

# The Impact of Digital Technologies and Marketing Innovations on the Role of Human Capital in the Transformation of Logistics Processes

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## ABSTRACT:

The productivity of the logistics sector has traditionally depended on the skills and qualifications of its specialists. In the era of digitalization, however, the role of technical, managerial, and executive personnel as a strategic resource has grown significantly. This study examines the importance of human capital and professional development programs in the digital transformation of logistics processes. It highlights the synergy between supply chain reconfiguration and the enhancement of employee competencies within digitalized logistics systems. The transition from traditional manual logistics operations to technology-based automated functions redefines the role of human capital, emphasizing innovation and adaptability. Despite the growing demand for specialists with advanced digital skills, the pace of competency development remains slow even in highly efficient logistics countries. Analysis of the Ukrainian experience reveals a need for continuous training and reskilling initiatives. The study also explores the interrelation between marketing innovations and logistics activities in a digital environment.

*Keywords: logistics process, innovation marketing, green technologies, digital technologies, digital marketing, logistics, human capital.*

## 1. Introduction

The logistics sector is in the process of digital transformation and business restructuring as a result of the introduction of digital technologies and information systems. Digital technologies – technologies for optimizing the use of resources in the provision of logistics services, including real-time business process processing systems, logistics complex management systems, enterprise resource planning systems ERP, business analytics, big data, artificial intelligence, blockchain – are fundamentally changing the ways of organizing work, allowing to optimize logistics processes and build new business models.

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The driving force of digital change in logistics is determined by human capital, capable of carrying out new digital developments, implementing and integrating digital innovations. Digital literacy, skills and competencies of personnel determine the effectiveness of digital transformation in logistics.

In these conditions of digitalization, the role of human capital in the performance of logistics functions is changing towards an increasing need for enterprises for personnel with digital skills for the automated performance of logistics functions using technology. The need for companies to develop the skills and competencies of personnel is growing, and advanced training and training programs allow to meet the new needs of logistics operators.

Innovation marketing is considered a new concept of doing business, the implementation of which ensures the creation of innovations in the activities of the enterprise (Grizovska & Romanova, 2018). Innovation marketing in logistics allows, based on research on market trends, to identify unsatisfied consumer demand and ensure the development of new logistics services and processes to meet demand. The most innovative services in logistics – responsible storage, fulfillment, value-added service (VAS services or value added service), processing of customer orders during warehousing and others – are developed by logistics operators as a result of marketing innovation activities and comprehensive market research.

Despite significant theoretical and practical developments devoted to digital transformation in logistics under the influence of innovation marketing, the role of human capital as a factor in the creation of new products, processes and services in logistics remains insufficiently studied. Given the above, there is a need to substantiate the role of human capital in the context of the implementation of digital technologies in logistics for the transformation of logistics business processes and innovation marketing as a prerequisite for the optimization of logistics services and processes.

## **2. Literature Review**

In academic literature, increasing attention is paid to the issues of digitalization of logistics and the study of the importance of human capital as a driving force for the productivity of digital logistics. Thus, the work (Kantsedal et al., 2025) revealed the role of digital tools in optimizing the processes of supply, transportation, and storage of goods (automated warehouse systems, supply chain management systems, blockchain technologies and artificial intelligence, the Internet of Things). Digitalization provides a transition to sustainable production – building business models for automating production processes, rational use of resources (Desyatnyuk & Ptashchenko, 2025). The study (Prokopenko et al., 2021) substantiates the role of logistics concepts in optimizing business processes, proposing an optimization methodology based on integrated logistics technologies. The use of technologies contributes to the growth of transaction costs, ensures transparency of operations, and optimizes delivery routes (Table 1).

**Table 1:** Digital technologies in logistics processes

Type of digital technology	Impact on logistics processes
Supply Chain Management (SCM) Systems	Real-time control of all stages of the supply chain from suppliers to end consumers of goods, reduction of costs for logistics processes, increase of the level of transparency of processes, reporting on the movement of goods and resources
Automated warehouse systems (WMS)	Improve inventory management processes in warehouses, warehousing processes, goods placement, goods transportation processes in warehouses, reduce errors when loading, shipping goods, fast customer order processing processes
Business analytics and big data	Automation of big data and information processing and analysis processes in logistics, accurate demand forecasting, optimization of order and inventory processes, optimization of delivery routes based on data, accurate planning of other logistics processes
Internet of Things (IoT)	Automated monitoring of cargo and vehicles through created cyber-physical systems to increase the safety of transportation processes
Blockchain	Security and transparency of transactions in supply chains, prevention of fraud and data manipulation, automation of processes through smart contracts and reduction of time to conclude deals
Artificial Intelligence (AI) and Machine Learning	Optimization and automation of all business processes (demand forecasting, route optimization, order processing automation)
Cloud technologies and cloud computing services (cloud-based transportation management systems, TMS)	Automation of cargo tracking and transportation processes in real time, automation of inventory management processes and planning of delivery routes, cost reduction through the purchase of services, integration of data from various sources
Real-time business process processing systems (CRM, RPA, ERP)	Automation of routine business processes of logistics enterprises (sales, communication, information transfer and exchange, inventory planning, etc.)

*Source: created by authors based on (Kantsedal et al., 2025; Desyatnyuk & Ptashchenko, 2025; Krysovatyiy et al., 2024; Prokopenko et al., 2021)*

With the fundamental change in logistics processes in the context of digitalization, human capital is becoming increasingly important as a productivity factor in logistics. Traditionally, research on human capital in logistics has focused on the impact of education, experience, and professional skills on logistics productivity, with skills being the main predictors of productivity (interpersonal, technical, managerial, etc.) (Gammelgaard & Larson, 2001; Myers et al., 2004). The integration of various software products to perform logistics functions requires personnel training, despite a number of advantages of an integrated logistics approach (Marinov & Lisenyi, 2024): increased profitability of logistics operations, transparency of logistics processes, automation of document flow, and reduction of the need for manual labor. Digital business transformation contributes to cost optimization and increased sustainability of operational processes, but the success of digitalization depends on human capital (Bobro et al., 2025; Desyatnyuk et al., 2024a,

2024b). Human capital (operational, managerial, leadership) is determined by the factor of successful implementation of technologies in the Logistics 4.0 environment (Rahman et al., 2022). Recent studies prove the positive relationship between “green logistics” and “green human capital”, their driving force of influence on the circular economy (Cheng et al., 2023).

Despite the coverage of the impact of digital technologies on the transformation of logistics processes, the role of human capital as a factor in effective digitalization and optimization of processes in logistics remains an under-researched issue. Traditionally, the attention of scientists has been focused on the issues of acquiring skills for the use of digital technologies in logistics activities.

The purpose of the article is to study the role of human capital in the transformation of logistics processes under the influence of the introduction of digital technologies and marketing innovations.

### **3. Materials and Methods**

In the 21st century, logistics has undergone large-scale digital changes, caused by the development of digital technologies, the need for automation and robotization of logistics functions in conditions of labor shortages, the need to introduce new ways of organizing transportation, warehousing, storage, and order processing.

Digital transformation in logistics involves restructuring and optimizing business processes and business models using modern technologies, purchasing and updating equipment and software. As a result, fundamental changes are taking place in management approaches, corporate culture, and external and internal communications.

The role of human capital using digital technologies in logistics is growing, as approaches to labor organization are changing. The need for specialists engaged in routine operations is decreasing, while the need for personnel with highly specialized skills in technological order processing, distribution center management, ensuring continuity of supplies and speed of delivery, and providing specialized services and delivery services to customers is increasing.

Despite the growing role of human capital in logistics, investment in the development of digital and analytical skills in the private sector and the state remains a contentious issue. First, companies spend significant resources on remuneration and benefits for employees in the sector. Second, companies make significant investments in infrastructure and tangible non-current assets as the main factor in the sector's efficiency. A culture of learning has not become widespread, although the experience of individual companies in logistics demonstrates its impact on improving skills. On the other hand, the state is focused on investing in infrastructure development, while the skills and competencies of specialists remain neglected by both industry enterprises and the public sector.

In the EU, transport and warehousing companies provided jobs for 10.4 million people in 2022 (6.5% of the workforce). The average remuneration for employees was €38,900 per person in 2022. The total amount spent by companies in the EU on remuneration was €362.6 million, with an added value of €642.7 million. The sector is

dominated by large companies providing postal, rail, and air transport services (Eurostat, 2022).

According to a review by the International Investment Forum 2025, investment in domestic transport infrastructure in different countries around the world ranges from 0.1% of GDP in Ireland to 3% of GDP in Azerbaijan. Developed countries with mature transport systems and lower investment potential invest up to 1% of GDP (International Transport Forum, 2025).

One of the leading telecommunications companies in the American market, in the context of digitalization, completely changed the approach to the performance of traditional logistics functions by logistics managers, who worked according to uniform standards of service for all customers to maintain a high level of service. At the same time, the company's logistics managers did not change their skills and competencies for many years. In the context of digitalization, the need to use digital technologies and at the same time the accumulated assets in logistics activities (warehouses, distribution centers, trucks) led to a constant increase in costs. At the same time, the needs of customers for highly specialized services were significantly leveled. Changing the approach to service and moving away from uniform standards to specialized services allowed not only to improve the skills of specialists, but also to achieve the strategic goals of companies for more efficient use of assets and increased sales (Fuller *et al.*, 1993).

Digitalization, as one of the factors influencing the internal activities of logistics operators, requires companies to develop personnel with technical, managerial, and administrative skills for consistent optimization of operational and administrative business processes.

The American company General Motors, due to the emergence of IT and the increasing level of autonomy in the automotive industry, has increased labor requirements, which has led to the need to reduce staff in the context of digitalization of the supply chain. Thus, traditionally the automotive industry needed workers responsible for mechanical and maintenance work, but in the context of digital transformation, the need for digital skills is growing exponentially (Muro & Robert, 2018).

In contrast, the automotive company Volvo completely changed its hiring strategy to strengthen its competitive position in the market, including with General Motors and Toyota. During 2011–2013, the company recruited more than 3,000 employees from other industries in the field of engineering and development for and developed a program for their integration to develop human capital capable of ensuring business transformation. The change in strategy was due to the company's staff skills development needs, which did not match external changes in the industry (Charan *et al.*, 2018).

Developing digital literacy among employees is becoming a necessity. Singapore-based DBS has implemented digital literacy initiatives since the beginning of its digital transformation strategy: training, retraining, and upgrading employees, promoting hands-on experience with technology, and engaging innovation professionals in every department of the company (Woerner *et al.*, 2022).

Human capital is defined as a strategic resource in the processes of digital transformation of logistics. Employees ensure the effective use of digital technologies, form an innovative environment for the creation of new products, services, and processes. Involving personnel in the processes of automation of logistics functions allows to

increase the level of motivation of employees, develop logistics services, improve the interaction of personnel involved in the performance of various business functions, and also involve personnel in the implementation of the strategic goals of the company. In the conditions of the digital economy, there is a reorientation of labor functions: the need for physical labor decreases and the demand for analytical, digital, creative, and managerial skills increases.

In developed countries, the role of human capital using digital technologies in logistics is only growing, in particular, the need for personnel with highly specialized skills in technological order processing, distribution center management, ensuring continuity of supply and speed of delivery, and providing specialized services and delivery services to customers is growing.

A business survey on ICT use shows a significant digital divide between small and medium-sized enterprises in the adoption of complex technologies (data analytics, cloud computing) or mass technologies (enterprise resource planning). Enterprises are mainly focused on digitizing administrative and marketing functions, while logistics functions remain less technologically equipped. Digital awareness and gaps in internal skills remain among the barriers to the digitalisation of enterprises. In some countries, government intervention through training is attempting to address this issue (OECD, 2021). However, investment in fixed assets remains a priority for the logistics business. As a result, in 2021, UK logistics firms increased their investment in the acquisition of warehouse and distribution facilities (Logistics UK, 2021).

According to the Logistics Efficiency Index, world leaders in the logistics industry note slow changes in personnel competencies even in countries where logistics is most developed and efficient (Table 2).

**Table 2:** Assessments of logistics competencies and logistics quality according to the Logistics Efficiency Index in the leading countries in the ranking in 2014–2023

Logistics quality and competences	2014	2016	2018	2023	Deviation, +/-
Germany	4.12	4.28	4.31	4.2	0.08
Netherlands	4.13	4.22	4.09	4.2	0.07
Belgium	4.11	4.07	4.13	4.2	0.09
Great Britain	4.03	4.05	4.05	3.7	-0.33
Singapore	3.97	4.09	4.10	4.4	0.43
Sweden	3.98	4.25	3.98	4.2	0.22
Norway	4.19	3.70	3.69	3.8	-0.39
Luxembourg	3.78	4.01	3.76	3.9	0.12
USA	3.97	4.01	3.87	3.9	-0.07
Japan	3.93	3.99	4.09	4.1	0.17

Ireland	3.94	3.79	3.60	3.6	-0.34
Canada	3.94	3.90	3.90	4.2	0.26
France	3.75	3.82	3.84	3.8	0.05
Switzerland	3.75	3.95	3.97	4.3	0.55

*Source: World Bank (n.d.)*

*Note: on a scale from 1 to 5, where 1 is low, 5 is high*

The role of human capital in the digital transformation of business processes in logistics is summarized in Table 3: teams with specialized knowledge, skills, and experience are important for the digitalization of logistics processes; technology centers created within the structure of enterprises allow the accumulation of limited human resources to implement the most important strategic initiatives in logistics; involving personnel in digitalization processes allows the development of skills in digital logistics for better performance of operations and functions; the development of personnel skills in logistics becomes a factor in improving the performance of core and supporting business processes using technology; personnel training programs allow increasing logistics productivity.

**Table 3:** The role of human capital in the digital transformation of business processes in logistics (author's development)

Human capital	Digital transformation of logistics processes
Creating teams with specialized knowledge, skills, and experience in implementing digital technologies to ensure digitalization in logistics	Technological (digital) changes in logistics processes that are being automated and optimized
Creation of technology centers within the structure of companies in conditions of shortage of human resources	Effective allocation of human resources is based on the principle of the greatest level of strategic impact of the digital initiative on business processes
Involving personnel in the digitalization of logistics processes	Development of skills and competencies in the field of digital logistics, experience in solving the most common challenges in digitalization
Development of new skills of personnel in the use of technologies in transportation and logistics	The combination of personnel skills and technology allows to significantly improve the execution of business processes in logistics, personnel see possible improvements in the weakest areas of business processes even when using technology
Systematization of knowledge and experience of personnel in logistics, development of new skills through training programs in conditions of shortage of labor resources in logistics	Improving the execution of logistics processes and functions, as well as logistics management

*Source: created by authors*

In contrast, in Ukraine, the role of human capital in the logistics sector differs from developed countries and the experience of international companies primarily due to

the lower share of the ICT sector in the economy, the lower level of technical and digital skills of the workforce. The logistics sector began to develop actively before the war, and since 2022, the need for high-quality logistics has increased in conditions of a shortage of personnel involved in transportation, warehousing processes, and service processes.

The Ukrainian experience demonstrates the need for highly qualified personnel in the face of a shortage of labor resources in logistics. In Ukraine, the number of people employed in the transport, warehousing and courier sectors decreased from 729,388 thousand people in 2020 to 538,929 thousand people in 2024 (State Statistics Service of Ukraine, n.d.-b). According to research on the logistics industry in Ukraine during martial law, more than 76% of supply chain managers claim a shortage of labor resources in 2024 (Gordon, 2024). This indicates that human capital is not only a factor of efficiency, but also a limitation of the digital transformation of the logistics industry. The development of professional competencies, digital literacy and change management skills is becoming a necessary condition for the digital technological development of the sector (Impulse Consulting, 2024).

In Ukraine, during the war, the role of the transport and logistics sector has increased with the growing shortage of labor, especially in warehouse logistics. In these conditions, the demand for highly qualified workers has increased in the labor market, and the state and educational sectors offer free programs and initiatives to develop the human resources potential of the logistics business (Chaikovska, 2024). Thanks to the project "Increasing the Human Resources Potential of the Logistics Business" to develop the skills needed by logistics enterprises, employment opportunities are opening up for various categories of the population (including veterans, internally displaced persons) (Chaikovska, 2024).

Since 2021, in the context of active development of the logistics sector, a Logistics Development Program has been operating in Ukraine, which allows practitioners to systematize and acquire new knowledge and expand their professional skills (managers, heads of foreign economic activity, heads of transport and warehouse logistics) (European Business Association, 2021). Thanks to professional training in logistics, Kernel develops its own critical industry expertise in agrotechnology (Forbes BrandVoice, 2025). The international company MHP has developed internal programs in the training center and provided mentoring by specialists with experience in logistics for women to retrain and attract them in conditions of labor shortage. Other well-known Ukrainian companies (Nova Poshta, Aurora, ATB, Silpo) have also developed training programs for women to solve the problem of staff shortage in internal logistics, introduced the practice of cross-training to master additional skills of personnel (Karpenko, 2025). Thanks to training programs, companies not only develop the skills necessary to perform logistics functions, but also create better conditions for attracting personnel and increasing their level of motivation for employment in logistics.

The shortage of labor in logistics has become an additional factor in the need to use integrated digital technologies to compensate for it, and to develop human capital to replace manual labor and solve the problem of limited human resources of enterprises.

The problem of labor shortages in logistics can be solved by creating new service models based on innovative marketing. Most studies do not explain the interaction between technology, human capital, and the concept of innovation marketing. However,

the focus of logistics companies on the digitalization of marketing functions and administrative processes, coupled with significant investments in tangible assets, indicates the considerable potential of this interaction. To measure the effectiveness of combining these concepts, it is worth comparing indicators of investment in new current assets, employee compensation costs, and marketing costs. An additional indicator of effectiveness will be the number of innovations (innovative processes, products) implemented at the firm level.

In Ukraine, the level of Internet use in the field of transport, warehousing and courier activities is increasing, the number of employed workers who have access to the Internet in this sector is increasing, and the total share of enterprises in this sector of the economy with fixed access is increasing (Table 4). Over the years 2018–2025, the pace of digitalization has significantly increased, which is due to the needs of providing employees with a remote workplace, developing a cyber protection and information security infrastructure, and other needs of the domestic logistics business. At the same time, unlike the global experience of logistics companies, domestic business traditionally involves IT specialists in the development and support of digital solutions as one of the most common forms of digital transformation of processes.

The Ukrainian experience demonstrates not only the importance of human capital as a strategic resource for logistics in the context of digitalization, but also as a constraint for firms in the context of labor shortages. With this in mind, effective intervention policies, corporate retraining programs for specialists, and institutional partnerships can overcome existing barriers to the development of logistics and the construction of new logistics systems.

**Table 4:** Dynamics of ICT usage indicators by transport, warehousing and courier enterprises in Ukraine in 2018–2025

ICT usage indicators	2018	2019	2021	2022	2023	2024	2025	Absolute deviation, +/-
1. Number of enterprises with access to the Internet, units	3462	3553	3590	3422	3185	3159	3176	-286
in % to the total number of enterprises of the corresponding type of economic activity	87.8	87.9	85.5	86.2	93.6	94.5	94.0	6.0
2. Number of employed workers who have access to the Internet, thousand people	98.51	113.1	120.83	109.98	79.67	97.35	149.01	51.0
in % to the total number of enterprises of the corresponding type of economic activity	15.2	18.5	17.6	16.9	14.2	18.8	30.0	15
3. Share of the number of enterprises using fixed Internet access in the total number of enterprises, %	58.1	58.2	58.8	60.0	81.0	84.8	83.4	25

*Source: State Statistics Service of Ukraine (n.d.-a)*

Therefore, the role of human capital goes beyond the traditional use of knowledge, skills, and experience to provide logistics services and perform logistics functions using technology. Involving employees in automation processes allows for improving and increasing the level of technology use in logistics activities, providing personalized comprehensive services to customers, and thus ensuring increased productivity in the logistics industry.

The role of human capital in the implementation and use of digital technologies is growing, business needs highly qualified personnel capable not only of servicing technologies, but also of interpreting the results of analytical processing of information, using data to make management decisions, develop new products, services and optimize logistics processes. The latter requires the involvement of personnel in automation processes, as well as innovative marketing to identify the main market trends in the areas of digitalization and logistics.

Innovation marketing plays an important role in shaping the competitiveness of logistics operators, its integration with logistics processes allows creating new business models for providing services based on data, knowledge, and experience. Enterprises that actively use digital marketing gain advantages in demand forecasting, inventory management, and developing innovative logistics solutions (Figure 1).

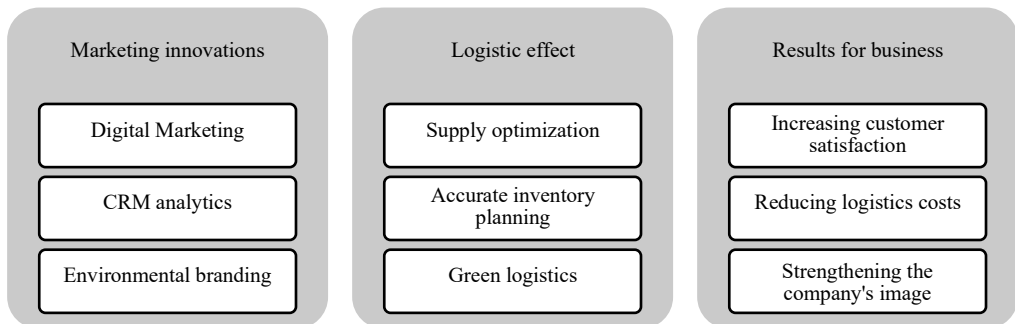


Figure 1. Relationship between innovation marketing and logistics efficiency  
Source: created by authors

Digital technologies are becoming a key tool for implementing the principles of "green" logistics: the use of data analytics, GPS monitoring and automated route planning allows to reduce carbon emissions, reduce fuel consumption and increase the efficiency of transportation processes.

## 5. Conclusions

The digital transformation of logistics processes requires the integrated use of digital technologies and the involvement of personnel in the processes of their optimization. In this context, the role of human capital is not only to use existing skills and competencies in the practical use of technologies for the provision of services, but also to involve personnel in optimization processes and identify weaknesses in processes. Automation of logistics processes requires the involvement of personnel, while allowing

to improve logistics services and provide quality service with the practical application of the concept of marketing innovations. The use of technologies requires the development of highly specialized specialists, therefore, the role of human capital in the performance of logistics functions is changing. On a global scale, the need for human resources with highly specialized skills is growing. Human capital is becoming a strategic resource, shifting from performing routine tasks to jointly creating value through innovation, technology, and innovation marketing.

At the same time, in countries leading in terms of logistics efficiency, the development of competencies in the sector is quite slow. Human capital is defined as a strategic resource in the processes of digital transformation of logistics, which ensures the effective use of digital technologies, forms an innovative environment for the creation of new products, services, and processes. The analyzed trends of the Ukrainian experience have revealed the need for enterprises to develop new knowledge and professional skills of logistics specialists in the face of increasing digitalization of the transport and warehousing sectors and labor shortages. To this end, leading enterprises are developing training programs and implementing initiatives to improve personnel skills. The Ukrainian experience demonstrates the importance of training programs for the development of human capital as a strategic resource in the context of the global trend toward the need for highly qualified personnel. Overall, the results of the study confirm the importance of human capital as a decisive factor in the digitalization of logistics. At the same time, the study expands existing knowledge by arguing that combining innovation marketing with human resource development contributes to the creation of new service models in logistics. The introduction of technology is not enough to improve logistics productivity without strategic investment in employee competencies.

The relationships between the concept of innovation marketing and logistics activities are determined. The integration of innovation marketing with logistics processes allows to create new business models for providing services based on data, knowledge, and experience of personnel in performing logistics functions. Further research should be directed at studying the experience of using digital technologies in creating innovative products, processes, and services in logistics.

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