs could significantly impact profit flows and operational efficiency by providing a centralized platform for logistics coordination. They suggest two options: firstly, the large volume of carrier routine information is an advantage for ELMs in helping carriers set up a collaborative logistics network; and secondly, ELM alliances focusing on different logistics markets to support multimodal transportation services and integrate different carriers into a single shipment. Moreover, they enable greater collaboration among shippers and carriers through demand bundling, enhanced service offerings, and cost efficiencies (Andres Figliozzi et al, 2003; Yu, Wang, Zhong, & Huang, 2016). Liu, Yeoh, Qu, and Gao (2022) further explored the integration of blockchain technology with digital twin systems in ELMs, proposing a framework to enhance data management, security, and transparency in supply chain operations. Their research suggested that such integration could lead to more resilient and efficient logistics marketplaces.

Additionally, Vincze, Karovič Jr., and Kavalets (2022) analyzed the efficiency of transport management within ELMs, emphasizing the role of information and communication technology in facilitating information flow between transport companies and customers. Their findings indicated that ELMs contribute to more efficient transport management by enhancing information exchange and decision-making processes. Furthermore, Huang (2024) examined the evolution of e-commerce logistics planning, integrating embedded technology and ant colony algorithms to enhance the efficiency of logistics operations. This study demonstrated

that advanced computational techniques could improve route planning and overall logistics performance within ELMs.

In conclusion, the literature over the past two decades underscores the transformative role of Electronic Logistics Marketplaces in enhancing supply chain efficiency, collaboration, and technological integration. The continuous evolution of ELMs, driven by advancements in digital technologies, presents opportunities for further research and development to address emerging challenges and optimize logistics operations (Yu et al., 2017; Tseng & Liao, 2015; Tiwari, 2021). Consistent with these findings, we propose the following research hypothesis:

- H1: The integration of Electronic Logistics Marketplaces (ELMs) with firms' internal information systems facilitates IT-enabled information, which substantially enhances interfirm operational efficiency and process coordination.

### *IT-enabled information in demand-driven supply chain Management*

Research indicates that IT has transformed traditional logistics and supply chains, delivering numerous benefits, including enhanced efficiency and responsiveness (Gunasekaran & Ngai, 2004; Subramanian, Abdulrahman, & Zhou, 2014). The integration of Information Technology (IT) into Supply Chain Management (SCM) has significantly enhanced operational efficiency, real-time visibility, and collaboration among stakeholders (Neubert et al, 2004; Longo et al, 2019). Moreover, scholars increasingly proposed that IT capability enables the utilization of IT-enabled quality information (Popovič, Hackney, Coelho, & Jaklič, 2012). IT-enabled systems facilitate seamless information flow, streamline processes, and support data-driven decision-making across the supply chain (Habjan et al, 2014). For instance, the use of IT in supply chain management has been shown to improve coordination and reduce costs, thereby enhancing overall performance (Arora et al, 2011). Advances in IT-enabled information have also affected the way transportation fleets are operated and managed. More quality information about the current and future status of the fleet and demand can highly improve the efficiency of fleet operations (Hyland & Mahmassani, 2018).

Advanced technologies such as the Internet of Things (IoT), blockchain, and big data analytics have further strengthened IT-enabled SCM (Lin & Wang, 2024). IoT devices enable real-time tracking of goods, improving inventory management and reducing delays (Tan & Sidhu, 2022). Blockchain technology provides secure, transparent transaction records, fostering trust among supply chain participants. For example, Kshetri (2018) discusses the various mechanisms by which blockchain helps to achieve the supply chain objectives, including cost, quality, speed, dependability, risk reduction, sustainability, and flexibility. His work presents early evidence that blockchain use in supply chain activities increases transparency and accountability. Moreover, big data analytics enables predictive insights, optimizing demand forecasting and resource allocation (Wang et al., 2016). These technologies collectively contribute to more agile and responsive supply chains (Dong et al, 2009; Ajayi & Udeh, 2024). Big data analytics has likewise developed tools and techniques to support data-driven supply chain decisions (Govindan, Cheng, Mishra, & Shukla, 2018). Analyzing and interpreting results in real time can help enterprises make better, faster decisions to meet customer requirements (Waller & Fawcett, 2013). Big data can be used effectively for logistics planning, production planning, and scheduling (Zhong, Newman, Huang, & Lan, 2016).

However, implementing IT-enabled systems in supply chain management is not without challenges. Issues such as data quality, system integration, and user adoption

can hinder the effectiveness of these technologies (Seymour & Koopman, 2022). Research indicates that suppliers' perceived use of IT-enabled information significantly influences customer satisfaction in B2B markets, underscoring the importance of effective IT integration (Habjan, 2023). Additionally, the role of information quality in road transport operations has been explored, emphasizing its impact on decision-making and operational performance (Al-Talib et al, 2025; Kuberkar & Singhal, 2020). Moreover, Koçoğlu et al (2011) examine the influence of supply chain integration on information sharing and supply chain performance, highlighting that effective integration fosters improved communication and collaboration among partners. This integration is crucial for aligning interfirm processes, enabling real-time data exchange, and facilitating informed decision-making.

Our primary focus is the transportation sector, highlighting the need for real-time acquisition of critical information to ensure that implemented infrastructure remains robust and highly responsive (Mendes, Leal, & Thomé, 2016). Adaptability of real-time information enables swift adjustments to dynamic fluctuations in supply and demand, thereby enhancing operational efficiency and resilience (Chi, Huang, & George, 2020). This new trend, which is becoming a crucial paradigm in supply chain management, is the so-called demand-driven supply chain (Chi et al., 2020). It is "a system of coordinated technologies and processes that senses and reacts to real-time demand signals across a network of customers, suppliers, and employees" (Stern & Deimler, 2012). To enhance the responsiveness of demand-driven supply chain to fluctuations in demand, four critical enablers have such as, comprehensive visibility of information across the supply chain, a resilient and agile infrastructure capable of swiftly adapting to short-term variations in supply and demand, seamless coordination among stakeholders to ensure operational efficiency and cost-effectiveness, and the strategic optimization of overall supply chain performance to deliver superior client services while simultaneously maximizing financial outcomes, have been identified (Chi et al, 2020). Furthermore, achieving an efficient, demand-driven supply chain requires addressing the lack of transparency among stakeholders, a key factor that delays responses to disruptions (Giusti, Manerba, Bruno, & Tadei, 2019). In conventional supply chains, information dissemination follows a sequential path from one stakeholder to another, often resulting in delays as it traverses multiple intermediaries. Conversely, an effective demand-driven supply chain requires real-time information exchange among all stakeholders to ensure swift, efficient updates (Tavasszy, Behdani, & Konings, 2017).

Finally, while IT-enabled information systems offer substantial benefits for demand-driven supply chain management, including improved efficiency and collaboration, organizations must address implementation challenges to fully realize their potential. Ongoing advancements in technology and a focus on effective integration strategies are essential for leveraging IT in modern demand-driven supply chains. To summarize, we propose the research hypothesis:

- H2: Use of IT-enabled information in cross-organizational processes in a demand-driven supply chain facilitates improved operational efficiency and collaboration among all stakeholders.

In summary, the reviewed literature highlights the growing relevance of IT-enabled systems and Electronic Logistics Marketplaces (ELMs) in enhancing visibility, coordination, and responsiveness across supply chains. However, existing research has primarily focused on conceptual models or isolated technological components, with limited empirical evidence on how these solutions function in practice across cross-organizational settings. This study seeks to address that gap by exploring the

integration of IT-enabled information in real-time shipment tracking through a detailed case study in a demand-driven logistics environment.

## Methodology

This study adopts a qualitative case study methodology to explore RQ1, examining how IT-enabled systems and Electronic Logistics Marketplaces (ELMs) support the integration of cross-organizational processes for real-time shipment tracking. The case study approach enables in-depth investigation within a real-world logistics context, providing detailed insights into system interactions and organizational outcomes.

### *Research design: single case study*

In this case study, research is used. Case study research is a well-established qualitative methodology often used to explore complex phenomena in real-world contexts. It is particularly valuable for examining contemporary issues in which the boundaries between the phenomenon and its context are not clearly defined (Yin, 2018). In transportation and demand-driven supply chain management, case study research enables the investigation of dynamic, cross-organizational processes, offering nuanced insights that other methodologies might overlook. This review evaluates the key aspects of case study research methodology, focusing on design, data collection, analysis, and validity, and drawing on recent scholarly contributions.

To ensure construct validity, this study uses multiple sources of evidence and establishes a transparent chain of evidence (Yin, 2018). Furthermore, this research involved the active participation of diverse individuals, including both internal personnel and representatives from external organizations.

Table 1 provides an overview of internal staff involved in the case study, including their roles, years of experience, and job responsibilities. Appendix 1 provides additional context on the educational and demographic background of the internal participants.

*Table 1*

Internal staff who participated in this case study

Working place	Years in the company	Years in the industry	Job description
Dispatcher A	8 years	8 years	Planning and routing of vehicles, reporting, and transport administration
Dispatcher B	5 years	5 years	Planning and routing of vehicles, communication with clients, and handling of tenders
Dispatcher C	2 years	6 years	Planning and routing of vehicles, reporting, and transport administration
Dispatcher D	6 years	6 years	Planning and routing of vehicles, reporting and transport administration, handling of the goods in the warehouse
Driver	15 years	15 years	Performing domestic and international transport
Logistics Manager	20 years	20 years	Planning and routing of vehicles, controlling, and reporting to the Management Board
CEO	14 years	20 years	Strategic planning, controlling, and communication with clients

Source: Author's work

Table 2 presents the external participants in the case study—manufacturers and shippers—along with their industries, the duration of their cooperation with the transport company, and their main transport routes.

Table 2  
External parties that participated in this case study

Client	Industry	Years of cooperation with the company	Transports
Manufacturer A	Insulation industry	25 years	Transports to and from Germany and Austria
Manufacturer B	Steel industry	10 years	Transports to and from Germany
Manufacturer C	Paper industry	10 years	Transports to and from Germany, the Netherlands, Belgium, and France
Manufacturer D	Automobile industry	5 years	Transports to and from France
Shipper A	Logistics and warehousing	5 years	Transports to and from Germany, the Netherlands, Belgium, France, and Austria
Shipper B	Logistics and warehousing	10 years	Transports to and from Germany, the Netherlands, Belgium, France, and Austria

Source: Author's work

Internal validity was addressed through triangulation and explanation-building techniques, which help establish plausible causal relationships (Sridharan, 2021). However, external validity, or the generalizability of case study findings, remains a commonly debated limitation. Still, the applicability of this study's findings across multiple industries suggests a broader relevance (Gunasekaran et al., 2017).

Reliability in case study research refers to the consistency and replicability of the study's procedures, ensuring that future researchers can achieve similar results by following the documented methodology (Yin, 2018). To uphold this standard, a comprehensive case study protocol was developed, and a detailed database was constructed to meticulously document each stage of the research process (Quintão, Andrade, & Almeida, 2020). Moreover, reliability was ensured through the use of multiple data sources (Triangulation), including interviews, observations, and document analysis. This methodological triangulation helps mitigate biases inherent in single-source studies (Kern, 2018). Additionally, by implementing consistent data collection methods, we ensured that the data gathered was dependable (Riege, 2003). Finally, we maintained a transparent chain of evidence throughout the study, allowing external observers to trace the derivation of evidence from initial research questions to ultimate conclusions. This transparency is crucial for assessing the study's reliability (Quintão et al, 2020). This approach not only promotes methodological transparency but also enhances the reproducibility of the findings, thereby strengthening the study's overall rigor (Aguinis, Ramani, & Alabduljader, 2018).

The company participating in this study is family-owned. Family-owned companies are particularly suitable subjects for single case studies due to their unique characteristics and the depth of insight they offer into complex organizational phenomena (Leppäaho, Plakoyiannaki, & Dimitratos, 2016). A single case study

enables an in-depth examination of these complexities in their real-life context, facilitating a comprehensive understanding of cross-organizational processes (Garcia & Gluesing, 2013). The unique attributes of family-owned businesses make them ideal for theory building and extension (De Massis & Kotlar, 2014). By focusing on a single case, researchers can delve deeply into specific phenomena, generating insights that contribute to the development of new theories or the refinement of existing ones (Duarte Alonso, Kok, & O'Shea, 2018). In conclusion, using a family-owned company as the subject of a single case study offers significant advantages for researchers seeking a deep, nuanced understanding of complex organizational phenomena (De Massis & Kotlar, 2014).

### *Company description*

The company participating in this study is a family-owned enterprise with a distinguished legacy of over 45 years in the transportation industry. The enterprise's headquarters are in Slovenia, close to the capital city of Ljubljana. Operating across Central and Northern Europe, the company specializes in the transportation of a diverse range of goods, including high-volume commodities, steel, insulation materials, paper, and other freight. With a fleet of more than 75 vehicles, the company efficiently handles over 20,000 shipments annually, covering an impressive 8.5 million kilometers.

The company has developed robust partnerships with clients across key sectors, including the automobile, insulation, paper, and steel industries. Leveraging cutting-edge information and communication technologies (ICT), the organization has integrated advanced tools into its operations, including a Transportation Management System (TMS), GPS-enabled tablets, and the closed ELM platform, Transporeon, which offers a comprehensive suite of end-to-end transport logistics management solutions, providing a seamless interface for shippers, suppliers, retailers, goods recipients, and carriers, enabling efficient coordination and execution of logistics processes in a demand-driven supply chain.

In response to the disruptions caused by the COVID-19 pandemic and the resulting policy changes across countries, the company made significant investments in technology to enhance its operational resilience and connectivity. These investments focused particularly on linking manufacturers and shippers with carriers through sophisticated order and status reporting systems. This technological evolution also laid the foundation for virtual workplaces, enabling dispatchers to perform their duties remotely and ensuring business continuity and operational flexibility.

The subsequent sections provide a concise overview of the company's transport process and the mechanisms for reporting order status to clients. Figures 1 and 2 in the results section illustrate these processes in detail, offering visual insight into the company's operational framework and its innovative use of ICT.

With its long-established history, significant operational transformations, growth from a small enterprise to over 100 employees, and pioneering adoption of advanced ICT technologies, this family-owned business is a strong candidate for an in-depth single-case study. Its combination of historical continuity, adaptability, technological innovation, and family governance offers a rich and valuable context for academic research.

## **Results**

The subsequent sections provide a detailed exposition of the case study's findings. Initially, the state of order-status reporting prior to the implementation of the ELMs is examined, highlighting the challenges and inefficiencies inherent in the pre-ELM

communication processes. This is followed by a comprehensive discussion of the strategic actions undertaken to address these challenges, focusing on the integration of ELM technology into the transport operations. Finally, the enhanced state of order-status reporting post-ELM implementation is presented, showcasing the improvements achieved in communication, efficiency, and overall operational performance.

### Pre-ELM order-status reporting

Order-status reporting is crucial in demand-driven supply chain management to ensure a high-quality transport service. This mainly involves sharing crucial transport information with the client, including road conditions, vehicle status, environmental data, and other relevant details. The transport firm collects this data using a GPS-tracking tablet that is also connected to the internal TMS. However, prior to the process change, the ELM used by the client and the transport firm was not connected to the GPS tracking provider. Thus, the automatic exchange of order-status data was not possible. The process described in the following paragraph was used prior to the change.

First, the client placed the order in the ELM Transporeon. However, the carrier and manufacturer-shippers had to pre-establish the connection in the ELM on the ordering side. The carrier then accepted or declined the order, depending on whether it could perform the transport service in accordance with the client's requirements. If the dispatcher confirmed the order, it was automatically transferred to the internal TMS as a processed order. When the dispatcher assigned the order to a vehicle, they entered the registration plate into the TMS and sent the vehicle routing order to the GPS tracking tablet. *"When we received an order and assigned it to a driver, we entered the license plate to the ELM,"* dispatcher D. The GPS tracking sensor, together with the driver's manual entry, collected data like route, date and time of stop point, arrival at the loading/unloading place, start time and date of the loading/unloading, end time and date of loading/unloading, leaving the loading/unloading place, quantity and number of coli, quantity in the number of loading meters, registration plate, driver's name, mileage, traffic congestions, etc. Specific data that were crucial for further reporting to the client and invoicing were reported directly into the internal TMS. The dispatcher then manually entered the client's required information into the ELM (Figure 1).

Figure 1  
Order-status reporting before the ELM connection



Source: Author's illustration

The process in place met all the firm's internal requirements, the dispatcher's, and, of course, the management teams. All information and data about vehicle positions, order statuses, and other things were in place. However, in this phase, the client (manufacturer-shipper) was still not included in real-time information sharing and order-status reporting.

- As stated by dispatcher E: *"We had all the information in the system; however, we still emailed and phoned the client about statuses and delivery times"*.
- When the information was available in the TMS, the dispatcher manually forwarded it to the client. *"It was very time-consuming, and sometimes even impossible to enter all statuses in the system manually,"* dispatcher A.

In some cases, dispatchers entered the order status by e-mail; in most cases, they entered it manually in the ELM. Order-status reporting included the date and time of arrival at and departure from the loading/unloading place, the vehicle's registration plate, and other additional information.

- *"We managed over 300 e-mails daily; many times, it happened that we entered statuses with a one-day delay,"* dispatcher C.

The situation had many disadvantages and was problematic for both parties, the client (manufacturer-shipper and carrier), as listed below:

- reporting was not up to date,
- work overload for the dispatchers,
- entry of data and information could be biased (a high probability of an error, or a mistake while information was being entered manually),
- data and information could be entered for the wrong transport or an incorrect vehicle,
- reporting was not made at all (dispatcher did not enter any of the order-status information).

The lack of information sharing from the client's perspective could reflect in many difficulties. Some of them were:

- inability to organize prompt personnel and equipment at the loading/unloading site,
- long waiting, loading/unloading times,
- higher costs of warehousing,
- inability to plan further production,
- production delays,
- low flexibility in the case of delays and changes,
- incapacity to control warehouse peaks.

Due to these challenges and problematic situations, establishing a connection between the carrier and the client (manufacturer-shipper) was necessary. While very rigorous General Data Protection Regulations (GDPR) are in place in this area, data protection is essential, especially given that the online reporting of the order status is essentially the driver's position. Nevertheless, the transport firm took action to resolve the issue, as explained in the following paragraphs.

### *After-ELM status reporting*

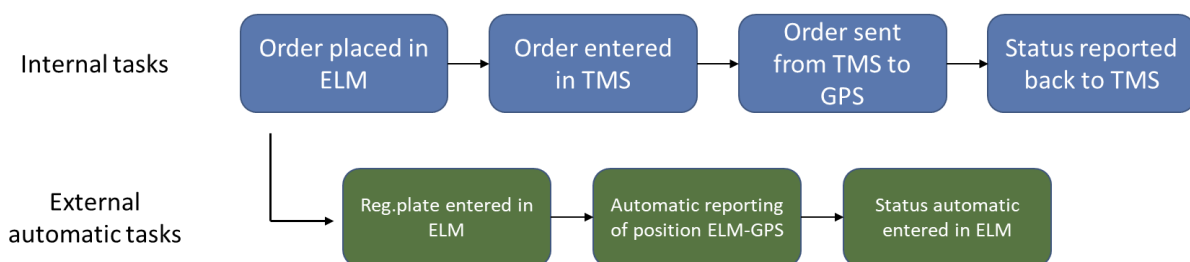
The transport firm gathered online transport data, including the vehicle's position, route, driving time, loading and unloading status, and estimated delivery time, using GPS devices installed in the vehicles. These devices were then connected to an online application in the Transport Department, where dispatchers handled all incoming information. From this point forward, the dispatcher entered the client's required information manually into the ELM or any other system. To solve this issue, the company established a link between the ELM and the GPS provider through a third party, thereby connecting the dots from pickup to delivery. The information automatically transferred to the clients included: loading time and date, unloading time and date, license plate, route, position on the route upon request, and estimated arrival time. This enabled the carriers to meet the customer expectations far better. It happened automatically and enabled clients to plan to know exactly where their incoming shipments are. After the connection, the clients were delighted. Here are a few short insights:

- *"This is really great, now we can see where the vehicle is, and we can, therefore, plan the production process."* Production Manager, manufacturer A from Germany.

- “The real-time status visibility starts the invoicing process automatically, which is really great.” Logistics Manager, manufacturer C from Germany.
- “We have over 100 loadings per day; with this connection, our warehouse can adjust the working hours, which enables us to plan more up-to-date.” Transport and Logistics Manager at manufacturer D in Slovenia.
- “If we have some problems with production, we now reschedule loading times to ensure loading according to the planned time of the vehicle.” Shipper A from France.
- “We have many COVID-19 restrictions in place. While we have exact info about the arrival of the vehicles, the restrictions in our warehouse are easily manageable.” Shipper B from Germany

When the client places an order in the ELM, it is automatically entered into the TMS. When this order is assigned to the vehicle, the dispatcher enters the registration plate into the ELM, and, based on the loading and unloading dates, the GPS device, through a third party, connects to the client (Figure 2).

Figure 2  
Order-status reporting after process change



Source: Author's illustration

The outcomes of integrating GPS with the TMS, aimed at enhancing cross-organizational processes, are comprehensively analyzed and presented in the discussion chapter. This section delves into the transformative impact of this technological linkage, highlighting its role in streamlining operations, fostering inter-organizational collaboration, and delivering measurable improvements in efficiency and transparency.

## Findings and implications

This section presents the key findings of the case study, with a focus on their practical implications for both the carrier and the manufacturer-shipper. Detailed outcomes are organized by the two main stakeholder perspectives and supported by Appendices 2 and 3.

### Implications for logistics service providers

Gathering high-quality information with IT is extremely important for a career. Therefore, carriers invest heavily in GPS tracking systems, which significantly alter their transport processes in at least three ways. First, integrating GPS-generated information into vehicle fleet routing and scheduling enabled efficient routing plans (Repoussis et al., 2009). It therefore allowed better control of the process.

- The General Manager of Firm A explained: *"In the past, we had to monitor all vehicles periodically ... obtaining the required information was, due to poor access, extremely complicated and lengthy. GPS enables us to control the vehicle all the time."* This led to an approximate 2% increase in monthly mileage. The drivers can now cover greater distances, while the planning and dispatching processes have significantly improved.

The adoption of GPS has enhanced internal communication between drivers and dispatchers, further improving transport efficiency. GPS enabled the sending, receiving, monitoring, and archiving of both sent and received text messages. Obtaining information from the driver before GPS adoption was highly problematic.

- A Logistics Manager argued, *"We had to call the driver to find out the position of the vehicle. Many times, either the driver did not answer the phone, or we could not get through. This was very inconvenient due to the customer's short reaction time. After the conversation with the driver, we recorded the information on a form, discussed it with other co-workers, and decided which driver would go in each direction. Then we called the driver again. If he or she did not answer, we sent a text message or called him or her again."*

After GPS was adopted, dispatchers and other workers used it to obtain the required information. Only in extreme situations (e.g., when a vehicle has lost power or when a dispatcher needs a detailed explanation of a particular problem) do they actually have to call a driver. Although dispatchers are highly engaged in their tasks, the company actively monitors the number of orders processed daily. With this IT integration, they have more time to focus on order handling. It has thus been observed that each dispatcher manages an additional 10 orders per day, thereby enhancing overall operational efficiency and throughput.

Second, interactions with trading partners and clients via GPS-enabled supply chain partners to conduct online transactions, share and exchange up-to-date information, provide customer service upon request, manage logistics, transportation, and inventory levels, and routinely communicate shipment-tracking information to clients (Sumah et al., 2020). Instead of relying on mobile phones and, sometimes, fax machines, GPS was now the primary means of communication.

- A dispatcher D highlighted the benefits: *"Sending information through GPS is fast, easy, and simple. We save time and money, while expensive international calls are no longer needed."*

Third, integrating GPS-enabled information with the transport firm's TMS (spanning operational planning, statistics, and personnel management) enabled more accurate and timely operational decisions (Habjan et al., 2014). In this study, both the carrier and the shipper reported improvements in optimization and strategic coordination of internal task planning.

Moreover, integration of GPS-enabled information with the ELM is essential for the manufacturer-shipper. The client (manufacturer-shipper) enters the order in the ELM, which is then transferred automatically (see Figure 3).

Dispatcher B explained: *"When we receive the order in the ELM, we see it next in our TMS. This enables us further to enter the license plate in the ELM, which is great."*

The assigned transport to the vehicle is monitored from the loading place to the unloading place. The information is reported instantly from the GPS to the TMS and ELM as the order status, and to the manufacturer-shipper as the vehicle's position, order status, and estimated arrival date.

- Dispatcher A illustrated: *"We can see all the up-to-date information on the vehicle, and now we do not need to call our client to inform them about the status of the transport."* The Logistics Manager further added, *"The client can*

*then organize the workforce in their warehouse easily. These decreases in waiting times at loading and unloading places are significant."*

According to the evidence, both the manufacturer and the shipper reported a 3–4% reduction in total working hours within the warehouse. Furthermore, enhanced operational efficiency enabled the manufacturer to achieve a productivity increase ranging from 5% to 10%. Lastly, the shipper reported an approximate 10% monthly increase in processed orders while maintaining the same personnel capacity.

Additionally, reduced waiting times enable drivers to plan their driving and working hours better.

- The driver illustrated: *"If I unload the shipment in one hour, instead of in 5 hours, I have more working time to drive to the next loading place. Waiting at the loading or unloading place is the worst for performing the transport; a direct loss of valuable time."*
- Dispatcher B also supported: *"The drivers have 13 or 15 working hours per day, whether he drives, waits, loads, unloads, or not, so quick loading and unloading is extremely important for us."*

The decreased workload in the Transport and Accounts Departments was identified as the most important. Information for the client (shipper-manufacturer) is automatically available; hence, dispatchers do not need to call, e-mail, or use any other method to contact the client about the shipment's status and vehicle position.

- Dispatcher D illustrated: *"Now, we do not need to enter statuses of transports in the client's web page, this is so great,"* and the Logistics Manager added: *"And now we do not need to send so many e-mails to clients to inform them when the vehicle is coming and what is the ETA. This is fantastic."*

Finally, significant implications are also recognized in the Account Department. Linking the GPS with the internal TMS further streamlined invoicing and document handling. After unloading, the driver immediately uploads the signed transport documents, which are available in the Accounts Department in a few seconds. The invoice is thus issued on the same day and sent to the client electronically.

- The CEO illustrated: *"In our TMS, we close all transports that are finished immediately with status 3 with an issued invoice. We no longer need to wait for the driver to come to the office and bring us the documents. This is really good."* All carrier implications are summarized in Appendix 1 as well.

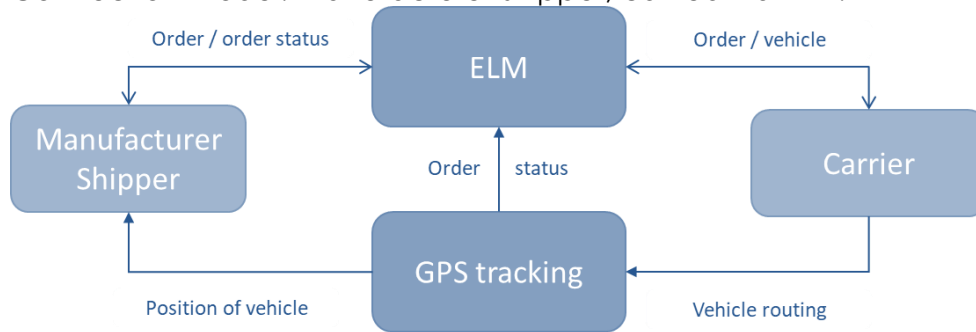
### *Implications for manufacturing and shipping partners*

To improve cross-organizational processes with the carrier and the manufacturer-shipper, the linkage between GPS and ELM is significant. As shown in Figure 3, the GPS automatically reports the vehicle's order status and position to the manufacturer-shipper via ELM. The manufacturer-shipper has up-to-date information on the arrival of the goods at the warehouse or the vehicle's arrival to pick up the goods from the warehouse. Additionally, the manufacturer-shipper has information about the vehicle route and can thus adjust the warehouse work plan.

- Manufacturer A explained, *"While we know exactly when the vehicle will arrive, we can prepare for the unloading and further production."* This is further linked to better workforce organization in the manufacturer-shipper's warehouse. In the long run, they reported that fewer workers are needed for handling loading and unloading.
- Manufacturer D added: *"We can now plan the staff in the warehouse better. We see now that with better planning, we need less staff in the warehouse, and working hours are used more productively."* In practice, this resulted in an approximate 3% reduction in total working hours within the warehouse.

Figure 3

Connection model: manufacturer-shipper, carried via ELM.



Source: Author's illustration

Likewise, if there are any road disturbances (such as congestion, delays, or other unexpected events), this information is immediately available to the client. The manufacturer-shipper can thus reorganize warehouse operations or adjust production accordingly.

- o “We are aware that many situations can occur on the road. Now that we know the vehicle's position, we can easily rearrange the work in our warehouse. Some personnel can work in production for a couple of hours, or even stay at home if more vehicles are late.” Manufacturer B discussed.

Due to increased flexibility in managing transport delays and disruptions, the shipper and manufacturer reported an approximate 4% reduction in overall warehouse labour hours. Moreover, the manufacturer-shipper, due to greater visibility into the shipment location and status, can plan loading and unloading with specific equipment—usually rented, such as a crane or a specialized forklift—more effectively. This equipment is extremely costly, and a vehicle delay can result in high additional costs. If the manufacturer-shipper reschedules the crane or special forklift, significant savings can be reached.

- o “Especially when we unload with a crane or a special forklift that we do not have in our company, the ETA of the vehicle is essential. If the vehicle is delayed, we can reschedule the crane as necessary and thus save on costs,” argued shipper A.

The results provide evidence that improved prevention of production delays reduced crane waiting times, thereby lowering crane-related costs by approximately 2 days per month.

Finally, due to stringent COVID-19 rules, only a limited number of internal personnel and external personnel are allowed in the warehouse at any given time. Especially in the warehouse, it is crucial to have information about the vehicle's arrival. Thus, the COVID-19 rules can be followed successfully.

- o Manufacturer C added, “We have stringent rules to follow due to COVID-19. Now we can easily plan the number of people in the warehouse. If more vehicles are on the way to our main warehouse, we can reroute them to our other warehouses, where we can also unload the goods.”

Therefore, improved management of COVID-19 restrictions led to fewer disruptions and adverse events.

## Concluding remarks

This single case study illustrates the critical role of IT-enabled information systems and ELMs in connecting cross-organizational processes to enable real-time shipment tracking. By enabling seamless information sharing across the demand-driven supply

chain, these technologies significantly enhance operational efficiency and collaboration among all stakeholders, including carriers and manufacturer-shippers.

In addressing RQ1, this study demonstrates that IT-enabled systems and Electronic Logistics Marketplaces (ELMs) significantly contribute to integrating cross-organizational processes, enabling real-time shipment tracking within a demand-driven supply chain. Furthermore, the findings provide support for the proposed hypotheses. H1 is validated through evidence of improved coordination and operational efficiency resulting from the integration of ELMs with internal information systems. H2 is also supported, as the use of IT-enabled information in cross-organizational processes proved instrumental in enhancing collaboration and streamlining operations among stakeholders. Together, these results highlight the strategic importance of real-time data integration in modern logistics ecosystems.

One of the primary advantages highlighted in this study is the optimization of invoicing and document handling processes. Enhanced information flow reduces errors and delays, ensuring smoother financial transactions between partners. Furthermore, the ability to prevent production delays and minimize crane and other resource waiting times underscores the transformative potential of IT-enabled information sharing in streamlining supply chain operations. Improved planning of driver schedules – including driving and rest times – enhances compliance with regulations and contributes to overall efficiency and safety.

The study also emphasizes the increased flexibility that logistics companies can achieve when equipped with real-time data. This adaptability is especially critical in managing delays or disturbances in transport processes. For instance, sharing real-time updates allows all parties to respond proactively, reducing loading and unloading waiting times and minimizing disruptions. These benefits collectively highlight the strategic value of linking IT systems across organizational boundaries and integrating them with client or third-party platforms that facilitate robust information exchange.

Given these advantages, the study advocates greater investment in integrating demand-driven supply chain processes with available IT infrastructure. Logistics companies and their partners are encouraged to prioritize developing interconnected systems that support collaborative decision-making and adaptive planning. This emphasis on technological connectivity is essential for driving competitive advantages in an increasingly dynamic and complex logistics landscape.

Despite its contributions to logistics and transportation theory and practice, this study has limitations that open opportunities for future research. Initially, the research was conducted using single-case studies, indicating the need to further validate the model through quantitative methodologies. Furthermore, the study was conducted within a particular organizational or regional context, which may not reflect conditions or dynamics present in other settings. This implies that future research should prioritize testing the model across diverse industrial contexts to enhance its generalizability and applicability. Moreover, future research could focus on specific metrics, such as cost reductions, time savings, or improvements in customer satisfaction, to provide a more comprehensive understanding of the benefits. Additionally, investigating differences across ELMs and transport sectors, such as domestic versus international transport or specialized logistics requirements, could yield valuable insights to tailor IT-enabled solutions to diverse operational contexts. These recommendations underscore the need for continued exploration of IT integration in transportation and logistics to unlock its full potential for enhancing demand-driven supply chain performance.

## References

1. Aguinis, H., Ramani, R. S., & Alabduljader, N. (2018). What you see is what you get? Enhancing methodological transparency in management research. *Academy of Management Annals*, 12(1), 83–110. <https://doi.org/10.5465/annals.2016.0011>
2. Ajayi, F. A., & Udeh, C. A. (2024). Agile work cultures in IT: A conceptual analysis of HR's role in fostering innovation supply chain. *International Journal of Management & Entrepreneurship Research*, 6(4), 1138–1156. <https://doi.org/10.51594/ijmer.v6i4.1004>
3. Al-Talib, M., Al-Saad, W., Alzoubi, A., & Anosike, A. I. (2025). A systematic review of the literature on the use of information technologies in supply chain management. *International Journal of Industrial Engineering and Operations Management*, (7)3, 247-268. <https://doi.org/10.1108/IJIEOM-09-2023-0073>
4. Andres Figliozzi, M., Mahmassani, H. S., & Jaillet, P. (2003). Framework for Study of Carrier Strategies in Auction-Based Transportation Marketplace. *Transportation Research Record: Journal of the Transportation Research Board*, 1854(1), 162-170. <https://doi.org/10.3141/1854-18>
5. Arora, R., Haleem, A., Arora, P. K., & Kumar, H. (2021). Impact of Integrating Artificial Intelligence with IoT-Enabled Supply Chain—A Systematic Literature Review. *Lecture Notes in Mechanical Engineering*, 1183-1188. [https://doi.org/10.1007/978-981-15-8542-5\\_105](https://doi.org/10.1007/978-981-15-8542-5_105)
6. Asamoah, D., Agyei-Owusu, B., Andoh-Baidoo, F. K., & Ayaburi, E. (2021). Inter-organizational systems use and supply chain performance: Mediating role of supply chain management capabilities. *International Journal of Information Management*, 58, 102195. <https://doi.org/10.1016/j.ijinfomgt.2020.102195>
7. Chi, M., Huang, R., & George, J. F. (2020). Collaboration in demand-driven supply chain: Based on a perspective of governance and IT-business strategic alignment. *International Journal of Information Management*, 52, 102062. <https://doi.org/10.1016/j.ijinfomgt.2019.102062>
8. De Massis, A., & Kotlar, J. (2014). The case study method in family business research: Guidelines for qualitative scholarship. *Journal of Family Business Strategy*, 5(1), 15–29. <https://doi.org/10.1016/j.jfbs.2014.01.007>
9. Dong, S., Xu, S. X., & Zhu, K. X. (2009). Research note - Information technology in supply chains: The value of IT-enabled resources under competition. *Information Systems Research*, 20(1), 18–32. <https://doi.org/10.1287/isre.1080.0195>
10. Duarte Alonso, A., Kok, S., & O'Shea, M. (2018). Family businesses and adaptation: A dynamic capabilities approach. *Journal of Family and Economic Issues*, 39(4), 683–698. <https://doi.org/10.1007/s10834-018-9586-3>
11. European Commission. (2021). *EU transport in figures: Statistical pocketbook 2021*. Publications Office. [https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2021\\_en](https://transport.ec.europa.eu/facts-funding/studies-data/eu-transport-figures-statistical-pocketbook/statistical-pocketbook-2021_en)
12. Foltean, F. S., Trif, S. M., & Tuleu, D. L. (2019). Customer relationship management capabilities and social media technology use: Consequences on firm performance. *Journal of Business Research*, 104, 563–575. <https://doi.org/10.1016/j.jbusres.2018.10.047>
13. Garcia, D., & Gluesing, J. C. (2013). Qualitative research methods in international organizational change research. *Journal of Organizational Change Management*, 26(2), 423–444. <https://doi.org/10.1108/09534811311328416>
14. 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>
15. Gosain, S., & Palmer, J. (2004). Exploring Strategic Choices in Marketplace Positioning. *Electronic Markets*, 14(4), 308-321. <https://doi.org/10.1080/10196780412331311757>
16. Govindan, K., Cheng, T. C. E., Mishra, N., & Shukla, N. (2018). Big data analytics and application for logistics and supply chain management. *Transportation Research Part E:*

- Logistics and Transportation Review*, 114, 343-349. <https://doi.org/10.1016/j.tre.2018.03.011>
17. Gunasekaran, A., & Ngai, E. W. T. (2004). Information systems in supply chain integration and management. *European Journal of Operational Research*, 159(2), 269-295. <https://doi.org/10.1016/j.ejor.2003.08.016>
  18. Gunasekaran, A., Subramanian, N., & Papadopoulos, T. (2017). Information technology for competitive advantage within logistics and supply chains: A review. *Transportation Research Part E: Logistics and Transportation Review*, 99, 14–33. <https://doi.org/10.1016/j.tre.2016.12.008>
  19. Habjan, A. (2023). How a Perceived Utilisation of IT-enabled Information shapes Customer Satisfaction in B2B markets. *Business Systems Research Journal*, 14(2), 81-101. <https://doi.org/10.2478/bsrj-2023-0013>
  20. Habjan, A., Andriopoulos, C., & Gotsi, M. (2014). The role of GPS-enabled information in transforming operational decision making: An exploratory study. *European Journal of Information Systems*, 23(4), 481–502. <https://doi.org/10.1057/ejis.2014.2>
  21. Huang, L. (2024). Evolving e-commerce logistics planning: Integrating embedded technology and ant colony algorithm for enhanced efficiency. *arXiv preprint arXiv:2402.15965*. <https://doi.org/10.48550/arXiv.2402.15965>
  22. Hyland, M., & Mahmassani, H. S. (2018). Dynamic autonomous vehicle fleet operations: Optimization-based strategies to assign AVs to immediate traveler demand requests. *Transportation Research Part C: Emerging Technologies*, 92, 278–297. <https://doi.org/10.1016/j.trc.2018.05.003>
  23. Ivanov, D., Dolgui, A., & Sokolov, B. (2019). The impact of digital technology and Industry 4.0 on the ripple effect and supply chain risk analytics. *International Journal of Production Research*, 57(3), 829–846. <https://doi.org/10.1080/00207543.2018.1488086>
  24. Jahani, H., Jain, R., & Ivanov, D. (2023). Data science and big data analytics: a systematic review of methodologies used in the supply chain and logistics research. *Annals of Operations Research*. <https://doi.org/10.1007/s10479-023-05390-7>
  25. Jevinger, Å., Zhao, C., Persson, J. A., & Davidsson, P. (2024). Artificial intelligence for improving public transport: A mapping study. *Public Transport*, 16(1), 99–158. <https://doi.org/10.1007/s12469-023-00334-7>
  26. Kamble, S. S., Gunasekaran, A., & Gawankar, S. A. (2020). Achieving sustainable performance in a data-driven agriculture supply chain: A review for research and applications. *International Journal of Production Economics*, 219, 179–194. <https://doi.org/10.1016/j.ijpe.2019.05.022>
  27. Kern, F. G. (2018). The trials and tribulations of applied triangulation: Weighing different data sources. *Journal of Mixed Methods Research*, 12(2), 166–181. <https://doi.org/10.1177/1558689816651032>
  28. Kim, N., Pae, J. H., Han, J. K., & Srivastava, R. K. (2010). Utilization of business technologies: Managing relationship-based benefits for buying and supplying firms. *Industrial Marketing Management*, 39(3), 473–484. <https://doi.org/10.1016/j.indmarman.2008.11.004>
  29. Koçoğlu, İ., İmamoğlu, S. Z., İnce, H., & Keskin, H. (2011). The effect of supply chain integration on information sharing: Enhancing the supply chain performance. *Procedia - Social and Behavioral Sciences*, 24, 1630-1649. <https://doi.org/10.1016/j.sbspro.2011.09.016>
  30. Kshetri, N. (2018). Blockchain's roles in meeting key supply chain management objectives. *International Journal of Information Management*, 39, 80–89. <https://doi.org/10.1016/j.ijinfomgt.2017.12.005>
  31. Kuberkar, S., & Singhal, T. K. (2020). Factors influencing adoption intention of AI powered chatbot for public transport services within a smart city. *International Journal of Emerging Technologies in Learning*, 11(3), 948–958.
  32. Leppäaho, T., Plakoyiannaki, E., & Dimitratos, P. (2016). The case study in family business: An analysis of current research practices and recommendations. *Family Business Review*, 29(2), 159–173. <https://doi.org/10.1177/0894486515614157>

33. Lin, H., & Wang, J. (2024). Enabling AI into business operations: Investigating the impact of IoTs, big data, and IT-enabled technologies on supply chain performance. *International Journal of Electronic Business*, 19(2), 123–138. <https://doi.org/10.1504/IJEB.2024.137703>
34. Liu, J., Yeoh, W., Qu, Y., & Gao, L. (2022). Blockchain-based digital twin for supply chain management: A literature review and future research directions. *arXiv preprint arXiv:2202.03966*. <https://doi.org/10.48550/arXiv.2202.03966>
35. Longo, F., Nicoletti, L., Padovano, A., d'Atri, G., & Forte, M. (2019). Blockchain-enabled supply chain: An experimental study. *Computers & Industrial Engineering*, 136, 57–69. <https://doi.org/10.1016/j.cie.2019.07.026>
36. Loro, C., & Mangiaracina, R. (2022). The impact of e-marketplace on the B2B relationships. *Industrial Management & Data Systems*, 122(1), 37–54. <https://doi.org/10.1108/IMDS-11-2020-0651>
37. Mendes, P., Jr., Leal, J. E., & Thomé, A. M. T. (2016). A maturity model for demand-driven supply chains in the consumer product goods industry. *International Journal of Production Economics*, 179, 153–165. <https://doi.org/10.1016/j.ijpe.2016.06.004>
38. Neubert, G., Ouzrout, Y., & Bouras, A. (2004). Collaboration and integration through information technologies in supply chains. *International Journal of Technology Management*, 28(2), 259. <https://doi.org/10.1504/ijtm.2004.005065>
39. Núñez-Merino, M., Maqueira-Marín, J. M., Moyano-Fuentes, J., & Martínez-Jurado, P. J. (2020). Information and digital technologies of Industry 4.0 and Lean supply chain management: A systematic literature review. *International Journal of Production Research*, 58(16), 5034–5061. <https://doi.org/10.1080/00207543.2020.1743896>
40. Oladimeji, D., Gupta, K., Kose, N. A., Gundogan, K., Ge, L., & Liang, F. (2023). Smart transportation: An overview of technologies and applications. *Sensors*, 23(8), 3880. <https://doi.org/10.3390/s23083880>
41. Orji, I. J., Kusi-Sarpong, S., Huang, S., & Vazquez-Brust, D. (2020). Evaluating the factors that influence blockchain adoption in the freight logistics industry. *Transportation Research Part E: Logistics and Transportation Review*, 141, 102025. <https://doi.org/10.1016/j.tre.2020.102025>
42. Popovič, A., Hackney, R., Coelho, P. S., & Jaklič, J. (2012). Towards business intelligence systems success: Effects of maturity and culture on analytical decision making. *Decision Support Systems*, 54(1), 729–739. <https://doi.org/10.1016/j.dss.2012.08.017>
43. Qizhi Dai, R. J. K. (2002). Business models for internet-based B2B electronic markets. *International Journal of Electronic Commerce*, 6(4), 41–72. <https://www.jstor.org/stable/27751032>
44. Quintão, C., Andrade, P., & Almeida, F. (2020). How to improve the validity and reliability of a case study approach? *Journal of Interdisciplinary Studies in Education*, 9(2), 264–275. <https://doi.org/10.32674/jise.v9i2.2026>
45. Reis, J., Amorim, M., Melão, N., & Matos, P. (2018). Digital transformation: A literature review and guidelines for future research. In *Trends and Advances in Information Systems and Technologies: Volume 1* (pp. 411–421). [https://doi.org/10.1007/978-3-319-77703-0\\_41](https://doi.org/10.1007/978-3-319-77703-0_41)
46. Repoussis, P. P., Paraskevopoulos, D. C., Zobolas, G., Tarantilis, C. D., & Ioannou, G. (2009). A web-based decision support system for waste lube oils collection and recycling. *European Journal of Operational Research*, 195(3), 676–700. <https://doi.org/10.1016/j.ejor.2007.11.004>
47. Riege, A. M. (2003). Validity and reliability tests in case study research: A literature review with “hands-on” applications for each research phase. *Qualitative Market Research: An International Journal*, 6(2), 75–86. <https://dx.doi.org/10.1108/13522750310470055>
48. Sambamurthy, V., Bharadwaj, A., & Grover, V. (2003). Shaping agility through digital options: Reconceptualizing the role of information technology in contemporary firms. *MIS Quarterly*, 27(2), 237–263. <https://doi.org/10.2307/30036530>
49. Seymour, L. F., & Koopman, A. (2022). Analysing factors impacting BPMS performance: A case of a challenged technology adoption. *Software and Systems Modeling*, 21(3), 869–890. <https://doi.org/10.1007/s10270-021-00922-w>

50. Spravil, J., Hemminghaus, C., von Rechenberg, M., Padilla, E., & Bauer, J. (2023). Detecting maritime GPS spoofing attacks based on NMEA sentence integrity monitoring. *Journal of Marine Science and Engineering*, 11(5), 928. <https://doi.org/10.3390/jmse11050928>
51. Sridharan, V. G. (2021). Methodological insights theory development in qualitative management control: Revisiting the roles of triangulation and generalization. *Accounting, Auditing & Accountability Journal*, 34(2), 451–479. <https://doi.org/10.1108/AAAJ-09-2019-4177>
52. Stern, C. W., & Deimler, M. S. (Eds.). (2012). *The Boston consulting group on strategy: Classic concepts and new perspectives*. John Wiley & Sons.
53. Subramanian, N., Abdulrahman, M. D., & Zhou, X. (2014). Integration of logistics and cloud computing service providers: Cost and green benefits in the Chinese context. *Transportation Research Part E: Logistics and Transportation Review*, 70, 86–98. <https://doi.org/10.1016/j.tre.2014.06.015>
54. Sumah, B., Masudin, I., Zulfikarijah, F., & Restuputri, D. P. (2020). Logistics management and electronic data interchange effects on logistics service providers' competitive advantage. *Journal of Business and Economic Analysis*, 3(2), 171–194. <https://doi.org/10.36924/sbe.2020.3205>
55. Tan, W. C., & Sidhu, M. S. (2022). Review of RFID and IoT integration in supply chain management. *Operations Research Perspectives*, 9, 100229. <https://doi.org/10.1016/j.orp.2022.100229>
56. Tavasszy, L.A., Behdani, B., & Konings, R. (2017). Intermodality and synchronomodality. In *Ports and Networks* (pp. 251–266). Routledge. <https://doi.org/10.2139/ssrn.2592888>
57. Tijan, E., Akseptijević, S., Ivanić, K., & Jardas, M. (2019). Blockchain technology implementation in logistics. *Sustainability*, 11(4), 1185. <https://doi.org/10.3390/su11041185>
58. Tiwari, S. (2021). Supply chain integration and Industry 4.0: A systematic literature review. *Benchmarking: An International Journal*, 28(3), 990–1030. <https://doi.org/10.1108/BIJ-08-2020-0428>
59. Tseng, P. H., & Liao, C. H. (2015). Supply chain integration, information technology, market orientation and firm performance in container shipping firms. *The International Journal of Logistics Management*, 26(1), 82–106. <https://doi.org/10.1108/IJLM-09-2012-0088>
60. Tzika-Kostopoulou, D., Nathanail, E., & Kokkinos, K. (2024). Big data in transportation: A systematic literature analysis and topic classification. *Knowledge and Information Systems*, 1–26. <https://doi.org/10.1007/s10115-024-02112-8>
61. Verdouw, C. N., Wolfert, J., Beulens, A. J. M., & Rialland, A. (2016). Virtualization of food supply chains with the internet of things. *Journal of Food Engineering*, 176, 128–136. <https://doi.org/10.1016/j.jfoodeng.2015.11.009>
62. Vincze, R., Karovič Jr., V., & Kavalets, I. (2022). The efficiency of transport-management in the e-logistics marketplace. In *Developments in Information & Knowledge Management for Business Applications* (pp. 239–255). Springer. [https://doi.org/10.1007/978-3-030-95813-8\\_11](https://doi.org/10.1007/978-3-030-95813-8_11)
63. Waller, M. A., & Fawcett, S. E. (2013). Data science, predictive analytics, and big data: A revolution that will transform supply chain design and management. *Journal of Business Logistics*, 34(2), 77–84. <https://doi.org/10.1111/jbl.12010>
64. Wang, G., Gunasekaran, A., Ngai, E. W., & Papadopoulos, T. (2016). Big data analytics in logistics and supply chain management: Certain investigations for research and applications. *International Journal of Production Economics*, 176, 98–110. <https://doi.org/10.1016/j.ijpe.2016.03.014>
65. Wang, Y., Potter, A., & Naim, M. (2007). Electronic marketplaces for tailored logistics. *Industrial Management & Data Systems*, 107(8), 1170–1187. <https://doi.org/10.1108/02635570710822804>
66. Wang, Y., Potter, A., & Naim, M. (2009). An evaluation of electronic logistics marketplaces within supply chains. In *Supply Chain Management and Knowledge Management* (pp. 269–287). [https://doi.org/10.1057/9780230234956\\_15](https://doi.org/10.1057/9780230234956_15)

67. Yin, R. K. (2018). *Case study research and applications* (Vol. 6). Thousand Oaks, CA: Sage.
68. Yu, Y., Huo, B., & Zhang, Z. J. (2021). Impact of information technology on supply chain integration and company performance: Evidence from cross-border e-commerce companies in China. *Journal of Enterprise Information Management*, 34(1), 460–489. <https://doi.org/10.1108/JEIM-03-2020-0101>
69. Yu, Y., Wang, X., Zhong, R. Y., & Huang, G. Q. (2016). E-commerce logistics in supply chain management: Practice perspective. *Procedia CIRP*, 52, 179–185. <https://doi.org/10.1016/j.procir.2016.08.002>
70. Yu, Y., Wang, X., Zhong, R. Y., & Huang, G. Q. (2017). E-commerce logistics in supply chain management: Implementations and future perspective in furniture industry. *Industrial Management & Data Systems*, 117(10), 2263–2286. <https://doi.org/10.1108/IMDS-09-2016-0398>
71. Zhang, C., Yu, H., & Liu, Z. (2008, October). Supporting logistics collaboration through electronic logistics marketplaces. In *2008 IEEE International Conference on Service Operations and Logistics, and Informatics* (2), 909–2913. <https://doi.org/10.1109/SOLI.2008.4683032>
72. Zhao, M., Dröge, C., & Stank, T. P. (2001). The effects of logistics capabilities on firm performance: customer-focused versus information-focused capabilities. *Journal of Business Logistics*, 22(2), 91–107. <https://doi.org/10.1002/j.2158-1592.2001.tb00005.x>
73. Zhong, R. Y., Newman, S. T., Huang, G. Q., & Lan, S. (2016). Big data for supply chain management in the service and manufacturing sectors: Challenges, opportunities, and future perspectives. *Computers & Industrial Engineering*, 101, 572–591. <https://doi.org/10.1016/j.cie.2016.07.013>

## About the author

Andreja Habjan is a recognised expert in transport, logistics, and business administration, with a solid background in both academia and the professional world. Her educational journey began at GEA College, where she earned a master's degree in business administration and management from 2002 to 2006, laying the groundwork for her future career. Her pursuit of further education led her to Brunel University London, where she conducted research in business, management, and logistics as a research student from 2006 to 2010. Her academic journey reached a peak at Cardiff University, where she earned a Doctor of Philosophy (PhD) in Ground Transportation in 2015, further deepening her knowledge and research skills. Alongside her academic pursuits, Andreja has built a notable professional career. Since July 2007, she has been a pivotal figure at Habjan Transport, d.o.o. Her tenure as CEO has been marked by steady leadership and strategic development. In addition to her role at Habjan Transport, Andreja has also contributed to academia. In April 2021, she took on the position of Assistant Professor at NOA in Slovenia, further demonstrating her commitment to education in transport and logistics. The author can be contacted at [andreja.habjan@mynoa.com](mailto:andreja.habjan@mynoa.com).

## Appendices

### Appendix 1

#### Demographic and Educational Profiles of Internal Participants

Working place	Age	Educational background
Dispatcher A	32	Germanist
Dispatcher B	33	Traffic engineer
Dispatcher C	32	High school graduate
Dispatcher D	43	Economic technician
Driver	51	Logistics technician
Logistics Manager	45	Graduated in traffic engineering
CEO	44	Master of Economics

Source: Author's work

### Appendix 2

#### Process changes implications

Process change implications	Description	Impact party	Illustrative quote	Estimated impact
<b>Decrease of loading and unloading waiting times</b>	With up-to-date vehicle status information, waiting times at loading and unloading points are significantly reduced.	Carrier	"We have now decreased waiting times at the loading as well as the unloading place by 10%."	Strong
<b>Better organization of processes in the client's warehouse</b>	Due to the visibility of the vehicle's status in the client's warehouse, the client can better plan internal processes.	Shipper/Manufacturer	"While we know exactly when the vehicle will arrive, we can prepare for the unloading and further production."	Strong
<b>A smaller workforce is needed to handle the loading and unloading</b>	The client can better plan warehouse workforce capacity.	Shipper/Manufacturer	"We can now plan the staff in the warehouse better."	Moderate
<b>Less workload for dispatchers in the Transport Department</b>	While information is transferred to the client automatically, the dispatcher does not need to pass this information to the client.	Carrier	"Now, we do not need to enter the statuses of transport on the client's web page; this is so great."	Strong
<b>Decreased administration in the Transport Department</b>	Due to the automatic transfer of information, fewer emails and other administrative work are done in the Transport Department.	Carrier	"Now we do not need to send so many e-mails to the client, and inform him when the vehicle is coming and what"	Strong

			is the ETA. This is fantastic."	
<b>Better information visibility to the carrier and manufacturer/shipper</b>	As soon as the event occurs, this information is available to both the carrier and the manufacturer/shipper.	Carrier/Shipper/Manufacturer	"This is really helpful that we have all the up-to-date information immediately."	Strong
<b>Increased flexibility in the case of delays or disturbances in the transport process</b>	If there are any disturbances on the road (such as road congestion, delays, or other unexpected events), this information is immediately available to the client. The client can thus reorganize work in a warehouse or adjust production accordingly.	Shipper/Manufacturer	"We are aware that many situations can occur on the road. Now that we know the up-to-date position of the vehicle, we can rearrange the work in our warehouse easily."	Moderate
<b>Better management of the COVID-19 restrictions</b>	Due to COVID-19 restrictions, many companies have implemented new rules and regulations. Especially in the warehouse, it is crucial to have information about the vehicle's arrival. Thus, the COVID-19 rules can be followed successfully.	Shipper/Manufacturer	"We have stringent rules to follow due to COVID-19. Now we can plan the number of people in the warehouse easily."	Weak
<b>Improved planning of driving time and the rest of the driver's time</b>	With information on ETA, current driving time, and the driver's working time, the dispatcher can better plan the driver's rest and work time.	Carrier	"Today, we see the working and driving time of the driver. If the ETA changes, we can reroute the vehicle and adjust the working plan for the driver."	Moderate
<b>Improved prevention of production delays, waiting times of cranes, etc.</b>	When the client unloads with a crane, the vehicle's punctuality is essential. This system enables the client to adjust the crane's arrival time based on the ETA. This, in the case of delays, saves a lot of costs.	Shipper/Manufacturer	"Especially when we unload with a crane or a special forklift that we do not have in our company, the ETA of the vehicle is essential. If the vehicle is delayed, we can reschedule the crane a day early, and thus save on costs."	Strong

<b>Smoothed further invoicing and document handling</b>	With the automatic reporting of loading and unloading statuses, the Accounts Department is informed immediately when transport is finished. This enables immediate further invoicing.	Carrier	"Now we can enter into our TMS all transports that are finished with status three immediately and close with an issued invoice. We no longer need to wait for documents, which is really good."	Moderate
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Source: Author's work

### Appendix 3

#### Savings implications for the carrier/manufacturer/shipper

<b>Process change implications</b>	<b>Impact party</b>	<b>Estimated impact on the stakeholders in the supply chain</b>
<b>Decrease of loading and unloading waiting times</b>	Carrier	A reduction of approximately two hours in average waiting times.
<b>Better organization of processes in the client's warehouse</b>	Shipper/	Enhanced productivity by an estimated 5–10%.
<b>Better organization of processes in the client's warehouse</b>	Manufacturer	Achieved a productivity enhancement ranging between 5% and 10%.
<b>A smaller workforce is needed to handle the loading and unloading</b>	Shipper/	Approximately a 3% reduction in total working hours within the warehouse.
<b>A smaller workforce is needed to handle the loading and unloading</b>	Manufacturer	An approximate 4% reduction in overall working hours within the warehouse.
<b>Less workload for dispatchers in the Transport Department</b>	Carrier	The dispatcher manages an additional 10 orders per day, enhancing operational throughput.
<b>Decreased administration in the Transport Department</b>	Carrier	Achieved an approximate 10% monthly increase in processed orders with the same personnel capacity.
<b>Better information visibility to the carrier and manufacturer/shipper</b>	Carrier/	Enhanced optimization and strategic coordination of internal task planning.
<b>Better information visibility to the carrier and manufacturer/shipper</b>	Shipper/	Enhanced optimization and strategic coordination of internal task planning.
<b>Better information visibility to the carrier and manufacturer/shipper</b>	Manufacturer	Enhanced optimization and strategic coordination of internal task planning.
<b>Increased flexibility in the case of delays or</b>	Shipper/Manufacturer	Approximately a 4% reduction in overall warehouse labour hours.

<b>disturbances in the transport process</b>		
<b>Better management of the COVID-19 restrictions</b>	Shipper/Manufacturer	Reduced disruptions and adverse occurrences.
<b>Improved planning of driving time and the rest of the driver's time</b>	Carrier	Achieved an approximate 2% increase in monthly mileage.
<b>Improved prevention of production delays, waiting times of cranes, etc.</b>	Shipper/Manufacturer	Reduced crane-related costs by approximately two days per month.
<b>Smoothed further invoicing and document handling</b>	Carrier	Reduced the average invoice issuance time from 9 to 3 working days.

Source: Author's work