

## LOGISTICS IN THE PROCESS OF ENTERPRISE MANAGEMENT IN CONDITIONS OF THE COVID-19 PANDEMIC ON THE EXAMPLE OF SELECTED ENTERPRISES

Magdalena K. GAŚOWSKA

University of Warsaw, Faculty of Management; mgasowska@wz.uw.edu.pl, ORCID: 0000-0002-4971-5440

**Purpose:** The aim of the article is to analyze and assess the role of logistics in the process of enterprise management during the COVID-19 pandemic on the example of selected manufacturing, trade and service enterprises.

**Design/methodology/approach:** The article is based on the study of literature and own empirical research. The results of own empirical research presented in the study constitute the effects of more extensive research on an in-depth analysis of the logistics process management in Polish manufacturing, trade and service enterprises in 2019-2021 in the context of shaping enterprise results. The research was conducted in 2022 among 335 randomly selected small, medium and large Polish manufacturing, trade and service enterprises.

**Findings:** The results of the research show that the strategic and operational management of logistics processes within the enterprise and between entities which are the links in the supply chain increasingly determined the economic and market results of the best surveyed enterprises and the supply chains they created during the COVID-19 pandemic. Thanks to adequately applied logistics to the occurred conditions, the best surveyed enterprises responded quickly and appropriately to the effects of the pandemic and created and maintained the competitive advantage. The analyzed enterprises did not use the full potential of logistics processes to reduce the negative influence of the COVID-19 pandemic on their results. The research confirmed that logistics played an extremely important role in the process of enterprise management during the COVID-19 pandemic.

**Research limitations/implications:** The article presents only selected aspects of logistics in the process of enterprise management of the surveyed enterprises during the COVID-19 pandemic.

**Practical implications:** The article offers logistics managers practical suggestions on how to use logistics to achieve above-average economic and market results in conditions of a pandemic.

**Originality/value:** The article fills the cognitive and empirical gap regarding logistics in the process of enterprise management during the COVID-19 pandemic.

**Keywords:** Logistics, enterprise, supply chain management, competitive advantage, COVID-19 pandemic.

**Category of the paper:** Research paper.

## 1. Introduction

Contemporary enterprises are increasingly exposed to unpredictable occurrences that have a significant influence on their functioning. In recent years, the COVID-19 pandemic have quickly caused economic shocks in most countries around the world and unprecedented, enormous and global changes in the conditions of functioning of economic entities. As a result of the COVID-19 pandemic, enterprises had to face challenges related to rapid changes in demand and supply, health and safety, supply chain, slowing down the globalization process, reorganization of global value chains, disruption of foreign direct investment flows, workforce, cash flows, sales and marketing, acceleration of digital transformation, robotization and automation of production (Donthu, Gustafsson, 2020; Acioli, Scavarda, Reis, 2021; Gorynia, Kuczevska, 2022; Zhaon, Chen, 2022; Choi et al., 2023; Klöckner et al., 2023). During the pandemic, the most effective managers took quick actions to reduce the likelihood of disruption and severity of the effects of the occurred events, and create and maintain competitive advantages of their enterprises.

The activity of every enterprise is related to logistics processes that concern physical flows, services and associated with them information within the enterprise and between economic entities participating in the delivery of a product or service to a customer. Logistics processes implemented within logistics system determine the results of enterprises and are very susceptible to disruptions during the pandemic. Logistics is responsible for managing logistics processes in order to provide the service desired by customers at the lowest possible costs. Logistics managers increasingly deal with logistics processes across the enterprise and the entire supply chain. The COVID-19 pandemic has caused unprecedented disruptions to logistics procurement processes, logistics production processes, and logistics distribution processes in enterprises and supply chains around the world (Chowdhury et al., 2021; Butt, 2022; Ardekani et al., 2023; Montoya-Torres, Muñoz-Villamizar, Mejia-Argueta, 2023; Rinaldi, Bottani, 2023). During the pandemic, logistics managers should very quickly identify rapidly emerging threats related to logistics processes, opportunities to reduce logistics costs, emerging opportunities and implement appropriate adaptation processes to rapidly changing market conditions.

The aim of the article is to analyze and assess the role of logistics in the process of enterprise management during the COVID-19 pandemic on the example of selected manufacturing, trade and service enterprises.

## **2. Theoretical aspects of logistics in business process management during the COVID-19 pandemic**

The COVID-19 pandemic has induced unprecedented, enormous changes in the conditions of enterprise functioning, which overlapped with the determinants of activities of contemporary organizations before the pandemic. Fast, adequate and effective response of enterprises to the unprecedented dynamics of changes in the global market, complexity, uncertainty, high risk, growing and changing customer requirements and expectations, rapid technological progress, consequences of the COVID-19 pandemic, hypercompetition, growing political tensions and increased importance of national interests depend on the adequate management of physical flows, services and associated with them information at the scale of the enterprise and the entire market system (Remko, 2020; Roscoe et al., 2020; Chung, 2021; Herold et al., 2021; Park, 2021; Zahra, 2021; Wolniak, 2023).

Modern logistics managers should apply a strategic approach for creating logistics activities and solutions which is implemented at the strategic and operational level in the enterprise (Gąsowska, 2022a). Strategic decisions concern a long time horizon and come down to selecting some action options from an incomplete set of possibilities in an imperfectly perceived environment and the accompanying ambiguity and uncertainty (Czakon, 2020). At the strategic level, decisions are made regarding solving basic logistics problems and tasks. When there are serious disruptions in the environment, such as a pandemic, logistics managers should make strategic decisions adequate to the logistics conditions, regarding the reallocation of resources, reconfiguration of structures, processes and strategies. At the operational level, logistics managers make short-term decisions resulting from implementation of the strategic decisions and responding to current disruptions and problems.

The COVID-19 pandemic has induced many new challenges in the operational management of logistics processes in enterprises and supply chains (Paul, Chowdhury, 2020; Farooq et al., 2021; Schleper et al., 2021; Singh et al., 2021; Kayikci, Usar, Aylak, 2022; Mishra, Singh, Subramanian, 2022). Adequate operational management of logistics processes in the enterprise and between economic entities participating in the process of delivering a product or service to a customer enables the implementation of strategic goals, quick and appropriate response to changing wishes and expectations of customers, threats, disruptions, opportunities, risk reduction, and in the case of the occurrence of risk factors, the reduction effects of losses, ensuring business continuity, maintaining good reputation, better use of assets, generating sales revenues, reducing logistics costs, improving financial liquidity and protecting health and safety. Logistics affects the basic factors determining enterprise's existence in the conditions of a pandemic.

During the pandemic, the ability to adapt is very important. It means the ability to adapt to the changing environment and involves the necessity to make changes (Chingwena, Scheepers, 2022). Creating company value, competitive advantage and above-average results during the pandemic conditions is conditioned by building and improving dynamic capabilities (Dyduch et al., 2021; Ali et al., 2022; Ahmad, Naseem, Rehman, 2023; Dejardini et al., 2023; Kähkönen et al., 2023). The basic component of enterprise's dynamic capabilities is the ability to change. Logistics processes of enterprises during the pandemic must be adequate to rapidly changing conditions, which involves the necessity to make changes (Handfield et al., 2020; Yang et al., 2022; Gąsowska, 2022b; Gąsowska, 2022c; Zwolińska, 2022).

The most effective managers treat innovations as a response to difficult market conditions (Markovic et al., 2021). Open innovations played a key role in adapting the enterprise's activities to the conditions related to the COVID-19 pandemic (Greco et al., 2022; Sharma et al., 2022; Jabeen et al., 2023). In order to prevent unpredictable disruptions, enterprises should respond quickly and adequately to the effects of the pandemic, create and maintain a competitive advantage and implement logistics innovations (Dovbischuk, 2022; Gligor, Russo, Maloni, 2022; Orlando et al., 2022). The innovativeness of an enterprise in the area of logistics is conditioned by engaging appropriate financial resources, appropriate staff, knowledge, skills, appropriate culture supporting creativity and openness to new ideas, and cooperation with customers and entities involved in the process of delivering products or services to a customer.

The COVID-19 pandemic has caused enormous uncertainty and a sharp increase in risk in logistics systems. In such conditions, the key task of logistics managers is to strive to reduce the probability of disruption of logistics processes in the entire logistics system and to quickly take actions to reduce the severity of the effects of the occurred event (Handfield, Graham, Burns 2020; Kovács, Sigala, 2021). Digital technologies play an important role in the risk analysis of logistics systems, enable the acceleration of decision-making processes with the appropriate use of information, and facilitate quick responses to disruptions in logistics systems (Choi, 2021).

Logistics managers should build an information system enabling the integration and coordination of logistics processes, constituting the basis for effective solving logistics problems, enabling a very quick response to threats, identifying and exploiting opportunities faster than competitors, and reducing uncertainty and risk associated with logistics activities and solutions on the scale of the enterprise and the entire market system. The use of modern technologies in the area of logistics enables the enterprise to increase the speed and reliability of deliveries, provide and accelerate the information sharing, supports the traceability of physical flows along the supply chain, monitors and replenishes inventories, allows for the satisfaction of customer wishes and expectations, reduces operating costs, implements the principles of sustainable development, helps identify, analyze, reduce and monitor risks related

to logistics processes in the enterprises and supply chains (Fischer-Preßler et al., 2020; Acioli, Scavarda, Reis, 2021). The mentioned benefits are particularly important during the pandemic.

Cooperation with other entities, including competitors, may be a source of benefits, such as improving the level of customer service, greater flexibility, reducing costs, increasing operational efficiency, unique access to resources and competences, implementing innovations, reducing operational risk, increasing resistance to disruptions, quicker use of opportunities and, consequently, achieving above-average results in the conditions of the pandemic. Enterprises increasingly compete with supply chains. Logistics is a key area in supply chain management. Fast, efficient and effective logistics activities and solutions determine the survival and building the competitiveness of the supply chain in the conditions of the COVID-19 pandemic (Choi, 2020; Singh et al., 2021; Gąsowska, 2022b; Gąsowska, 2022c; Song et al., 2022).

Supply chains, especially the global ones, are particularly vulnerable to the disruptions and had to face enormous supply, demand and logistics challenges during the pandemic. According to many researchers, in conditions of extreme uncertainty, enterprises should create resilient supply chains (Pettit et al., 2019; Aslam et al., 2020; Świerczek, 2020; Madhavi, Wickramarachchi, 2022). The resilient supply chains are ready to respond quickly and effectively to emerging threats, maintaining continuity of operations at the desired level and control over the structure and functions (Ponomarov, Holcomb, 2009). The attributes of disruption-resistant supply chains are flexibility and adaptability. Research shows that during the pandemic, enterprises undertook proactive and reactive actions to build resilience to disruptions, but these were not enough to mitigate all the negative effects of the COVID-19 pandemic. The most effective factor in building supply chain resilience during the pandemic was innovation (Ozdemir et al., 2022). Building resilience to supply chain disruptions was also possible by systemic risk management in the supply chain, strengthening the position, building strong relationships with suppliers, customers and employees, adequate forecasting and designing products (Ozdemir et al., 2022; Browning et al., 2023; Gurbuz et al., 2023).

Agile, resilient, innovative and sustainable supply chains can respond quickly and effectively to emerging opportunities, short-term supply chain disruptions and long-term global crises such as the COVID-19 pandemic (Ivanov, 2022). The COVID-19 pandemic has contributed to the acceleration of digital transformations in enterprises and supply chains. Digital technologies help organizations develop global value chains, visibility, agility, flexibility and dynamic capabilities necessary for sustainable enterprise development, which enables enterprises creating the supply chain to achieve greater efficiency during the pandemic (Lee, Trimi, 2021; Ye et al., 2022).

### 3. Research methodology

The results of author's own empirical research presented in the study are the effects of more extensive research on an in-depth analysis of the logistics process management in Polish manufacturing, trade and service enterprises in the years 2019-2021 in the context of shaping enterprise's results. The research was conducted in 2022 using the method of direct interview with managers responsible for logistics in the surveyed companies and the method of computer-assisted interview conducted via the Internet with logistics managers. During the interviews, a detailed survey questionnaire was used, consisting of 39 questions.

335 randomly selected small, medium and large manufacturing, trade and service enterprises (based in Poland) from the following provinces were examined: Masovian, Lesser Poland, Kuyavian-Pomeranian, Greater Poland, Lodz, Lublin, Subcarpathian, Podlasie, Pomeranian, Silesian, Swietokrzyskie, Warmian-Masurian and Greater Poland. The majority of the surveyed population constituted enterprises from the Masovian Province. The surveyed enterprises were characterized by diverse competitive positions on the market.

The largest group among the surveyed companies constituted small enterprises (44.4%). The share of medium enterprises in the surveyed population was 30.1%. The smallest percentage of the surveyed enterprises represented large companies (25.5%). Manufacturing enterprises constituted 37.0% of the surveyed sample of the enterprises (14.3% small manufacturing enterprises, 11.9% medium manufacturing enterprises, 10.8% large manufacturing enterprises). Trade and service enterprises had a similar share in the surveyed population. Trade enterprises accounted for 32.2% of the surveyed companies (13.7% small trade enterprises, 10.4% medium trade enterprises, 8.1% large trade enterprises), whereas service enterprises constituted 30.8% of the surveyed population (16.4% small service enterprises, 7.8% medium service enterprises, 6.6% large service enterprises).

In the structure of the surveyed enterprises, from the point of view of the sales revenue criterion, the largest group constituted companies generating sales revenues up to PLN 10 million (41.1%). The second largest surveyed group were enterprises generating sales revenues from PLN 10 to 50 million (18.2%). There was also a large group of enterprises with sales revenues ranging from PLN 100 to 500 million (17.3%). Enterprises with sales revenues exceeding PLN 1 billion constituted 9.6% of the surveyed population. 8.7% of the surveyed companies were companies generating sales revenues from PLN 50 to 100 million. The smallest share in the surveyed population had enterprises generating revenues from PLN 500 million to PLN 1 billion (5.1%).

The majority of the surveyed enterprises (56.1%) conducted international operations. The vast majority of the surveyed national enterprises constituted small companies. Only 31 of the 149 small surveyed companies operated internationally. Among international enterprises, the largest group constituted companies with the share of exports in the sales value

up to 10% (18.5% of the surveyed sample of the enterprises). The second largest group among international enterprises were companies with the share of exports in the sales value above 50% (15.8% of the surveyed sample of the enterprises). Companies with the share of exports in the sales value in the range of 10-30% constituted 13.7% of the surveyed population. The analysis covered 28 enterprises with the share of exports in the sales value in the range of 30-50% (8.1% of the surveyed sample of the enterprises). The surveyed companies with international operations exported their products or services primarily to the European Union.

The research results presented in the article concern selected aspects of logistics in the surveyed enterprises in the years 2019-2021.

#### **4. Logistics in management of the surveyed enterprises in the conditions of the COVID-19 pandemic – selected aspects**

The logistics goals of the surveyed enterprises in 2019-2021 constituted the subject of the research. The analysis of the research results led to the conclusion that 331 out of 335 surveyed companies had clearly defined logistics goals in 2019-2021. The largest number of the survey participants declared that in 2019 the logistics goals of the enterprise were: improving customer service (76.1%), building customer trust (65.7%), shaping the enterprise's competitive advantage (54.6%), maximizing sales revenues (52.2%), reducing logistics costs (45.9%), reliability of deliveries (44.1%), increasing enterprise flexibility (43.3%), increasing enterprise adaptability (42.1%), increasing sensitivity to customer requirements (40.8%).

In the years 2020-2021, the surveyed enterprises operated during the COVID-19 pandemic. The analysis of the research results allowed for the conclusion that in 2020, in most of the surveyed enterprises, the logistics goals were: improving customer service (78.2%), building customer trust (69.9%), maximizing sales revenues (56.4%), shaping the enterprise's competitive advantage (55.2%), shortening the order fulfilment time (53.7%), increasing the enterprise's flexibility (51.6%), increasing the speed of response to changing conditions – agility (50.7%).

In 2021, respondents most often indicated that the logistics goals of the company were: improving customer service (86.6%), building customer trust (74.0%), shaping the enterprise's competitive advantage (69.2%), maximizing sales revenues (62.6%), shortening the order fulfilment time (61.8%), reducing uncertainty and risk of business activity (61.8%). The majority of the study participants declared that the logistics goals of the enterprise were: building an effective information system (59.4%), increasing the speed of response to changing conditions – agility (58.8%), reducing logistics costs (58.2%), increasing the enterprise's flexibility (57.3%), increasing the enterprise's adaptability (54.6%), building resistance to

disruptions (53.7%), increasing sensitivity to customer requirements (52.2%) and increasing reliability of supplies (50.7%).

In order to check whether there are significant differences in frequency of distributions between subsequent periods in the case of the answers regarding logistics goals in the surveyed enterprises, chi-square tests were performed.  $P < 0.05$  was adopted as the limit of the statistical significance. In the following years, a statistically significant increase was observed in the frequency of choosing the following answer options regarding the logistics goals of the surveyed enterprises: shaping the enterprise's competitive advantage ( $p < 0.001$ ), shortening the order fulfilment time ( $p < 0.001$ ), building resistance to disruptions ( $p < 0.001$ ), reducing uncertainty and risk of business activity ( $p < 0.001$ ), increasing the speed of response to changing conditions – agility ( $p < 0.001$ ), building an effective information system ( $p < 0.001$ ), inventory protection ( $p < 0.001$ ), making logistics sustainable ( $p < 0.001$ ), improving customer service ( $p = 0.001$ ), increasing the enterprise's flexibility ( $p = 0.001$ ), reducing logistics costs ( $p = 0.002$ ), increasing the innovativeness of logistics ( $p = 0.002$ ), maintaining safety stocks ( $p = 0.004$ ), increasing adaptability of the enterprise ( $p = 0.005$ ), increasing sensitivity to customer requirements ( $p = 0.013$ ), optimization of logistics personnel management ( $p = 0.015$ ), maximization of sales revenues ( $p = 0.02$ ), increasing resource productivity ( $p = 0.046$ ), optimization of inventory levels ( $p = 0.048$ ). The response to increasing the financial liquidity was  $p = 0.05$ .

The results of the research show that in the analyzed period 15.2% of the surveyed enterprises did not create plans to achieve logistics goals. The vast majority of the surveyed companies had specified logistics goals in their operational plans (80.3% in 2019, 82.4% in 2020, 83.6% in 2021). During the examined period, the percentage of companies that included logistics problems in the process of strategic planning increased the most (34.9% in 2019, 36.7% in 2020, 46.3% in 2021), which ensured the systemic and consistent pursuit to achieve the set goals. In the years 2019-2021, most medium and large enterprises created logistics goals defined in their strategic plans.

The enterprise's logistics goals should be supported by an appropriate logistics strategy. The research shows that not all surveyed enterprises had logistics goals supported by an appropriate strategy. In the years 2019-2021, less than half of the surveyed enterprises had a formalized global logistics strategy, i.e. they had developed a coherent concept of the systemic operation in the area of logistics, implementation of which was to achieve the competitive advantage (39.2% in 2019, 45.4% in 2020, 47.2% in 2021). In 2019, 24.5% of the surveyed companies had a formalized supply chain management strategy (38 manufacturing enterprises, 27 trade enterprises and 17 service enterprises). In 2020, the number of the surveyed manufacturing enterprises possessing a formal supply chain management strategy increased to 39, and in the case of trade enterprises to 31. In 2021, 29.9% of the surveyed companies implemented a supply chain management strategy (47 manufacturing enterprises, 33 trade enterprises and 19 service enterprises).



The analysis of the respondents' declarations allows for the conclusion that in the years 2019-2021, almost every fifth surveyed enterprise did not have a formalized logistics strategy (21.2% in 2019, 19.4% in 2020, 17.9% in 2021). The percentage of surveyed enterprises that did not have a formalized logistics strategy was much higher in small enterprises than in medium and large enterprises. In the years 2019-2021, over 30% of the surveyed enterprises did not have a formalized global logistics strategy, but had developed partial strategies for supply and distribution (14.3% in 2019, 11.3% in 2020, 11.0% in 2021), partial strategies for procurement, production and distribution (12.5% in 2019-2021) or partial strategies for production and distribution (8.4% in 2019, 9.3% in 2020 and 2021).

In the years 2019-2021, most of the surveyed medium and large companies, in which logistics created the competitive advantage, implemented a supply chain management strategy that was in a constant stage of creation and development and was characterized by an immediate response to changing customer requirements, environmental conditions and competitors activities. More than half of the surveyed enterprises with the best economic and market results during the pandemic implemented a supply chain management strategy, respecting, at the same time, the principles of sustainable development.

The research results provided the basis for formulating the conclusion that almost every second surveyed enterprise cooperated with enterprises in the supply chain to reduce the negative impact of the COVID-19 pandemic on their results (49.0% in 2020, 51.6% in 2021). In the years 2019-2021, the vast majority of the surveyed enterprises did not integrate logistics processes with all entities in the supply chain and did not build relationships in the supply chain based on the principles of trust, sharing risks and benefits which translates into not using all possibilities of logistics activities and solutions to adequately respond to the effects of the pandemic.

The importance of logistics in enterprise management in the years 2019-2021 was the subject of the research. Most respondents indicated that in 2019, logistics had a significant influence on the quality of customer service (79.7%) and creating and maintaining the competitive advantage (76.4%). Subsequently, the participants of the study indicated the following importance of logistics in enterprise management: logistics has a significant influence on the reduction of operating costs (66.3%), logistics has a significant influence on the increase in sales revenues (66.0%), logistics enables reliable deliveries (65.4%), logistics has a significant influence on the increase in market share (64.8%), logistics increases the enterprise's flexibility (55.2%), logistics has a significant influence on the reduction of transport costs (54.3%), the information system has a large influence on the economic and market results of the enterprise and achieving the advantage over its competitors (53.7%), there is still a very large potential for improvements in operational logistics (50.7%), logistics has a significant influence on the enterprise value (50.1%).

In 2020, over 80% of the respondents indicated that logistics had a significant influence on the quality of customer service (86.3%) and logistics had a significant influence on creating and maintaining the competitive advantage (83.2%). According to 75.8% of the respondents, logistics had a significant influence on adapting the enterprise's activities to the conditions related to the COVID-19 pandemic. In more than half of the surveyed enterprises: logistics had a significant influence on the increase in sales revenues (69.9%), logistics had a significant influence on the reduction of operating costs (68.1%), logistics enabled reliable deliveries (66.9%), logistics had a significant influence on the increase in market share (66.2%), logistics increased the enterprise's flexibility (64.5%), operational logistics still had a very large potential for improvements (61.8%), the information system had a significant influence on the economic and market results of the enterprise and achieving the advantage over its competitors (59.1%), logistics had a significant influence on the increase in the innovativeness of the enterprise (56.7%), logistics had a significant influence on the adaptability of the enterprise (55.8%), logistics had a significant influence on the reduction of transport costs (55.2%), logistics increased the enterprise's resistance to disruptions (54.9%), logistics became more and more professional and organized (51.6%), logistics had a significant influence on the reduction of storage costs (51.0%) and logistics had a significant influence on increasing the financial liquidity (50.4%).

Nearly 90% of the survey participants indicated that in 2021 logistics had a significant influence on creating and maintaining the competitive advantage (90.7%), and the quality of customer service (89.6%). 82.4% of the respondents indicated that logistics had a significant influence on adapting the enterprise's activities to the conditions related to the COVID-19 pandemic. Subsequently, the participants of the study indicated the following importance of logistics in enterprise management: logistics has a significant influence on the reduction of operating costs (77.9%), logistics has a significant influence on the increase in sales revenues (75.2%), logistics has a significant influence on the increase in market share (72.8%), logistics enables reliability of deliveries (71.6%), logistics increases the enterprise's flexibility (70.7%), operational logistics still has a great potential for improvements (68.4%), logistics has a significant influence on the increase in the enterprise adaptability (68.1%), the information system has a significant influence on the economic and market results of the enterprise and achieving the advantage over its competitors (65.7%), logistics increases the enterprise's resistance to disruptions (65.7%), logistics is becoming more and more professional and organized (64.5%), logistics has a significant influence on the increase in the enterprise innovativeness (60.1%), logistics has a significant influence on the enterprise value (55.8%), logistics has a significant influence on the reduction of storage costs (55.2%), logistics has a significant influence on the reduction of transport costs (58.2%), logistics has a significant influence on increasing the financial liquidity (51.3%).

In the following years, the frequency of selecting the following answer options regarding the importance of logistics in the management of the surveyed enterprises increased significantly: logistics has a significant influence on creating and maintaining competitive advantage ( $p < 0.001$ ), logistics increases the enterprise's flexibility ( $p < 0.001$ ), logistics has a significant influence on the increase in the enterprise adaptability ( $p < 0.001$ ), logistics increases the enterprise's resistance to disruptions ( $p < 0.001$ ), operational logistics still has a great potential for improvements ( $p < 0.001$ ), logistics is becoming more and more professional and organized ( $p < 0.001$ ), logistics is a tool for sustainable development ( $p < 0.001$ ), logistics has a significant influence on the quality of customer service ( $p = 0.001$ ), logistics has a significant influence on the reduction of operating costs ( $p = 0.002$ ), the information system has a significant influence on the economic and market results of the enterprise and achieving the advantage over its competitors ( $p = 0.007$ ), logistics is included in the overall strategy of the enterprise ( $p = 0.007$ ), logistics has a significant influence on the increase in the enterprise innovativeness ( $p = 0.008$ ), logistics has a significant influence on adapting the enterprise's activities to the conditions related to the pandemic COVID-19 ( $p = 0.03$ ), logistics has a significant influence on the increase in sales revenues ( $p = 0.03$ ).

The research also covered the changes actually made in the logistics processes of the surveyed enterprises in the years 2019-2021. In 2019, the respondents most often indicated the following changes in logistics processes: improving the quality of customer service (50.4%), increasing sales revenues (49.6%), strengthening cooperation with customers (45.7%), strengthening cooperation with suppliers (45.1%), increasing the ability to achieve the competitive advantage (43.2%), increasing flexibility (44.2%), cost reduction (43.2%), increasing the efficiency and effectiveness of logistic distribution processes (41.2%).

The analysis of the research results provided the basis for formulating the conclusion that in 2020 most of the surveyed enterprises made the following changes in logistics processes: improving the quality of customer service (55.2%), tightening cooperation with customers (52.2%), increasing flexibility (52.2%), tightening cooperation with suppliers (51.3%). The next most frequently mentioned changes in the logistics processes of the surveyed enterprises were: shortening the order fulfilment time (47.8%), increasing the efficiency and effectiveness of logistics supply processes (46.6%), possessing diversified supply sources (45.1%), cost reduction (44.2%), increase in the efficiency and effectiveness of logistics distribution processes (44.2%), increase in sales revenues (43.6%), health protection and safety assurance (43.3%), increase in innovativeness (41.9%), development of distribution channels (41.5%), reliability of deliveries (40.3%).

In 2021, the majority of the survey participants indicated that in the analyzed enterprise the following changes were made in the logistics processes: improvement of the quality of customer service (61.2%), shortening the order fulfilment time (55.5%), increase in sales revenues (54.0%), strengthening cooperation with customers (53.4%), strengthening cooperation with suppliers (51.6%), cost reduction (50.7%). In almost every second surveyed enterprise changes

in the logistics processes included: development of distribution channels (49.6%), increasing the ability to achieve the competitive advantage (49.0%), increasing flexibility (48.7%), increasing the efficiency and effectiveness of logistics procurement processes (47.2%), possessing diversified supply sources (47.1%). Subsequently, the respondents mentioned the following changes in the logistics processes of the surveyed enterprises: usage of new distribution channels (46.0%), increase in the efficiency and effectiveness of logistics distribution processes (44.8%), reliability of deliveries (44.5%), increase in innovativeness (43.3%), health protection and safety assurance (42.7%), increase in sensitivity to customer requirements (42.7%), implementation of new information and communication technologies (41.8%), increase in the effectiveness of the information system (41, 5%), implementation of new digital technologies (40.3%), reducing uncertainty and risk (40.1%).

In the following years, a statistically significant increase was observed in the frequency of selecting the following answer options regarding the changes actually made in the logistics processes of the surveyed enterprises in the years 2019-2021: shortening the order fulfilment time ( $p < 0.001$ ), usage of new distribution channels ( $p < 0.001$ ), health protection and safety assurance ( $p < 0.001$ ), increase in innovativeness ( $p < 0.001$ ), development of distribution channels ( $p < 0.001$ ), possessing diversified supply sources ( $p < 0.001$ ), increase in sensitivity to customer requirements ( $p < 0.001$ ), making logistics processes sustainable ( $p < 0.001$ ), implementation of new information and communication technologies ( $p = 0.001$ ), implementation of new digital technologies ( $p = 0.001$ ), increase in the effectiveness of the information system ( $p = 0.002$ ), changes in logistics staff management ( $p = 0.002$ ), increase in the efficiency and effectiveness of logistics procurement processes ( $p = 0.004$ ), improvement of the quality of customer service ( $p = 0.02$ ), increase in sales revenues ( $p = 0.025$ ), increase in the ability to achieve the competitive advantage ( $p = 0.03$ ), reduction of uncertainty and risk ( $p = 0.03$ ), increase in the efficiency and effectiveness of processes in the area of reverse logistics ( $p = 0.04$ ).

It should be emphasized that in 2020 and 2021, the surveyed enterprises made changes in logistics more often than in 2019. Changes made in logistics during the pandemic allowed the surveyed companies to adapt better to rapidly changing operating conditions. The research results provided the basis for formulating the conclusion that in the years 2020–2021, the most frequently mentioned main cause of changes in the management of logistics processes of the surveyed enterprises was the COVID-19 pandemic (73.3% in 2020, 72.8% in 2021). In the analyzed period, some enterprises did not achieve all logistics goals, which adversely affected the economic and market results of these companies. It is worth noting that in 2020 and 2021, the surveyed enterprises failed to achieve all logistics goals more often than in 2019. This is confirmed by a very large potential for improvements in operational logistics indicated by the respondents (50.7% in 2019, 61.8% in 2020, 68.4% in 2021).

Logistics innovations implemented in the surveyed enterprises in the years 2019-2021 constituted the subject of the study. During the analyzed period, 93.7% of the surveyed enterprises implemented logistics innovations. The most frequently implemented logistics innovations in the surveyed enterprises in 2019 were the improvement and development of logistics processes to improve customer service (47.5%) and the improvement of work organization (45.1%). In the years 2020-2021, the majority of the survey participants indicated that logistics innovations consisted in improving the work organization (63.5% in 2020, 65.1% in 2021) and improving and developing logistics processes to achieve improvement in customer service (53.4% in 2020, 59.1% in 2021).

In the following years, a statistically significant increase was observed in the frequency of selecting the following answer options regarding logistics innovations implemented in the surveyed enterprises in 2019-2021: improvement of work organization ( $p < 0.001$ ), usage of new distribution channels ( $p < 0.001$ ), improvement and development of logistics processes to achieve improvement in customer service ( $p = 0.001$ ), usage of information and communication technologies ( $p = 0.001$ ), usage of digital technologies ( $p = 0.001$ ), improvement and development of logistics processes to achieve time advantage ( $p = 0.04$ ).

The research results provided the basis for formulating the conclusion that in 2019 the sources of logistics innovations most frequently indicated by the respondents were employees' ideas and enterprise's own resources (51.3%), monitoring competitive enterprises and products on the market (48.1%) and customers (43.3%). In 2020 and 2021, the vast majority of the surveyed enterprises implemented logistics innovations in response to the COVID-19 pandemic (68.7% in 2020, 66.3% in 2021). Subsequently, the respondents indicated that the sources of innovation during the pandemic were: employees' ideas and enterprise's own resources (56.4% in 2020, 55.8% in 2021), monitoring competitive enterprises and products on the market (51.9% in 2020, 50.4% in 2021), customers (47.2% in 2020, 47.8% in 2021) and suppliers (43.3% in 2020, 43.0% in 2021). The economic considerations and the ability to better adapt the enterprise to the conditions related to the pandemic played a key role in decisions to implement logistics innovations during the pandemic.

## 5. Conclusion

The research shows that the pandemic has resulted in a significant increase in the importance of logistics in shaping the results of the analyzed enterprises. Most enterprises achieving the best results during the pandemic quickly and adequately adjusted logistics goals to dynamically changing conditions, included them in strategic and operational planning and implemented a supply chain management strategy that was in a constant state of creation and development, characterized by an immediate response to changing customer requirements,

environmental conditions and competitors' activities. During the pandemic, the best enterprises made numerous changes in the logistics process management within the company and between entities in the supply chain, appropriate to the conditions; they shortened the order fulfilment time, tightened contacts with suppliers and customers, used new distribution channels, developed existing distribution channels, increased operational flexibility, sensitivity to customer requirements, adaptability and resistance to disruptions, built customer trust and sense of security, increased the efficiency and effectiveness of all logistics processes, used digital technologies to analyze, create, implement and transform logistics processes, possessed diverse sources of deliveries, took systemic actions to reduce uncertainty and risk and balanced economic, ecological and social goals. Thanks to the implemented logistics innovations, the best companies responded quickly and adequately to the effects of the pandemic and created and maintained their competitive advantages. The best-performing enterprises used partnership relationships with suppliers based on the exchange of strategic and operational information to jointly implement logistics innovations contributing to the improvement of the efficiency and effectiveness of logistics processes, which translated into achieving above-average economic and market results.

Strategic and operational management of logistics processes within the enterprise and between entities which are the links in the supply chain, increasingly determined the economic and market results of the best surveyed enterprises and the supply chains they created during the COVID-19 pandemic. All enterprises did not use the full potential of logistics processes to reduce the negative impact of the COVID-19 pandemic on their results. The research confirmed that logistics plays an extremely important role in the process of enterprise management during the COVID-19 pandemic.

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