

# Standardisation of data in logistics and business operations



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**Abstract** The article investigates standardization processes in constructing logistic chains for maritime and aviation transportation. It considers publications proposing solutions to the challenges of selecting information technologies that simplify standardization and document flow in business processes. In the transport and logistics system of “supplier-manufacturer-consumer”, standardization of cargo units such as containers, wagons, and trucks is crucial. This is particularly important due to the low level of interaction and information exchange among process participants, as well as the significant divergence of interests. The article explores the use of various technologies, including blockchain and mathematical modelling, to optimize information exchange among participants in international supply chains involving air and sea transport. It discusses international experiences in standardizing and digitizing transportation data, which enables the creation of a logistic database. This text discusses the international experiences of several companies, including Maersk, Lufthansa, Walmart, Unilever, Nestlé, Samsung, and British Airways, in logistics and supply chain management using technology. It argues for the necessity of standardization in logistics and highlights the main advantages of such normalization.

**Keywords:** logistics planning, air transport, maritime transport, blockchain, business processes

## 1. Introduction

Currently, there is a revolution in big data. The massive amounts of data accumulated recently are actively utilized in the practical work of modern organizations, especially large and informationally advanced corporations. Standardization of data presentation and utilization plays a significant role in the competition for a competitive advantage. Companies that utilize big data analysis and quality management in their information policies gain a significant advantage in the market. They can collect and process data more efficiently, resulting in improved services.

The demand for logistics services is increasing globally, with higher quality requirements, making standardization a crucial issue. The need for logistic centres arises as companies require a focal point to manage material and related flows along the path of product promotion through new transport routes (De Filippi & Wright, 2018). The article highlights the characteristics of international chains that use air transport. It mentions two main categories of goods that are transported via air: high-value-added goods such as electronic devices and their components, fashion industry goods, and jewellery items; goods with strict delivery deadlines such as pharmaceutical products, live animals, perishable goods, e-commerce goods, and mail (Kryshtal et al., 2023).

When considering standardization issues in the development of maritime logistics, it is important to focus on the countries that are setting trends in this industry, both in the technological and standardization spheres. The ISO/TC 8 “Ships and marine technology” Technical Committee is chaired by the Standardization Administration of China (SAC). The purpose of this committee is to establish standards for the design and construction of marine vessels, as well as to develop shore-to-ship interface standards and conduct research on the maritime environment. The committee consists of 26 member countries (Participation Technical committees ISO/TC 8), with working groups led by Norway for “Special marine structure and auxiliary vessels”, the United Kingdom for “Maritime safety”, and Japan for “Ship scrapping”. Under China's leadership, the working groups (Working Groups Technical committees ISO/TC 8) cover areas such as “Polar issues”, “Smart shipping”, and “Dredgers”. The working groups under the United States' leadership cover “Liquid and gas fuel ships”, “Waterway issues”, and “Education in the maritime sector” (Prystavka et al., 2023).

This study aims to analyse the use and justification of technologies that enable standardization in logistics supply chains. Additionally, it describes international experience in the field of business process and logistics standardization.



The beginning of the 21st century is marked by the computerization of human activities, including scientific tasks, production, trade, commerce, and banking (Gleissner & Femerling, 2013). The main objective of logistics is to optimize the flow of goods, cash, and information, by constructing a supply chain and ensuring efficient interaction through system monitoring. Prioritizing the highest level of automation within an integrated supply chain and ensuring a seamless information supply are crucial for optimizing logistics activities. Ongoing efforts are being made by both individual theoretical and practical scientists, as well as organizations uniting experts in the field of logistics, to refine, improve, and standardize the conceptual framework of logistics.

For example, blockchain technology has already found successful applications in various areas of logistics (Tien, 2015). Maersk has implemented a joint project with IBM to create a standardized platform for servicing supply chains involving maritime transport. In the initial stage, a bill of lading based on blockchain technology was introduced, which reduced administrative costs by 15% of the value of shipped goods. Later, the system was integrated with the radio frequency identification (RFID) system using IoT technology to generate a unified information database for the logistics network. Additionally, the company uses GPS container tracking systems to monitor and manage their movement across borders throughout the delivery route. GPS sensors automatically record updates on the cargo's location and transmit the data to the system.

The adoption of a standardized computing network will improve the efficiency of information logistics, positively impacting interlinking within transport. Currently, IPv6 is used in several thousand networks worldwide, with over 14,000 networks using it as of autumn 2023. However, it is not yet as widely used on the Internet as IPv4. At the end of 2022, IPv6 network traffic accounted for only 1% of the total, but it is expected to increase to 3% by the end of 2023.

Digital technologies are being used for data standardization in port activities (Gausdal et al., 2018). For example, the Port of Hamburg requires all companies to connect to a unified information system using blockchain technology. In 2017, the Maritime and Port Authority of Singapore launched Smart Port Challenge systems to improve the efficiency of maritime logistics when delivering goods to the Port of Rotterdam (Lim, 2017; Alekseieva et al., 2023).

The increasing significance of newcomers in the industry is not limited to new technologies, but also encompasses new business models and players. Additionally, there has been a rise in investments in logistics startups from venture capitalists and enterprises. Sustainable development, powered by technology, is a trend that utilizes various technologies, from electric vehicles to AI-based software that calculates routes with minimal emissions. Autonomous vehicles are closely linked to the future of logistics (Ratul et al., 2020).

Walmart has been testing an IBM blockchain platform since October 2016. Research has focused on tracking the supply chains of mangoes in the U.S. and pork supply chains to China (De Meijer, 2018). The results indicated that the technology reduced the tracking time for mango shipments from seven days to 2.2 seconds. Research on pork supply chains enabled the uploading of compliance certificates for product origin verification. In 2017, British Airways collaborated with Heathrow, Miami, and Geneva airports to research the potential application of blockchain technology in aviation. The study demonstrated the effectiveness of using this technology for secure information exchange (Schyga et al., 2019). Cathay Pacific has launched a blockchain platform to monitor container cargo shipments (Hasan & Salah, 2018).

Nonetheless, the task of standardizing data in logistics globally is intricate and entails numerous obstacles. It is difficult to harmonize standards due to the need to process many international transport documents, different payment and currency terms, and different terms of trade. Furthermore, the involvement of numerous intermediaries at different stages of cargo movement also adds to the complexity. Translation and localization of information are required for multilingual support of transactions and products (labeling). The utilization of disparate information systems across diverse nations poses obstacles to the integration and standardization of data. Additionally, the uneven development of transport infrastructure in different countries affects the ability to implement common standards and technologies. Overcoming these challenges is essential to improving the efficiency and reliability of international logistics operations.

The socio-economic impact of standardization in logistics and business operations ought to be considered as a central factor in shaping the contemporary economic environment. The effects of standardization are manifested in improved efficiency of business processes, reduced administrative costs, increased competitiveness of enterprises in the international market, and improved quality of products and services. These effects are not only viewed as economic, but also as factors that have an impact on social development, ensuring stability and transparency of communication among supply chain participants, and enhancing consumer trust in brands and companies.

## 2. Materials and methods

The study analysed the standardization of sea and air transport in Ukraine and abroad. Various technologies were retrospectively analysed, including their technical characteristics, efficiency, and prospects for development. The methods employed included historical and logical analysis, comparison, expert assessments, system analysis, and forecasting. The evolution of data standardization in logistics and business operations was studied through historical analysis. This analysis allowed us to understand what factors influenced the development of modern approaches to data standardization and what trends were observed throughout the historical development of logistics and business operations. A logical analysis was

conducted to establish the cause-and-effect relationships between various aspects of standardization. This approach allowed us to systematize and analyze data on the relationship between different elements in the standardization process, identify key factors affecting this process, and understand their interaction and impact on the results. The comparative analysis helped to identify differences and commonalities between different approaches to standardization in different countries and regions. The system analysis allowed us to consider the problem in the context of the entire logistics system and business processes. The research focused on standardization in the development of maritime logistics, specifically the implementation of information technology to streamline the logistics database.

### 3. Results

The objective of logistics is to facilitate the movement of goods through obstacles with minimal time and cost during “door-to-door” cargo delivery. While many logistics operators prioritize delivery costs, they often overlook the importance of cargo delivery reliability and data standardization. Standardizing the interface is accompanied by the standardization of services. This allows for the retention of existing customers, attraction of new buyers, and the provision of high-quality service, including informational interest.

The logistics market leaders, China and the USA, cannot be ignored. China is a creator of standards in the field of international logistics as a whole. This involves organizing the supply chain, developing technologies and equipment, and outlining certain trends. It should be noted that China has the capability to meet domestic demands in the logistics sector and can bring established internal market standards, technologies, and products to the international level. Additionally, it is worth mentioning that China is leading the working group in the ISO/TC 8 Committee for standardization in computer applications. It can be assumed that the Chinese aim to take a leading position in the field of Artificial Intelligence (AI) will extend to standards for AI application in logistics. The development of the AI industry and its implementation in equipment, infrastructure development, and supply chain management is observable. It is noteworthy that China currently holds leading positions in logistic business processes (Novak et al., 2022).

China is a leading country in the development of maritime logistics due to its need for overall efficient logistics. As the largest exporter and importer, China requires a high-quality, fast, cost-effective, and durable transportation chain. Furthermore, China is investing in the development of the Arctic region, including resource extraction and transportation. The Arctic region presents challenges for standardization, including the development of standards for maritime vessels, equipment, components, communication tools, technical specifications for vessel coatings and parts, fuel consumption, spill prevention, and more.

The United States leads three working groups in the committee and is a leader in the field of Artificial Intelligence (AI). Therefore, it is important to consider their position on standardization and work within ISO. The ISO/IEC JTC 1/SC 42 Committee on AI is overseen by the United States. The National Committee for Information Technology Standards (INCITS) is a technical advisory group in the joint technical committee of ISO and IEC on information technology (JTC1) that promotes the adoption of ISO standards as American national standards. The JTC1 committees cover various areas, including information security, cybersecurity, barcodes, service management, and AI.

Another direction for future logistic standardization development is collaboration in the industry and establishing new relationships. Global clients expect a global presence and services. Providers cannot meet these demands individually but see an opportunity to form groups. For example, Supply Chain Services collaborated with a network of logistic partners called “Value-Added Warehousing and Distributors” to enhance adaptability to changing demand and geographic diversity. Clients can benefit from collaborating with average logistic partners through the information platform created by Supply Chain Services. This platform provides complete transparency, including detailed inventory analysis, SKU overview, rotation and ageing analysis of inventory, timely reports, and quality of deliveries at the entry and exit of specific warehouses, as well as cost analysis (Kruhlov et al., 2023).

The future direction of 3PL (Third Party Logistics) development will be based on the convergence of services. This convergence is similar to that found in the telecommunications market, where voice, video, data transmission, the Internet, and television services are unified in one telecommunication channel. The aim of the 3PL market is to converge logistics services. Traditional transportation, expedition, and storage services are combined with co-production services to enable point-of-distribution shifting and product customization. This involves individualizing the product and regulating actions according to quality, packaging, labelling, transportation, and documentation requirements, including certificates, permits, and licences (Buryk et al., 2023).

It is important to note that the directions of 3PL development mentioned above are related to the organization of a network of collaborating logistics service providers, the provision of services, and the integration of different economic systems of manufacturers, distributors, and retail sellers. The effects of these changes may not meet expectations due to the gap in IT technologies between 3PL capabilities and increased customer expectations, as well as financial crises and dynamic transformations in business ownership.

The complexity of standardization on a large international scale is caused by:

- 1) the need to process a large amount of international transport documentation;
- 2) the involvement of numerous intermediaries at various stages of cargo movement;
- 3) different conditions for payments and currency operations;
- 4) different trade terms;
- 5) the necessity of multilingual support for the agreement and product (labelling);
- 6) the use of different information systems in different countries;
- 7) unequal development levels of transport infrastructure in different countries.

It is imperative to note that these complexities may have a detrimental impact on forthcoming operations. For example, difficulties with processing transportation documents may result in delays in deliveries and increased logistics costs. Different payment terms and currencies can lead to imbalances in financial processes and losses due to currency fluctuations. The development of transport infrastructure may hinder the ability to develop and optimize logistics routes. Furthermore, the lack of uniform standards in trade terms and product labeling can lead to confusion and incorrectness in business processes, which can threaten the reputation of companies and reduce the quality of service. In these conditions, there is an increasing need for a high level of coordination in supply chain management (SCM) operations using systemic integration tools. This involves creating the ability to manage logistics operations from any point through electronic data interchange.

Blockchain technology can be employed to address this issue, and it has found wide application in the aviation industry. Lufthansa suggests that blockchain technology can be effectively used to track aviation components' supply chains. Samsung also plans to use this technology to trace the power supply of aviation supply chains, which they estimate will lead to long-term logistic cost savings. According to A.T. Kearney's survey, freshness is the primary factor in choosing perishable products for 93% of customers. Commercial companies provide various technological tools to manage specific stages of supply chains for perishable products (Figure 1).



**Figure 1** Participants in international supply chains.

*Source:* Hagen (2019)

The processing and dispatching of air cargo at the airport is a lengthy procedure, resulting in over 30% of the total delivery time being spent on the aircraft. The remaining time is consumed by cargo handling at airport terminals, document processing, and customs clearance. These time costs have the potential to be standardized and reduced to enhance the attractiveness of using air transport.

A study conducted by the global non-profit group Oceana found that 20% of seafood worldwide is incorrectly labelled. In certain countries, this percentage exceeds 80%. The incorrect labelling can be attributed to fraudulent actions by suppliers attempting to pass off cheap fish as more expensive, as well as human errors in completing invoices. Labelling errors can cause significant delays in customs clearance, resulting in increased costs for servicing and decreased quality of perishable goods stored temporarily. Customs delays can last up to three days, while efficient customs clearance in global practice is expected to take only two hours. If the procedure takes longer than six hours, it is considered inefficient (Xu et al., 2018).

Blockchain technology can be effectively used to manage international supply chains with Internet of Things (IoT) technologies and smart contracts, allowing for data standardization in transportation. In this case, it will serve not only as a means of tracking and controlling supply chains but also as a comprehensive management tool for them.

#### 4. Discussion

It is fair to say that the current period is characterized by a widespread overhaul of traditional business models, organizational structures, and economic processes. The establishment of a modern economic system, which prioritizes efficient management, considers optimisation principles for emerging market entities. Improving the efficiency of logistics infrastructure usage and enhancing the conditions of logistical activities are among the priority directions for the development of Ukraine's logistics system.

To achieve this goal, it is necessary not only to increase investments in the logistics sector but also to create conditions for constructing an optimized logistics infrastructure (Stathakopoulos and Cachin, 2017). Many companies use modern automated SAP systems based on ERP-class systems to manage information exchange. However, these systems are primarily designed for the B2B sector and may not be suitable for operation in a multi-party/multi-layer supply chain/network (Chaudhuri et al. 2018; Mironova et al., 2022). Standardization of service quality provided to external consumers and the standardization of the quality of outputs in a company's logistical business processes, carried out simultaneously within a unified model, allow for the processing of large volumes of data. This provides an advantage in the competitive landscape of the modern, information-rich internet space.

The development of information technologies has enabled the automation of logistics planning. Comprehensive cross-cutting automation of the entire project work cycle has been proven to have the most significant effect. This links crucial stages in the life cycle of the logistics process, starting from researching the project situation, including conceptual design and engineering analysis. In the design process, documenting relevant technical documentation standards is only considered as one component. Improving the efficiency of the business process involves standardizing data collection and transmission forms. In many companies, standard document forms are absent (Shevchenko et al., 2023).

A study of the leading countries in the field of maritime logistics (China) and AI (USA) has shown that they are pursuing their own developments in these areas, including the creation of international standards and their implementation in the national system. There is also a tendency to simplify this procedure. These nations aim to dominate the international stage by possessing cutting-edge technical equipment and developing standards accordingly. As a result, logistics standardization is expected to rapidly evolve in the coming years, driven by the demand for IT integration. There is a growing trend of exporting Chinese technologies in maritime logistics, which solidifies China's position as a state with advanced technologies in this field. Furthermore, there is a noticeable demand within the Chinese scientific community for attracting highly qualified personnel, including foreigners, with simplified employment conditions in China (Ream et al., 2016; Jaworski et al., 2021).

The use of these technologies to optimize logistics in Ukraine is relevant. It will not only reduce logistics costs at the national level but also increase the appeal of transit cargo delivery through the country. According to World Bank data from 2022, Ukraine ranks 70th out of 160 countries surveyed for the quality of its logistics services. The Logistics Performance Indicator (LPI) has an overall score of 2.80. Forstor is a prominent logistics company in Ukraine, consisting of a group of legal entities with a shared corporate name. It operates in five main business areas and is expanding into new ones to meet customer needs and offer comprehensive warehouse logistics solutions. This company has generated high interest among clients by collecting, structuring, analysing, and associating massive data sets to ensure high-quality logistics services.

#### 5. Conclusion

The implementation of the proposed technologies in managing data standardization for product supply through logistics chains will yield the following results:

1. Simplification of the document verification procedure and reduction of ground handling time for cargo at the destination airport. For example, delivering chilled cargo from East Africa to Europe involves stamps and permits from approximately 30 individuals and organizations interacting with each other in this process around 200 times. The cost of processing all documents is estimated at 15-50% of the cargo transportation cost. Using Blockchain technology eliminates the risk of errors in document completion, significantly reducing the time required for verification.
2. Ease of identifying counterfeit products.
3. Transparent tracking of the origin of goods and control of food safety.
4. Control of logistic operations and determination of responsibility for delivery condition violations. Continuous monitoring of compliance with delivery condition requirements allows tracking the moment of any violations and assigning responsibility to individuals.
5. Optimization of logistic processes and decision-making.
6. Automation of financial transactions.
7. Generation of a source of statistical information for government management bodies on cargo turnover for forecasting and planning transportation activities.

The use of these technologies, combined with innovative quality control technologies, will significantly reduce costs associated with managing logistics chains.

However, the endeavor to standardize logistics data on a global scale is intricate and rife with challenges. The complexity arises from the necessity to handle a multitude of international transport documents, diverse payment and currency terms, and varying trade conditions. Moreover, the involvement of numerous intermediaries throughout different stages of cargo movement compounds the intricacy further. Multilingual support for transactions and product labeling necessitates the translation and localization of information. The presence of disparate information systems across different nations poses hurdles to data integration and standardization efforts. Furthermore, the uneven development of transport infrastructure across countries hampers the adoption of common standards and technologies. Overcoming these obstacles is imperative for enhancing the efficiency and dependability of international logistics operations.

### Ethical considerations

Not applicable.

### Conflict of Interest

The authors declare no conflicts of interest.

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