

DEPÓSITO LEGAL ZU2020000153

ISSN 0041-8811

E-ISSN 2665-0428

# Revista de la Universidad del Zulia

Fundada en 1947  
por el Dr. Jesús Enrique Lossada



**Ciencias del**  
**Agro,**  
**Ingeniería**  
**y Tecnología**

**Año 14 N° 39**

**Enero - Abril 2023**

**Tercera Época**

**Maracaibo-Venezuela**

## Digital technologies as a tool of efficient logistics

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### ABSTRACT

The study is dedicated to the justification of the need for the wide implementation of digital technologies in logistics activities, taking into account globalization challenges. The purpose of the article is to highlight the basics of implementing digital technologies as a tool of efficient logistics in modern conditions. The methodological basis of the study is a systematic approach, which allows studying logistics as a complex set of interdependent and interacting subsystems that have integral properties and develop under the influence of internal and external influencing factors. It has been proven that the use of information technologies in logistics makes it possible to: effectively solve current problems and eliminate possible problems in the future; improve the quality of logistics services; maximally load the capacity of logistics flows; rationalize material flows; increase the safety of transportation; optimize costs for the supply of resources and products; eliminate intermediate links by ensuring the transformation of information into forms that are convenient for consumers; increase the efficiency of information exchange and increase its security; implement new services and innovative customer support tools.

**KEYWORDS:** Digital technologies, logistics, logistics sphere, logistics services, system approach.

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Recibido: 13/09/2022

Aceptado: 09/11/2022

## Tecnologías digitales como herramienta de logística efectiva

### RESUMEN

El estudio está dedicado a la justificación de la necesidad de una amplia implementación de las tecnologías digitales en las actividades logísticas, teniendo en cuenta los desafíos de la globalización. El propósito del artículo es resaltar los conceptos básicos de la implementación de tecnologías digitales como una herramienta para una logística eficiente en las condiciones modernas. La base metodológica del estudio es un enfoque sistemático, que permite estudiar la logística como un conjunto complejo de subsistemas interdependientes e interactivos que tienen propiedades integrales y se desarrollan bajo la influencia de factores de influencia internos y externos. Está comprobado que el uso de las tecnologías de la información en la logística permite: resolver eficazmente los problemas actuales y eliminar posibles problemas en el futuro; mejorar la calidad de los servicios logísticos; cargar al máximo la capacidad de los flujos logísticos; racionalizar los flujos de materiales; aumentar la seguridad del transporte; optimizar costos para el suministro de recursos y productos; eliminar los enlaces intermedios asegurando la transformación de la información en formas que sean convenientes para los consumidores; aumentar la eficiencia del intercambio de información y aumentar su seguridad; implementar nuevos servicios y herramientas innovadoras de atención al cliente.

**PALABRAS CLAVE:** Tecnologías digitales, logística, ámbito logístico, servicios logísticos, enfoque de sistema.

### Introduction

Today, logistics services occupy a leading place in the international market, as logistics is an indispensable tool for improving business efficiency. Modern challenges of the development of the world economy are increasingly actualizing issues related to international supply chains, which increases the requirements for the quality of logistics services. At the same time, it is impossible to improve the quality of logistics services without the introduction of modern digital technologies. Digital technologies expand the opportunities of enterprises to advance on the international market by conducting more profitable operations, finding new customers, optimizing production and sales costs through the use of modern information, its analytics and decision-making using digital technologies. The relevance of the implementation of digital technologies in logistics is also due to the COVID-19 pandemic, which dealt a serious blow to the sale of resources and goods through intermediaries and determined the expediency of the spread of the use of logistics.

Today, logistics is primarily a supply chain in Industry 4.0, represented in the form of a Cyber-Physical Systems (CPS), which ensures the interconnection of physical objects that, thanks to information processing processes, turn into virtual objects.

The purpose of the article is to highlight the basics of implementing digital technologies as a tool for improving the efficiency of logistics in modern conditions. To achieve the set goal, the following tasks were outlined and solved:

- proven relevance of research on the implementation of digital technologies in the field of logistics;
- the expediency of using the methodology of the system approach to the implementation of digital technologies as a logistics tool is substantiated;
- an analysis of modern digital technologies implemented in logistics was carried out
- the advantages of using modern digital technologies in logistics activities were proven, which made it possible to highlight the conclusions of the conducted research.

## 1. Literature Review

Studying the impact of digitization on logistics activities in modern conditions is an extremely relevant and timely issue. Many foreign and domestic scientists have devoted their research to this topic, including: Buss K.-P. (2022); Cosmulese C.G. (2019); Dimitrios K. Nasiopoulos (2021); Gan W. (2022); Gupta Himanshu (2022); Iqbal T. (2022); Ivanova N. (2022); Ju Yingjie (2021); Junge A.L. (2020); Kholiavko N. (2022); Kuteyi D. (2022); Merkaš Z. (2020); Papulová Z. (2023); Parhi S. (2022); Parola F. (2021); Popelo O. (2022); Tulchynska S. (2021); Vovk O. (2021); Wei F. (2019) and other.

The authors (Dimitrios K. Nasiopoulos et al., 2021) explore that the role of digital marketing is supported by numerous studies that address the following challenges: data explosion, social media, channel proliferation, and changing consumer demographics that correspond to developments in the digital marketplace and supply chain. Particularly useful for supply chain companies, researchers say, offering data to better understand the optimal level of digital marketing adaptability. The results of the study are extremely useful for logistics companies, as they lead to the optimization of the distribution network.

Within the scope of the study (Ju Yingjie et al., 2021), the scientists focused on the relationship between the quality of integration, joint value creation and sustainability in logistics. The results of the study show that the quality of integration is an important

antecedent variable that contributes to the sustainability of the logistics system. The researches (Parola F. et al., 2021) analyzed how the implementation of new digital technologies can provide valuable business opportunities for logistics centers in maritime supply chains. Scientists have proposed a special conceptual framework for delineating relevant business opportunities that arise as a result of the introduction of advanced digital technologies for each type of logistics center. Based on the results of the study, alternative strategic options for innovative logistics chains and increasing the competitiveness of various cargo logistics centers are proposed.

Scientists (Junge A.L., 2020) are exploring the prospects of using digital technologies for sustainable logistics and supply chain processes in manufacturing. The authors prove that digital technologies lead to possible improvements in terms of transparency of energy consumption, reduction of distribution distances and optimization of logistics resources.

The article (Merkaš Z. et al., 2020) explores the role of blockchain in achieving logistics goals. The authors determined that the implementation of blockchain technology in logistics and transport contributes to the optimization of business processes, traceability and transparency of the supply chain, as well as significant financial savings.

The practical significance of the study (Wei F. et al., 2019) lies in the development of a methodology for a structured assessment of digital transformation and its impact on logistics. The assessment approach takes into account economic, environmental and social aspects at different levels of planning, focusing on the relevant requirements and impacts to be obtained. This structured assessment approach provides researchers and decision-makers with a handy tool to analyze the large-scale implications of digital transformation for logistics.

The authors of the study (Papulová Z. et al., 2023) determine the advantages and disadvantages of digital technologies in logistics, based on the experience of using telematics technologies. Scientists have determined that digitization in the operator business will become one of the key tools that will bring transparency and efficiency, reduce various types of costs, but be successful in strong business competition.

The study (Iqbal T. et al., 2022) aims to examine the moderating role of digitalization in increasing the transparency of humanitarian logistics and supply chains in Pakistan. The authors emphasize that in Pakistan, where corruption and mismanagement in humanitarian

logistics and supply chain are of greatest concern to all stakeholders, digitization is the way to create transparency in the logistics system and strengthen donor confidence.

However, taking into account the significant publication activity in the indicated direction of research, the issue of using digital technologies as a tool of effective logistics is gaining more and more relevance and requires further research.

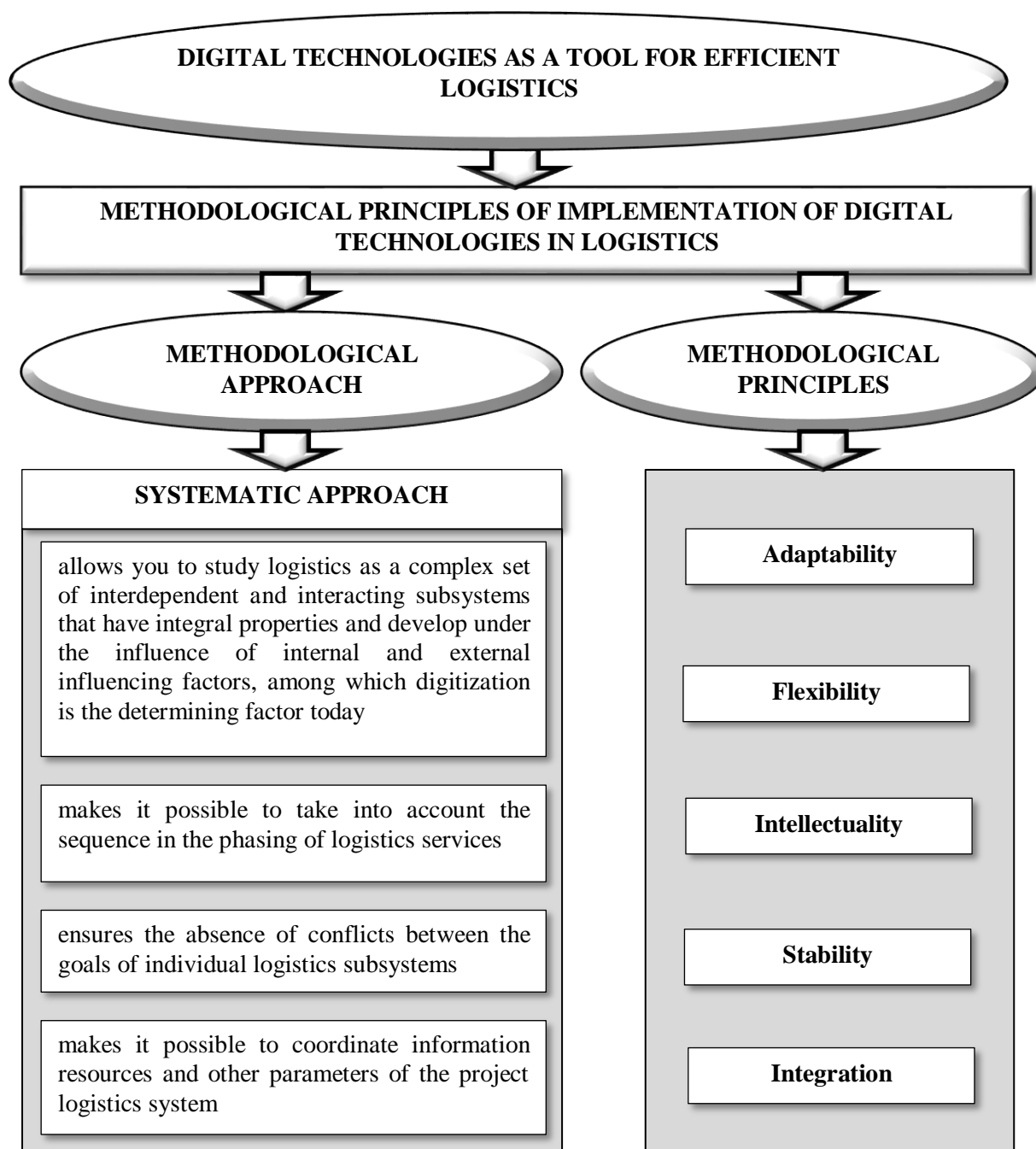
## 2. Methodology

The methodology for researching the implementation of digital technologies as a logistics tool is a systematic approach (Fig. 1), which acts as a methodological basis for the implementation of logistics services and allows studying logistics as a complex set of interdependent and interacting subsystems that have integral properties and develop under the influence of internal and external influencing factors of which digitization stands out today.

The system approach makes it possible to substantiate management decisions in accordance with the goals and objectives of the entire logistics system. A systematic approach to the study of the implementation of digital technologies as a logistics tool makes it possible to take into account the sequence in the phasing of logistics services, to coordinate information resources and other parameters of the project logistics system, to ensure the absence of conflicts between the goals of individual logistics subsystems.

According to the system approach of implementing digital technologies as a logistics tool, the following principles can be distinguished:

- flexibility, which provides for the possibility of changes in logistics processes in accordance with the emergence of new digital technologies;
- adaptability, which ensures changes in logistics services as a result of receiving information data on dynamic changes in the environment;
- stability, which is ensured as a result of the introduction of digital technologies under the influence of environmental factors;
- integration, which makes it possible due to the use of digital technologies, data collection and processing, transmission and accumulation of information to interact and make joint management decisions in logistics;



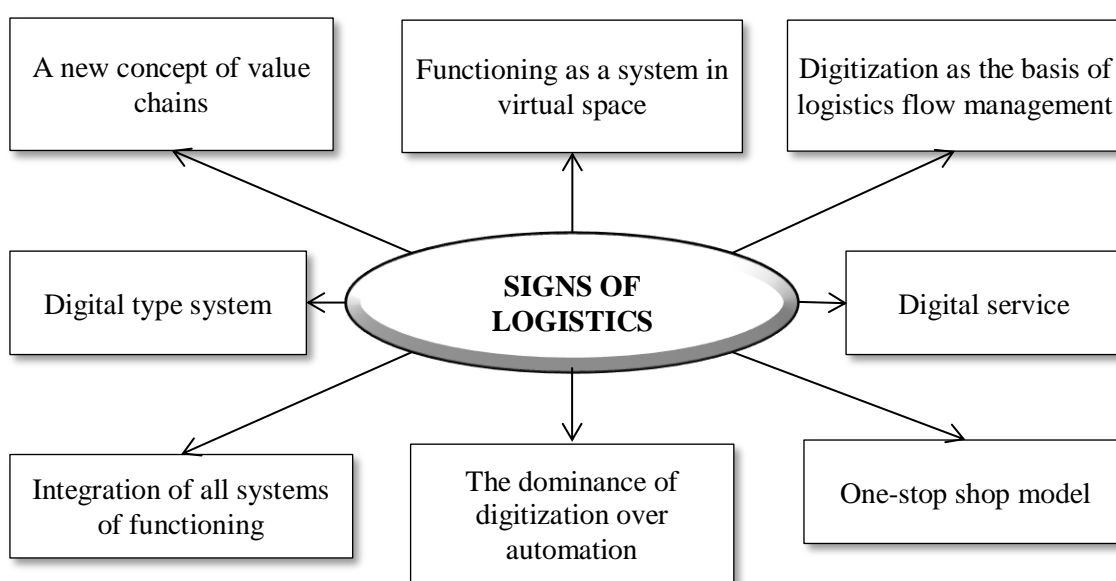
**Figure 1.** Methodological principles of implementation of digital technologies in logistics  
Source: constructed by the authors

- intellectuality, which involves the use of artificial intelligence, ensuring the appropriate level of informatization of logistics processes in the process of making management decisions.

Compliance with the principles of flexibility, adaptability, stability, integration and intelligence using a systemic approach to the implementation of digital technologies as a tool of logistics provides an opportunity to increase the efficiency of logistics processes.

### 3. Results

The implementation of digital technologies in the logistics sphere makes it possible to ensure better management of production stocks, more optimal use of warehouse space, reduce costs for internal warehouse maintenance, and increase the efficiency of picking goods in accordance with current demand. Digital technologies provide new features of the logistics sphere (Fig. 2). The software of the warehouse management system makes it possible to significantly reduce operating costs by reducing the time of searching for warehouse products, more optimal use of warehouse space.



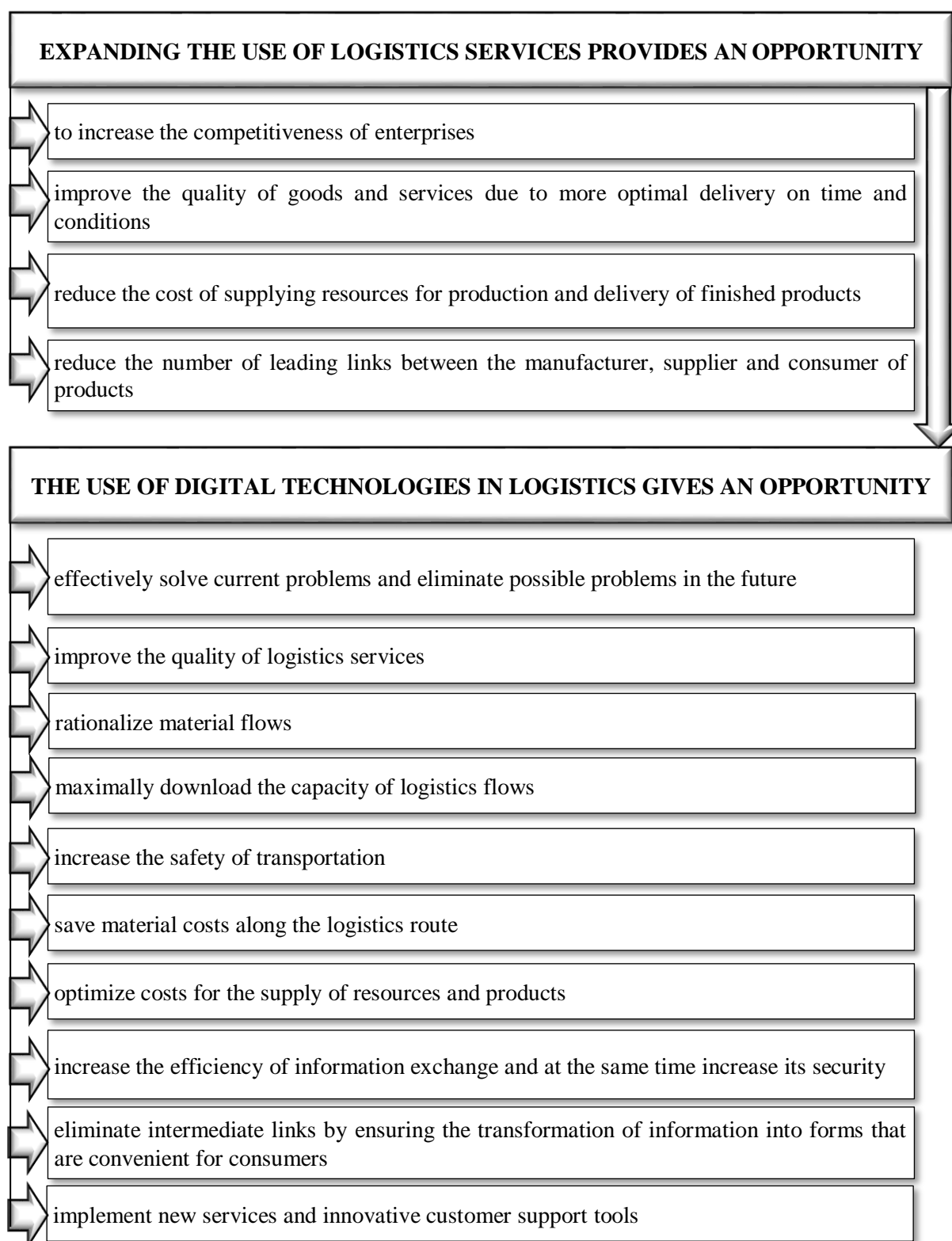
**Figure 2.** Signs of logistics under the influence of the use of digital technologies  
 Source: constructed by the authors

Also important is the accounting of cargoes and their constant support by the dispatch service, which can be carried out more at the expense of digital technologies, which reduces the influence of the human factor on decision-making, as well as the error of their decision-making.

Digital technologies make it possible to achieve a fundamentally new level of accuracy and reliability in information exchange, thanks to modern information and communication technologies, close interaction with business partners is possible, which makes it possible to shorten the order cycle and its processing during transportation.

The positive effects of the introduction of digital technologies in logistics are beyond doubt. The advantages of the implementation of digital technologies in the logistics activities of enterprises are presented in Fig. 3.





**Figure 3.** Advantages for enterprises of using logistics and implementing digital technologies

Source: constructed by the authors

In logistics activities, the use of digital technologies is important in planning the

distribution of resources, transport costs, the location of inventory and other areas of planned activities. Resource allocation planning makes it possible to minimize future inventory problems and ensure clarity and timeliness of inventory replenishment when using modern information resources.

But the positive effect of the implementation of digital technologies is manifested not only in the management of stocks, but also in the processing and registration of orders in real time, planning of transportation, auditing of payments for transportation of products, etc. Automation of product identification ensures awareness of all stages of the logistics service process, protects against the appearance of falsified products.

The development of digital technologies led to the transition from automation in the logistics system to digitalization thanks to the introduction of:

- Internet of Things – IoT / Machine-to-Machine – M2M;
- Interactive e-portals;
- Big Data;
- Artificial intelligence (AI);
- Business intelligence (BI);
- Data mining;
- Block Chain;
- Cloud Services;
- E-Commerce;
- Fifth Party Logistics (5PL);
- Call-center,
- Strategic Network Optimization (SNO);
- E-Supply Chain Management (E-SCM);
- Enterprise Resource Planning (ERP);
- Transport Management System (TMS);
- Warehouse Management System (WMS);
- Manufacturing (Distribution) resource planning (M(D)RP II);
- Enterprise resource planning (ERP II), (ERP II = MRP II + FRP);
- Customer Synchronized Resource Planning (CSRP);
- Customer Relationship Management (CRM);

- Supply Chain Management (SCM);
- Supplier Relationship Management (SRM);
- Continuous Acquisitions and Life Cycle Support (CALS);
- Electronic Data Interchange (EDI) et.al.

The introduction of digital technologies destroys operational differentiation due to its functioning in virtual space, which affects not only the cost component of values, but also customer orientation with a shorter cycle of logistics services.

The application of Fifth Party Logistics (5PL) through a "single window" provides the entire set of integrated logistics services and gives the cargo owner the opportunity to receive the entire range of logistics services on one resource at once on one resource. 5PL acts as a practical tool for managing logistics flows, which include material, virtual, labor, financial, information, and to ensure a synergistic effect for logistics as a whole.

Digital technologies led to the use of the "direct to consumer" (D2C) approach, which popularized the demand for delivery services and made it possible to reduce manufacturers' costs of maintaining their own fleet. Artificial intelligence (AI) toolkit that maximally implements digital technologies for self-management of transportation in real time and provides maximum personalization of relations with the end consumer.

Cloud technologies combine physical and virtual reality as a result of adding physical reality to digital virtual objects. Cloud technologies successfully serve such elements of the logistics system as: warehousing, supply of resources and products, optimization of transportation, etc. The greatest effect of the introduction of cloud technologies is observed in the maintenance of warehouse management, as they make it possible to reduce the costs of assembling goods by half, improve the picking process, and ensure better placement of cargo in warehouses. Cloud and network information systems make it possible to visualize warehouses and develop projects for their reconstruction to increase the efficiency of using warehouses.

Digital technologies of cloud and network services are actively used and have the potential for their further application in the optimization of transportation, especially international ones, verification of the completeness of deliveries, warehouse loading control, and the navigation system of logistics operations.

Digital technologies such as Knapp, SAP and Ubimax systems are also widely used in

logistics, which provide the opportunity to recognize such logistics objects as warehouses, transport, routes in real time, read barcodes, scan internal navigation and integrate information from warehouse management systems, calculate the most optimal routes, constantly update information about the balance in warehouses in real time, avoid errors in the accounting of goods in warehouses, reduce inventory costs.

A new direction in the implementation of digital technologies in logistics is the introduction for customers of services related to storage, repair and improvement of the quality of logistics services. Also, high efficiency is demonstrated by the application of cloud technologies in the control and monitoring of the activities of warehouse and repair employees with the help of advanced image recognition, which makes it possible to detect errors in the assembly and repair process. Cloud-based digital systems provide a visual way to support the identification and correction of errors by workers, reducing assembly and repair time.

The use of cloud technologies makes it possible to combine goods during shipment by scanning their dimensions and estimating their weight, which allows you to choose not only the best shipping option, but also packaging.

Today, the use of such digital technology systems as:

- the Transport Management System (TMS), which is used for the maintenance of transport business processes in logistics systems, provides for the management of business processes related to transportation and the provision of related services, which include calculations of the cost of transportation, including various types of transport, accounting for customs costs, accounting of data on loading and unloading operations, delivery terms, transportation time, etc.;

- the Warehouse Management System (WMS), which is used for warehouse logistics, provides for management of warehouse topology, parameters of product nomenclature, planning of warehouse operations, application of information systems for storage of stocks and processing of cargoes of finished products;

- the Manufacturing (Distribution) resource planning (M(D)RP II) system is used in the management of stocks, supply, sales of products, is an integrated methodology of the business process of planning or distribution of material and production resources;

- Enterprise resource planning (ERP II) system, ERP II = MRP II + FRP + DRP is an

enterprise resource management system where planning of the material component, time of work centers, as well as financial resources FRP, DRP – distribution resource management, makes it possible to cover all business processes of a logistics enterprise, is an integrated methodology for managing all enterprise resources. It is a fairly widespread information system for the simultaneous provision of management and financial functions. The system allows you to analyze the company's activities, planning and allocation of resources, prepare production tasks on the basis of analytical data, monitor the progress of their implementation based on the interactivity of information processing. The popularity of this system is connected with the possibility of combining a large number of specialized software modules, which are combined into contours and are multifunctional. The difference of the second generation of this program from the original one is the use of new, more innovative digital technologies, which include On-line Analytical Processing (OLAP), which is a new generation of multidimensional data analysis in a data bank, as well as a progressive Balanced Scorecard (BSC), which in general, it provides for ERP II a modular, not a process representation of the management of processes in the enterprise;

- the Customer Synchronized Resource Planning (CSRP) system also covers all business processes of the enterprise, it is an integrated methodology for managing all types of enterprise resources, its feature is synchronization with the needs of the buyer;

- the Customer Relationship Management (CRM) system provides logistics business processes, the integrated methodology of logistics management is aimed at interaction and relationships with customers;

- the Supply Chain Management (SCM) system provides for the creation of a network of enterprises thanks to the integrated methodology of supply chain management to meet the needs of the client with optimal costs, its use makes it possible to reduce the amount of working capital invested in inventories and simultaneously improve the level of service;

- the Supplier Relationship Management (SRM) system, the main direction of which is the management of interaction with suppliers, designed to automate the company's SRM strategy, is presented on the market as a corporate information system;

- the Continuous Acquisitions and Life cycle Support (CALS) system, which provides a general systemic approach in logistics as it involves the logistic design of supply chains with interactive support. The main focus of the system is focused on the strategy of

increasing the efficiency, profitability, productivity of heterogeneous processes in logistics due to the introduction of systematic methods of information interaction of participants in the logistics chain cycle. The use of such a system makes it possible to reduce time, reduce production costs, reduce the cost of technical documentation and protect against possible errors and mistakes in the implementation of logistics services. The application of the CALS system is based on the use of a single information space in which the interaction of participants takes place through the exchange of data in a certain supply chain. Legal, marketing, production, economic, open commercial information is used during the supply life cycle. The ease of distribution of innovative design solutions makes it possible to increase their effectiveness;

- E-commerce is positioned as working with buyers through a system of electronic trading platforms for online ordering on the website of the seller company;

- the Electronic Data Interchange (EDI) system is used to provide an electronic circulation document in a unified standard data format of direct and reverse converted texts, which allows you to quickly and efficiently integrate them into business programs thanks to the automation of the creation, receipt, processing and sending of electronic documents, which eliminates disadvantages of the traditional document flow process in logistics. The EDI system makes it possible to eliminate the shortcomings of the logistics process due to the digitalization of such processes as sending an order when it is changed, specifying an order, delaying invoicing, etc. Thanks to the EDI system implemented in logistics, communication channels between individual logistics units are improved, labor productivity increases, operational and administrative costs are reduced.

Expanding the use of logistics services makes it possible to:

- increase the competitiveness of enterprises;
- to improve the quality of goods and services due to more optimal delivery according to time and conditions;

- reduce the costs of supplying resources for production and delivery of finished products;

- to reduce the number of leading links between the manufacturer, supplier and consumer of products.

#### 4. Discussion

In our opinion, the study by the authors (Parhi S. et al., 2022) on the growth of scientific and managerial interests in sustainable development and digital logistics technologies, which explains the urgent need to expand the conceptual perspective and the perspective of implementation, deserves attention. Scientists have identified and critically evaluated fifteen favorable factors for the implementation of sustainable Logistics 4.0 for different companies at different stages of digitalization. As a conclusion, we support the results of the authors and believe that this study will help policymakers in conceptualizing and defining the plan for the implementation and implementation of the strategic map of sustainable Logistics 4.0.

We support the research of the authors (Gan W. et al., 2022), in which the main reasons for the harmonious development of the logistics industry, digitalization and ecological civilization in four provinces of China and the practical feasibility of the specific proposals are determined.

We consider it relevant to use the study (Gupta Himanshu et al., 2022), within which scientists identified obstacles to innovative digitization technologies that hinder the digital development of supply chain logistics during the pandemic. Within the framework of the article, a strategy for combating these barriers and overcoming them has been developed. Supporting the scientists, we believe that the results reveal an understanding of the barriers to digitalization during the pandemic, which can be valuable for managers and researchers.

Supporting the authors (Buss K.-P. et al., 2022), we would like to point out that the research deserves practical implementation, in which, based on empirical findings, it is claimed that the actual driver of digitalization and the purpose of using digital technologies is an attempt to optimize and control market relations and competitive processes, which are primarily determined by the specifics of the relevant industries industry, including logistics.

A study by scientists (Kuteyi D. et al., 2022) is worthy of attention, where it is proven that increasing the productivity of logistics is considered a significant driver of economic growth. We share the opinion of the authors that digitization in logistics promotes global trade and includes improved tracking systems, digitized information flows, artificial intelligence and automation.

Having considered the results of research by scientists, it should be noted that the

issue of the implementation of digital technologies in logistics is an important and relevant area of research and requires further study.

## Conclusion

Digital technologies make it possible to turn capital costs into operations, ensuring the preservation of information and providing quick access to it, on the basis of which more optimal management decisions are possible, as well as the implementation of preventive actions on any chain of logistics services, which increases the quality of customer service.

Justification of the advantages of using digital technology systems in logistics activities such as: E-Commerce; Fifth Party Logistics; Call center, Strategic Network Optimization; E-Supply Chain Management; Enterprise Resource Planning; Transport Management System, Warehouse Management System, Manufacturing (Distribution) resource planning, Enterprise resource planning, Customer Synchronized Resource Planning, Customer Relationship Management, Supply Chain Management, Supplier Relationship Management, Continuous Acquisitions and Life cycle Support, Electronic Data Interchange and others enables to evaluate their significant contribution to the development of the logistics sphere.

It has been proven that the use of digital technologies in logistics makes it possible to: effectively solve current problems and eliminate possible problems in the future; improve the quality of logistics services; load the capacity of logistics flows to the maximum; rationalize material flows; increase the safety of transportation; save material costs along the logistics route; to optimize costs for the supply of resources and products; to eliminate intermediate links by ensuring the transformation of information into forms that are convenient for consumers; increase the efficiency of information exchange and at the same time increase its security; implement new services and innovative customer support tools.

The issue of identifying existing problems in the development of logistics and developing ways to solve them using modern capabilities of digital technologies requires further scientific research.



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