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## DIGITAL TRANSFORMATION IN LOGISTICS CUSTOMER SERVICE OF INTERNATIONAL TRANSPORT ENTERPRISES

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**Abstract:** The article examines the impact of digital transformation on logistics customer service in international transport enterprises within the framework of Economy 4.0. A qualitative approach was applied, drawing on a systematic review of 16 peer-reviewed scientific publications and 9 major industry and company reports, complemented by an illustrative examples analysis of Uber Freight, DHL, DB Schenker, and Trans.eu. Findings show that automation, AI, data analytics, and digital interfaces enhance service by enabling personalization, continuous tracking, faster communication, and higher customer satisfaction. Benefits include efficient shipment handling, operational clarity, and responsiveness. However, challenges remain, such as uneven technology adoption and limited data access. The study concludes that digital transformation requires not only technological investment but also organizational change, workforce upskilling, and a customer-focused strategy. It identifies key technologies and provides a comparative analysis of digital platforms. This also addresses the digital transformation in logistics customer service of international transport enterprises, combining interdisciplinary research in the fields of management and quality science with perspectives from economics and finance.

**Keywords:** e-logistics, logistics customer service, international transport, platform economy.

### 1. INTRODUCTION

The rapid pace of digital transformation is reshaping nearly every aspect of global commerce, and logistics is no exception. Within this context, the concepts of Economy 4.0 and the platform economy serve as primary reference points. Economy 4.0 is understood as a new developmental paradigm where cyber-physical systems, the Internet of Things (IoT), and advanced data analytics integrate with economic processes, leading to decentralized decision-making and the automation of complex operations. In the transport sector, this manifests through the emergence of digital platforms that replace traditional intermediaries with intelligent interfaces, enabling

direct and real-time interaction between market participants [Barreto et al., 2017; Winkelhaus & Grosse, 2020].

As international transport platforms become increasingly complex and customer expectations continue to rise, there is a growing need for agile, intelligent, and customer-centric logistics services. Digitalization is no longer merely a trend but has become a strategic imperative for companies operating in the transportation sector [Tijan et al., 2021]. Competitive advantage in this industry increasingly depends on the ability to implement and scale digital solutions that enhance operational efficiency, responsiveness, and customer engagement.

The integration of advanced technologies, such as cloud computing, big data analytics, artificial intelligence (AI), and the IoT into logistics systems has ushered in a new era of smart and responsive supply chains [Ivanov, 2020]. These technologies facilitate the automation of routine tasks, real-time monitoring of shipments, predictive analytics for demand and disruption management, and data-driven decision-making – all of which are essential for handling the growing complexity of global logistics networks. Furthermore, digitization enables seamless data exchange among stakeholders, which fosters better collaboration and process synchronization across the supply chain [Barreto et al., 2017].

Digital platforms, such as Uber Freight, DHL's MySupplyChain interface, Trans.eu, TIMOCOM, and DB Schenker's Connect 4.0, exemplify how technology can revolutionize traditional logistics processes by streamlining operations, offering precise shipment oversight, and improving customer experience [Heilig et al., 2017]. These platforms facilitate dynamic matching of freight with available carriers, allow for predictive route planning, offer paperless documentation, and ensure end-to-end transparency – elements that are becoming indispensable in modern logistics ecosystems [Elbert & Gleser, 2019]. For example, intelligent Transport Management Systems (TMS) integrated with AI enable automatic scheduling based on customer preferences, route optimization under real-time traffic conditions, and forecasting based on historical trends and external variables [Fabbe-Costes et al., 2008].

Moreover, digital transformation in logistics aligns with the broader shift towards customer-centric business models, where value is co-created with clients through personalized services, proactive communication, and adaptive solutions [Christopher, 2016]. Customers today expect not only timely and reliable deliveries but also access to detailed shipment tracking, flexible delivery windows, real-time notifications, and immediate resolution of issues – expectations that can only be met through the effective application of digital tools [Winkelhaus & Grosse, 2020]. The use of customer data analytics further enhances service personalization by identifying behavioral patterns, preferences, and feedback trends [Hofmann & Osterwalder, 2017].

The role of international transport platforms in this transformation is particularly significant. Operating across borders and diverse regulatory environments, these platforms must harmonize logistics services while maintaining adaptability and scalability. Digitalization enables such capabilities by supporting coordination across

fragmented supply networks, enabling end-to-end control and visibility, and allowing transport service providers to respond rapidly to market fluctuations, disruptions (e.g., pandemics or geopolitical conflicts), or changes in consumer demand [Sternberg et al., 2014]. As a result, international transport platforms become key enablers of resilient, adaptive, and future-ready supply chains.

From a strategic perspective, digital transformation enhances operational efficiency and generates new value propositions for logistics service providers (LSPs), including data-driven consultancy, predictive risk management, and integrated Customer Relationship Management (CRM). The convergence of digital and physical flows creates opportunities for innovation and long-term differentiation in the logistics marketplace. However, this transformation also brings challenges related to technological standardization, cybersecurity, workforce adaptation, and investment priorities [Büyükoçkan & Göçer, 2018].

This article aims to explore the nature and implications of digital transformation in customer logistics services offered by international transport platforms. By analyzing recent research, industry trends, and case examples of global logistics operators, it seeks to identify the key digital enablers, barriers, and strategic outcomes associated with this ongoing transformation. Particular attention is given to how automation, artificial intelligence, data analytics, and digital customer interfaces contribute to enhancing logistics performance and customer satisfaction in cross-border environments.

## **2. OBJECTIVE AND METHODOLOGY**

This article aims to explore how digital transformation enhances logistics customer service in international transport platforms in the context of the platform economy and Industry 4.0. As logistics service providers face increasing customer expectations and growing operational complexity, the integration of digital technologies becomes a key factor in maintaining competitiveness and service excellence [Barreto et al., 2017; Frank et al., 2019].

The central objective of this study is to identify and analyze which specific digital technologies – particularly automation, artificial intelligence, data analytics, and digital customer interfaces – are implemented by international transport platforms and to assess how these technologies influence selected dimensions of logistics customer service, including service transparency, responsiveness, personalization, and customer satisfaction in international transport operations.

To operationalize this objective, the study addresses the following research question:

- How do selected digital technologies applied by international transport platforms contribute to improving transparency, responsiveness, and personalization of logistics customer service in cross-border transport activities?

Specifically, the objectives of the article include:

- Identifying the main digital tools and technologies adopted by international logistics platforms, such as real-time tracking systems, cloud-based transportation management systems (TMS), predictive analytics, and AI-driven recommendation engines [Wang et al., 2021].
- Examining the effects of automation and AI on logistics customer service, particularly in the areas of freight matching, route optimization, and service personalization [Winkelhaus & Grosse, 2020].
- Evaluating customer benefits from digital solutions, such as shipment visibility, customizable delivery options, digital communication channels (e.g., chatbots or dashboards), and automated issue resolution [Ivanov & Dolgui, 2020a].
- Investigating examples of best practices in platform-based logistics solutions, with an emphasis on user experience design, data integration, and collaboration between stakeholders in the transport ecosystem [Sternberg et al., 2014].

To achieve these objectives, the methodology employed in this article is based on a mixed qualitative research design. To ensure academic rigor, the research process was structured into three distinct stages:

1. **Systematic Literature Review (SLR):** A critical review of 16 peer-reviewed scientific publications and 9 major industry and company reports, for example, from McKinsey & Company, PwC, Capgemini, and Gartner [Capgemini, 2022; Gartner, 2023; Gosling et al., 2023; McKinsey & Company, 2023; PwC, 2020]. Key academic sources include such journals as *Transportation Research Part E*, *International Journal of Physical Distribution and Logistics Management*, and *Journal of Business Logistics*. The primary research timeframe of 2015-2025 was selected since 2015 marks the widespread popularization of the “Logistics 4.0” concept in academic literature, while 2025 serves as the strategic horizon for most current digitalization roadmaps. Foundational works from prior years were selectively included to establish the necessary theoretical context.
2. **Analysis Method:** The collected qualitative data were processed using a thematic coding matrix. This methodology allowed for the systematic categorization of technologies (AI, IoT, Automation) and their direct mapping against specific customer service dimensions (transparency, responsiveness, and personalization), ensuring that the study’s objectives remained the focal point of the synthesis.
3. **Case Study Selection:** Four international platforms (Uber Freight, DHL Freight, DB Schenker, and Trans.eu) were selected for detailed illustrative examples analysis. The criteria for selection included: (a) global or European market leadership, (b) documented high level of digital maturity, and (c) availability of transparent publicly accessible strategic data, white papers, and technical reports [DB Schenker, 2023; DHL, 2022; Trans.eu., 2022; Uber Freight, 2023].

The triangulation of these three data sources – academic literature, industry reports, and illustrative examples – ensures a comprehensive and multidimensional

understanding of how digital transformation is redefining customer logistics service in a global transport context.

### 3. RESULTS AND DISCUSSION

The findings of this study highlight that international transport platforms are leveraging digital transformation not only to improve internal logistics operations but also to revolutionize customer service. The analysis reveals that digital transformation in Economy 4.0 is driven by specific technological clusters. Table 1 summarizes the key elements of this transformation as identified in the analyzed literature.

**Table 1.** Key elements of digital transformation in logistics literature

Digital Element	Impact on Customer Service	Key Literature References
Automation	Faster booking, reduced paperwork, 24/7 availability	Winkelhaus and Grosse (2020)
AI & Predictive Analytics	Dynamic pricing, route optimization, demand forecasting	Wang et al. (2021)
IoT & Real-time Tracking	Full shipment visibility, environmental monitoring (temp/humidity)	Tijan et al. (2021); Ivanov (2020)
Cloud Platforms	Seamless stakeholder collaboration, data synchronization	Barreto et al. (2017); Elbert and Gleser (2019)

Source: own study.

The practical application of these technologies is evident in the analyzed platforms. As shown in Table 2, while all platforms prioritize digital interfaces, their specific focus areas vary.

**Table 2.** Comparative summary of analyzed transport platforms

Platform	Core Digital Features	Customer Service Value
Uber Freight	AI-driven load matching, dynamic pricing	Instant booking and high pricing transparency
DHL Freight	IoT-based sensors, MySupplyChain interface	Precise monitoring of sensitive/perishable goods
DB Schenker	Connect 4.0 ecosystem, automated document flow	Streamlined coordination for B2B and SME clients
Trans.eu	Verified carrier network, integrated communication	Enhanced safety and trust in freight exchange

Source: own study.

The integration of automation, advanced tracking systems, personalization, and artificial intelligence contributes to a more agile, transparent, and customer-centric logistics environment.

Automation in customer logistics refers to the deployment of digital technologies that streamline routine tasks, such as shipment booking, order confirmation, invoicing, claims management, and feedback collection. Self-service portals and mobile applications allow customers to perform operations independently, enhancing convenience and reducing operational costs [Winkelhaus & Grosse, 2020]. Chatbots and automated ticketing systems reduce response times and ensure 24/7 availability of support. For example, Uber Freight leverages AI-driven algorithms to automatically match available shipments with verified carriers, optimizing both time and resource allocation. Clients are notified instantly of status updates, cancellations, or changes in routing, improving service transparency and reliability [McKinsey & Company, 2023]. Moreover, such platforms as DB Schenker's eSchenker allow for the automated generation of documents and status updates, significantly reducing paperwork and manual coordination.

Real-time shipment tracking is one of the most visible and appreciated outcomes of digitalization in logistics. Customers increasingly demand full visibility over their goods – from pickup to final delivery – with real-time notifications and estimated time of arrival (ETA). DHL Freight utilizes GPS-based systems combined with IoT sensors to provide continuous updates on shipment location, vehicle conditions, and such environmental factors as temperature, humidity, or vibration, which is especially crucial for pharmaceutical or perishable goods [Tijan et al., 2021]. This visibility strengthens trust and allows customers to proactively manage their operations, adjust schedules, or respond to disruptions. Predictive alerts generated by tracking systems also contribute to risk mitigation and enhanced service continuity [Ivanov & Dolgui, 2020b].

Digital platforms enable a high degree of service personalization, allowing companies to tailor logistics offerings to individual customer needs. Modern transport platforms provide clients with user-friendly dashboards and interfaces that support personalized settings, such as preferred carriers, time slots, delivery preferences, or notification types. AI tools analyze historical customer behavior and preferences to recommend the most efficient or cost-effective delivery options. For instance, machine learning algorithms can prioritize sustainability (e.g., by suggesting low-emission transport modes), delivery speed, or cost optimization depending on previous selections [Sternberg et al., 2014]. Furthermore, digital tools allow customers to configure automated alerts for shipment delays or temperature deviations, which increases satisfaction, especially in B2B logistics where time and precision are critical.

AI and predictive analytics are among the most transformative digital enablers in logistics customer service. These technologies process vast datasets from previous shipments, traffic conditions, weather forecasts, and carrier performance to generate actionable insights. This allows platforms to predict delays, optimize routes in real-time, and anticipate customer needs. Advanced chatbots with natural language processing (NLP) capabilities are being implemented by companies like DB Schenker and TIMOCOM, offering multilingual support, automated responses to common

queries, and escalation to human agents when needed. This enhances efficiency and improves accessibility in international markets [Heilig et al., 2017]. Predictive models also support dynamic pricing, demand forecasting, and inventory allocation, ensuring that capacity and resources are aligned with customer requirements.

Real-world implementations of digital transformation in logistics platforms illustrate the diversity and maturity of digital tools across the industry:

- **Uber Freight:** Offers transparent and dynamic pricing, instant booking, AI-based load matching, and digital documentation handling. These features reduce administrative burden and enable faster, more accurate decision-making for shippers and carriers alike.
- **Trans.eu:** Combines a digital freight exchange with integrated communication and document flow systems. By focusing on verified carrier networks and trust-building mechanisms, the platform enhances transparency, safety, and reliability in international freight transactions.
- **DB Schenker Connect 4.0:** This digital ecosystem provides customers with access to online shipment booking, real-time tracking, and freight history. It supports both B2B and SME clients with intuitive interfaces and data-driven dashboards.

These platforms represent different approaches to digital maturity but share a common goal: placing the customer at the center of the logistics experience through intelligent, responsive, and data-driven solutions.

#### **4. CONCLUSIONS**

Digital transformation is profoundly reshaping customer logistics services within international transport platforms. The findings confirm that digital tools – especially automation, artificial intelligence, predictive analytics, IoT-based tracking systems, and advanced customer interfaces – significantly enhance logistics performance, transparency, and customer satisfaction [Ivanov & Dolgui, 2020a; Winkelhaus & Grosse, 2020]. Over the next years, the development of digital ecosystems will redefine global supply chain dynamics. Companies that invest in scalable digital infrastructures and prioritize customer-centric strategies will maintain a competitive advantage in increasingly complex market environments [Barreto et al., 2017; Tijan et al., 2021].

In comparison to other researchers, these results align with the findings of Winkelhaus and Grosse [2020], who emphasize that the success of Logistics 4.0 depends on the synergy between human expertise and automated systems. Similarly, the study supports the view of Tijan et al. [2021], stating that digitalization is no longer optional but a survival requirement in the transport sector. However, while Ivanov and Dolgui [2020b] focus primarily on supply chain resilience through “digital twins”, this study highlights that customer-centricity must be the primary driver of such technological investments to achieve long-term purchasing loyalty.

Moreover, digital transformation facilitates the emergence of new data-driven business models and value-added services, such as carbon footprint monitoring, predictive maintenance, and blockchain-supported traceability. These developments align with broader global priorities related to sustainability, transparency, and supply chain resilience [Hofmann and Osterwalder 2017; Tokarski et al. 2024]. Digitalization also strengthens collaboration between logistics providers and customers through real-time data exchange, feedback loops, and co-created service solutions [Christopher, 2016]. As expectations shift toward hyper-personalized and immediate service experiences, digital tools will continue to serve as a critical enabler of adaptability and agility. Providers that ignore these trends risk losing relevance to digitally mature competitors [Heilig et al., 2017].

Ultimately, the success of digital transformation depends not only on technological adoption but also on organizational readiness, workforce upskilling, cybersecurity resilience, and the strategic vision of logistics operators [Büyüközkan & Göçer, 2018]. International transport platforms must therefore continuously assess their digital maturity, benchmark market leaders, and pursue continuous improvement to fully leverage the transformative potential of digital technologies.

#### Research Limitations:

- The study relies heavily on secondary sources, such as academic literature and consulting reports, which may limit insight into proprietary internal processes [McKinsey & Company, 2023; PwC, 2020].
- The analysis includes selected international transport platforms [Uber Freight, DHL Freight, DB Schenker, Trans.eu], which may not represent the full spectrum of logistics digitalization globally.
- The rapid pace of technological change means that some innovations emerging after 2025 are not captured [Gartner, 2023].
- The absence of primary empirical data (e.g., interviews, surveys) restricts the ability to assess user perception and organizational barriers in depth.
- Regional differences were not extensively analyzed, although digital maturity varies across global markets [Capgemini, 2022].

#### Future Research Directions:

- Empirical assessment of customer perception and satisfaction related to digital logistics platforms [Ivanov, 2020].
- Quantitative evaluation of the impact of AI, predictive analytics, and IoT systems on logistics performance [Wang et al., 2021].
- Comparative studies across countries with different digital infrastructure maturity levels [Sternberg et al., 2014].
- Longitudinal studies on the development of digital maturity among logistics service providers [Frank et al., 2019].
- Exploration of cybersecurity and data governance risks in platform-based logistics [Büyüközkan & Göçer, 2018].

- Research on workforce digital competencies and organizational change management in logistics companies [Elbert & Gleser, 2019].
- Integration of sustainability indicators into analyses of digital transformation effectiveness [Fabbe-Costes et al., 2008].

In summary, the conducted study confirms the crucial importance of logistics and marketing customer service in the development of e-commerce and in building the competitive advantage of enterprises. The results indicate that effective management of the customer experience – encompassing both logistics processes and marketing communication – directly translates into higher customer satisfaction and increased purchasing loyalty. Despite the identified limitations, the collected data provide a valuable source of information on consumer behavior in the Polish e-commerce market and may serve as a foundation for further, more in-depth analyses involving larger research samples, different market segments, and international perspectives. The findings also highlight the need for integrating logistics and marketing activities as a prerequisite for effective competition in the dynamically changing digital environment.

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