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Trends in Logistics – Future Plans

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Abstract

Theoretical background: Based on available literature and additional sources of information, an analysis of the directions of development and the most important innovations, technologies, and processes shaping logistics areas was made. The analyses were carried out based on available scientific publications, industry reports, and current information available on websites and business portals, as well as on scientific websites and on the websites of companies and organizations operating in logistics areas.
Purpose of the article: Logistics is currently one of the fastest growing branches of the economy. Megatrends, including climate change, armed conflicts, the COVID-19 epidemic, digitalization, and urbanization, have contributed to the intensification of the pace of transformations taking place in the area of logistics. This study refers to the distinction and discussion of current and future development trends in the logistics industry. The final part presents a project of a quantitative study aimed at obtaining information on the strength and time of the impact of individual trends on logistics and the economy.

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Research methods: Below consideration to use general methodology in the field of management sciences as well as descriptive methodology in the area of issues related to logistics. The monographic method, observation and document analysis were also used.
Main findings: Isolating and distinguishing logistics areas with the greatest development potential. Indicating future trends in logistics. Defining key competencies and skills in the functioning and development of logistics. Highlighting threats and actions that need to be taken to appropriately respond to changing conditions and market trends.

Introduction

During dynamic changes and shocks affecting market entities, the ability to adapt innovative solutions from the areas of management becomes an essential element of the functioning of enterprises. It becomes obvious that the factor driving development and changes in every field are innovative activities. Without continuous improvement, whether of the management processes surrounding us or the introduction of new technical and technological solutions, the efficient operation of a market entity is significantly hindered (Schumpeter, 1960).

Modern methods and concepts related to issues in the area of logistics activities that emerged in the second half of the 20th century (e.g. outsourcing, offshoring or just-in-time) were and are being introduced to business entities, bringing with them major improvements and, consequently, noticeable optimization of logistics processes (Gajdos, 2023). Despite the fact that changes in the environment force innovative actions, companies are cautious when making their decisions and most often follow well-trodden paths, such as (Mudambi & Venzin, 2010):

– competition behaviour (imitation approach);
– possibility or opportunity to introduce changes (opportunistic approach);
– or introducing solutions that worked in the past (native approach).

Additionally, the use of new solutions, despite great caution, is not supported by sufficient analysis of the occurrence of possible threats, as well as having scenarios in case of unusual (emergency) situations (cf. Sheffi, 2007).

The analyses carried out in the study were based on available and relevant scientific publications from the point of view of the study objectives, industry reports and current information available on industry websites and on economic portals, as well as on scientific websites and on the websites of companies and organizations working for logistics.

Similarly to Riquelme (2018) or Krowas and Riedel (2019), who claim that there is an increase in the individuality of purchased products, as well as Werner-Lewandowska and Kosacka-Olejnik (2019) and Winkelhaus and Grosse (2020), who describe a significant shortening of the product life cycle, or Schmidtke et al. (2018), who refer to the need to increase the flexibility of current supply chains, an attempt was made to take a closer look at issues related to current and future trends in logistics. Factors such as Diversification and Flexibility of Supply Chains (cf. Barreto et al., 2017; Lagorio et al., 2020), Blockchain Technology, Big Data Analysis, Generative AI or the Internet of

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Things (Kodym et al., 2020, Korczak & Pawełoszek, 2023; Lee et al., 2018; www4; www6) are the main elements of development in relation to trends in logistics.

The aim of this study is in particular to determine current and future development trends in the logistics industry, and additionally to identify key competences that will be necessary for professionals in this field.

Based on available sources of information, an analysis of current directions of development in the logistics sector was carried out and the identification of innovations, technologies and processes shaping the industry was identified. This also enabled the identification of current problems and challenges and the formulation of preliminary answers to questions about new technologies, socio-economic processes, technological and global challenges, as well as preparation for the analysis of the structure of analytical, interpersonal and specialist skills necessary for the development of the industry. The analyses carried out also constituted a basis for identifying skills and competences necessary to cope with dynamic market changes.

The review of available literature provided a background for defining the research gap to be used in the following studies. It also allowed us to develop the following research hypotheses:

H1: Megatrends contribute to the intensification of the pace of transformations taking place in the areas of logistics.

H2: Changes in logistics areas cause changes in the demand for specialist skills on the labour market.

Logistics areas with the greatest potential of development

Logistics is currently one of the fastest growing sectors of the economy. A closer look at what is the reason for this state of affairs has allowed us to identify issues related to the current changes taking place in this area. The logistics industry is currently shaped by significant megatrends, including climate change, wars, urbanization, computerization, the COVID-19 epidemic, and others (Daniel, 2024; Golińska-Pieszyńska & Kazubski, 2024; www3). Recently, these have been the main factors in the increasing pace of transformation of logistics. In response to the changing conditions of functioning of logistics enterprises, (often adapted) solutions are generated to adapt to these changes and often actions are taken to anticipate or stimulate certain changes (cf. Log 24, 2023). An overview of such actions was presented below.

Diversification and flexibility of supply chains

The pandemic and the Russian-Ukrainian War (as well as conflicts in other parts of the world) have focused particular attention on the importance of resilient supply chains and supply chain management in the logistics industry. An important factor in

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increasing resilience is the issue of supply chain diversification. Selecting alternative suppliers and expanding the production and distribution network allows for increasing the resilience, flexibility, as well as the speed of response and competitiveness of the supply chain (Surmacz, 2015; Wieland, 2021; www1; www2). Key concepts in logistics trends here are multisourcing and multishoring.

Multisourcing in the context of logistics is a strategy in which a company uses multiple suppliers at the same time to diversify supply sources, increase supply chain flexibility, and minimize the risks associated with dependence on a single supplier. It is a frequently used model in supply chain management, which aims to increase resilience and enable more effective response to changing market conditions. The essential elements of multisourcing are:

– supplier diversity;
– supply market diversification;
– increased supply flexibility;
– cost optimization;
– better risk management;
– quality and performance control.

It is worth noting, however, that multisourcing requires complex management of supplier relationships and monitoring the quality and performance of each of them. However, effective implementation of multisourcing can significantly increase the resilience and efficiency of an organization's supply chain.

Multishoring, on the other hand, is a strategy based on the varied distribution of various elements of the supply chain in different geographic regions. This means that the company uses multiple locations (countries) to carry out different stages of production, storage, or distribution. Multishoring is a form of diversification, similar to multisourcing, but focuses more on different geographic locations than on different suppliers. The areas covered by multishoring are:

– location diversity;
– specialization-based distribution;
– cost optimization;
– political risk reduction;
– climate risk diversification;
– management of cultural differences.

The multishoring concept emphasizes the fact that suppliers come from different countries. During the coronavirus crisis, the heavy reliance on Chinese suppliers had a very negative impact and led to supply disruptions.

Diversification and flexibility in the context of supply chains are two key concepts that help organizations manage risk and adapt to changes in the business environment. Supply chain diversification mainly involves expanding supply sources, suppliers, logistics paths and production locations to minimize the risk associated with potential supply disruptions. Similar to multisourcing and multishoring, the benefits of effective supply chain diversification include:

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– risk protection;
– increased flexibility;
– cost optimization.

Supply chain flexibility, on the other hand, means the ability to adapt to changes in customer requirements, changes in production, and to react quickly to unforeseen events. The most important elements include:

– quick adjustment of production to changes in demand;
– innovation in the supply chain.

Together, diversification and agility help organizations minimize the risks associated with supply chain disruptions, which becomes especially important in a dynamic and volatile business environment. They include various elements such as suppliers, locations, technologies, and processes to increase the resilience of the supply chain to various types of challenges (Golińska-Dawson et al., 2023).

It is also worth mentioning that too much uncertainty in the environment of economic entities, and in particular supply chains, is causing significant changes in the approach to them (Baker et al., 2023). The nearshoring trend has now become an essential element to increase the flexibility of supply chains. Despite the high costs that must be taken into account in its implementation, its rapid development should be expected.

Internet of Things (IoT), Big Data, and Edge Computing

The changes taking place in logistics areas could not have taken place without the intensive development of information technologies that is currently being observed. Important elements of the development of the logistics industry today and in the future will undoubtedly are: processing large data sets (Big Data Analysis), edge processing and the Internet of Things (cf. DHL, 2023).

Large databases are data sets that, due to their volume, diversity and generation rate, require innovative and advanced data processing technologies. In the context of logistics, big data includes huge amounts of information generated in various areas of the supply chain. Inextricably linked to the concept of big data in logistics areas are:

– data volume and data diversity;
– data generation speed;
– information value;
– advanced processing technologies;
– predictive analytics.

Efficient analysis of large data sets allows for better risk management, among others, by identifying potential problems in real time and reacting faster to changing market conditions or external factors (cf. Dragun & Kuczyńska, 2023). In edge computing, data processing takes place directly or near a specific data source (the edge of the network). Therefore, data is not processed in a distant data centre. This refers to the decentralization of IT architecture, which is possible thanks to the IoT, mobile

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computers and the 5G network. The advantage of edge computing is that companies can gain insight into the analysis of large data sets in near real time, with lower latency and throughput of cloud servers. This solution also requires much less IT infrastructure than traditional cloud computing. The main features of edge computing includes: local processing, speed of response to emerging data, saving network bandwidth, increased data privacy and security, data scalability and real-time application. Edge computing has a wide range of applications, especially in the areas of industry, health, transportation, and wherever low latency, network bandwidth savings, and effective real-time data management are important. In the area of logistics, the IoT refers to the use of technologies that enable direct communication and collaboration between physical objects, devices, and systems within the supply chain. IoT in logistics can bring a number of benefits, improving the monitoring, efficiency, and management of various stages of transportation, storage, and delivery (Ding et al., 2023). It includes:

– real-time monitoring (thanks to IoT sensors and devices, logistics organizations can monitor the location, temperature, humidity, and even environmental conditions of products transported through the supply chain in real time);

– tracking and localization (GPS and RFID (Radio-Frequency Identification) technologies allow for precise tracking of the movement of goods and means of transport, which facilitates inventory management, route planning, and quick response to changes);

– warehouse management (IoT technology can be used to monitor inventory levels, manage the flow of goods, and optimize warehouse space);

– process automation (e.g. supply chain management can be integrated with data collected by IoT, which allows for faster decision-making and more efficient operations).

Industry 4.0 and the networking of all machines, installations, cyber-physical systems, etc. via the IoT will generate increasingly large amounts of data in the future, which will have to be processed directly on-site using edge computing in the company (Stasiuk-Piekarska, 2024). Sending such volumes of data via the Internet to remote data centres in the cloud is simply not practical. Incidentally, this solution even generates an additional layer of security. Edge computing can be used today and in the future for many purposes, including in logistics, for example, for collaborative warehouse robots, networking different areas of a company such as warehouses and production, autonomous vehicles, predictive maintenance, and many others. In principle, edge computing is useful wherever large amounts of data are generated in real time (cf. Jahani et al., 2023).

AGVs, AMR robotics and drones

The significant growth in e-commerce and the enormous increase in consumer demand require increasing digitalization and automation, as well as increasing the efficiency of intralogistics processes and supply chains. In intralogistics, more and more tasks will be taken over by Automated Guided Vehicles (AGVs) and stationary robots. Mobile robots for indoor applications include AGVs and Autonomous

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Mobile Robots (AMRs). The use of AGVs enables: automation of internal transport, optimization of operational efficiency, reduction of labour costs, precise route control, easy reconfiguration for the needs of the facility and increased work safety (cf. DHL, 2023; Gajewski, 2024).

AMRs are autonomous mobile robots that move independently in space, detect obstacles, plan their route and perform tasks without the need for constant human supervision. In logistics, AMRs play an important role in the automation of various processes, contributing to increased efficiency, cost reduction and streamlining of supply chain operations. These robots are more advanced than AGVs because they use real-time path planning and can more freely and easily avoid obstacles. They are used for order picking or other transportation tasks. When indoor mobile robots can be used on a much larger scale, they will unlock enormous potential for reducing costs and increasing efficiency and significantly change the industry.

With the rapid development of AI and sensor technology, stationary robots such as collaborative robots (cobots) and industrial robots are becoming increasingly diverse and versatile. It is predicted that in the future there will be an increasing division of labour between humans and cobots (DHL, 2023). Robots will of course be used mainly in repetitive, unchanging processes. It is interesting to see how innovations in AI will expand the areas of robot work. AI is also used in object recognition, while fields such as skill-based robot programming using data are an area that will shape the future.

Another important element is drones, which are starting to gain importance in the logistics sector and could strengthen their position in the coming years. International technology corporations such as Google and Amazon have been working on drone prototypes for some time now, with which it would be possible to deliver orders to customers by air. Drone deliveries would bring a number of benefits, such as reduced logistics costs, faster shipping, reduced road transport and reduced environmental pollution. Solutions of this type have not yet made it beyond the test phase, but they are a promising area of logistics development. Current applications, such as drone inventory counting, are already being implemented in warehouses. During inventory counting, the drone flies through the warehouse independently (along a planned route) and scans barcodes or RFID labels, then transmits information about the number of pieces of each product unit to the logistics system. In this way, thanks to efficient inventory management, it is possible to automatically detect irregularities in the stock without having to assign additional staff to this task.

Circular Economy, Decarbonization and Green Logistics

Despite Sustainable Development being a priority for societies, only a small fraction of the tens of billions of tons of used materials are recycled and returned to circulation. In the future, the share of fully recycled products is to be significantly increased by strengthening the concept of a circular economy worldwide.

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The Circular Economy is strongly associated with the Closer Loop Supply Chain Management (CL-SCM) approach. It can be said that it is an economic model that assumes minimizing resource waste by focusing on the efficient use, recovery and reuse of materials (cf. Duan et al., 2021). In contrast to the traditional linear economy model, where resources are extracted, processed, consumed and thrown away, the Circular Economy aims to close the product life cycle and reduce waste as much as possible. The key elements related to the Circular Economy are: resources as a closed cycle – in a closed loop, resources are viewed as a cycle in which products, materials and chemicals are designed so that they can be reused or recycled after use; design for recovery – designing products and packaging in such a way as to facilitate the recovery and reuse of materials. The aim is to minimize complex and difficult to decompose products; recycling and waste processing – much attention is paid to recycling and processing waste. Materials such as paper, glass, plastic or metal are collected, sorted and processed to produce new products; the principle of "from resource to resource" – this principle means that materials and products should be used in such a way as to minimize losses and ensure their longest possible use. In addition, at the end of a product's life cycle, its materials should be incorporated back into the economy; the importance of resource regeneration – the drive to regenerate natural resources through the use of sustainable agricultural, forestry and water management practices; the sharing economy – the tendency to develop business models based on sharing (e.g. car sharing, bike sharing), which helps to increase the efficiency of the use of available resources; the use of technology and innovation – technologies such as the IoT, AI or blockchain are used to monitor and manage the closed loop, enabling better control and efficiency; environmental impact – reducing the negative impact of economic activity on the environment, reducing greenhouse gas emissions, energy consumption and the amount of waste (Seles et al., 2016).

The Circular Economy is becoming an increasingly important direction of development, especially in the context of striving for sustainable development and minimizing the impact of human activity on the environment. Implementing this model requires cooperation between various economic sectors, innovative technological solutions and changes in consumer behaviour (cf. Gi Group Holding, 2024).

Sustainable Product Design takes into account the entire life cycle of a product, with all materials and components designed for recycling and returning to the circular economy. Around 80% of a product's environmental impact is determined at the design stage. Existing materials and products are reused, repaired, refurbished, shared, rented and ultimately recycled for as long as possible, maximizing the product's life cycle. In this way, waste generation is also reduced to a minimum. In contrast to the so-called throwaway economy, the circular economy also reduces total annual greenhouse gas emissions. The European Commission has published a Circular Economy Action Plan, which includes proposals for more sustainable product design and aims to reduce waste generation (EC, 2021).

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The most important issue of decarbonization is to create a zero-emission and climate-neutral economy by 2050. The basis of decarbonization is to move away from fossil fuels and use low-emission alternative energy sources. The process of reducing or eliminating carbon dioxide (CO_2) emissions from various sectors of the economy and human activities is an important element of the strategy to combat climate change and achieve the Sustainable Development Goals (UNDP, 2023; www5).

Another element is Green Logistics, or understanding logistics issues in an ecological way (also Sustainable Logistics and Sustainable Supply Chains). It is also an approach to Supply Chain Management that focuses on minimizing the impact of logistics activities on the natural environment (Stank et al., 2013). The main goal of Green Logistics is to achieve Sustainable Development, or meeting current needs without compromising the ability to meet the needs of future generations. These include: optimizing routes and transport, using eco-friendly vehicles, increasing flexibility in deliveries, responsible warehouse management, recycling and recovery of raw materials, optimizing the supply chain, using innovative technologies, and supporting local communities through an ethical approach to work, taking care of employee health, supporting local communities, and contributing to the development of the local economy (Dai et al., 2015). Green Logistics is an important element of the sustainable approach in business, contributing to minimizing the negative impact of economic activity on the environment and promoting more sustainable development.

Other factors influencing logistics trends

When reviewing the elements influencing the dynamic changes occurring in the logistics industry, one should not ignore the remaining – smaller factors, which, however, create a full and coherent picture of changes and future trends (cf. LODZistics, 2023).

An important and interesting element is and will probably be the implementation of Artificial Intelligence in Supply Chain Management. Software engineering supported by AI with improvements such as: autonomous code generation or translation of old programming languages into new ones will make engineers spend less time on mechanical activities, thanks to which they will gain more time for more creative activities. Progress in the field of AI does not only concern R&D or IT departments. Improving Generative AI (GAI – a type of AI that has the ability to generate new, authentic data, content, or other elements based on patterns and information that has been previously provided to it) will facilitate access to internal and external information (Richey et al., 2023).

Changes in logistic are also closely related to the development of e-commerce. Storing goods in the B2C (Business to Customer) model requires the organization of work and space to adapt it to the specifics of e-Commerce. The goal is to facilitate the "picking", completion and packaging of goods. As customer requirements grow,

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logistics operators are forced to introduce completely new elements to the offer (Siems & Seuring, 2021). These include handling returns and complaints, repacking, labeling and foiling, as well as adding marketing materials.

The growing role of the logistics operator and its multitasking is the fundamental difference between the B2B (Business to Business) model and B2C. The e-commerce industry is largely based on small parcels sent in the B2C model. The real challenge here is the huge number of parcels. This requires the use of completely new technologies and service systems. Warehouse space also requires reorganization. Many warehouses are being transformed into logistics centres adapted to handle a large number of parcels at the same time.

Another phenomenon is the development of Omnichannel, an approach to retail and customer service that integrates various shopping and communication channels, providing a consistent and uniform experience for customers regardless of how they use a company's services. The Omnichannel concept assumes that customers can move freely between different sales channels, and the company ensures consistency by continuing to provide service and information in an uninterrupted manner. Omnichannel involves the integration of all available channels, such as brick-and-mortar stores, online stores, mobile applications, social media and others, into a single system. This allows customers to move freely between different touchpoints, and data is shared between them. As part of Omnichannel, information about products, availability, prices and more is consistent across all channels. Customers have access to the same information regardless of whether they browse it online or visit a brick-and-mortar store. The goal of Omnichannel is to provide a consistent customer experience at all stages of interaction with the company. This means that regardless of whether the customer makes a purchase online, visits a physical store or uses a mobile application, the experience is to be uniform and integrated. Omnichannel enables personalization and contextualization of customer interactions based on data collected across all channels. This allows the company to tailor its offering to individual customer preferences and needs.

Unified Commerce goes a step further than Omnichannel and assumes complete uniformity in transaction management. Unified Commerce integrates different channels into one system, eliminating the traditional divisions between online and offline, so that all are treated as one enterprise.

The transition from Multichannel to Omnichannel represents a profound transformation in the approach to customer service and retailing, which emphasizes consistency, personalization, and a uniform experience. In today's business environment, where customers expect flexibility and convenience in shopping, Omnichannel has become a key element of many companies' strategies. Other elements that influence the development of future logistics include:

– Warehouse Simulation – which involves creating virtual copies of products or processes to test their operation before implementation. In terms of logistics, process simulation allows for testing the warehouse plan and the flow of personnel and

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goods. Three-dimensional visualization of the installation allows for checking how the company's logistics will function (also with the use of biometric technologies);

– Data Mining – analysis of big data sets aimed at identifying patterns and trends in order to obtain important information that helps in making good business decisions. Owing to automatic data extraction methods, information can be sorted and filtered to obtain useful knowledge on this basis, which allows, among others, detecting fraud (finance), predicting demand (trade and marketing) or finding bottlenecks (industry and logistics);

– Cloud Computing – allows full access from any device to the company's analytical resources (reduces costs related to infrastructure and software maintenance);

– Blockchain Technology – enabling transparent and secure data management, tracking goods from producer to consumer and eliminating forgeries or unauthorized changes to documents. Own to its decentralized structure, blockchain ensures honesty, immutability and availability of information for all participants in the supply chain.

The areas, processes and technologies indicated above, constitute key challenges for the development of modern economies. Many of them concern various economic processes (including social ones), some are specific to logistics.

Directions of change in logistics – preliminary study

Based on the analysis of the above processes, several dozen issues were identified that will determine socio-economic development, including the development of logistics, now and in the future. The processes (drivers) are listed below in alphabetical order: 3D Printing, Alternative Energy Sources, API Solutions, Artificial Intelligence, Autonomous Vehicles, Big Data, Bio-based Materials, Block Computing, Business Continuity Management, Business-to-Customer, Circular Economy, Cloud Solutions, CO_2 Emissions Monitoring, Collaborative Robots, Data Mining, Decarbonization, Digital Marketplaces, Digital Security, Disaster Response Planning, Drones, Edge Computing, Ergonomics, Exoskeletons, Green Logistics, Internet of Things, Mass Customization, Mathematical Models, Omnichannel, On-Demand Delivery, Physical Internet, Quantum Computing, Remote Working, Risk Identification and Assessment, Risk Management, Robotics, Sharing Economy, Silver Economy, Smart Labels, Smart Solutions, Space Logistics, Supply Chain Visibility, Warehouse Simulation (cf. DHL, 2023).

At the initial stage of the study, the above-mentioned issues (obtained from the literature review) were classified based on their frequency of occurrence in internet searches by Google Trends. The highest rankings were given to AI, the IoT, Cloud Solutions and Remote Work, with slightly less searches for Intelligent Solutions, Block Processing, Robotics and Edge Computing.

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Figure 1. Factors influencing logistics – search frequency

Source: Authors' own study.

The next stage of the analysis will consist in conducting a CATI/CAWI survey in which respondents (management staff, employees, students) related to the logistics area will determine the strength and duration of the impact of individual factors on the company (locally), the cluster (regionally) and the world (globally) and will indicate the key skills and competencies necessary for the smooth functioning and development of logistics.

The study results will enable the grouping of factors according to their expected strength and duration of impact on logistics in particular and the economy and society in general.

Discussions and conclusions

Developing an optimal strategy in logistics is not an easy task. It requires a thorough analysis of the current situation, the introduction of necessary changes, and ongoing monitoring of the effects, which allows for accurate assessment of the effectiveness of the actions taken, as well as quick response to changing conditions and market trends (Wieland, 2021).

The considerations made by Pereira et al. regarding flexible, diversified and thus resilient supply chains to the turbulent environment indicate that efforts related to these issues constitute key activities in the logistics areas (cf. Pereira et al., 2014).

The study of Rejeb et al. (2018), Pires et al. (2021) or Richnák (2022) highlights the significance of digitalization and the adoption of technologies such as Big Data Analytics, Robotics, IoT, Blockchain to use these functions and tools in getting

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benefits such as improved predictability, transactional automation, and Supplier Relationship Management.

Jemmali et al. (2019) discuss the application of a multi-criteria intelligent algorithm for efficient supply chain management. The authors propose an intelligent algorithm model as a solution that employs a set of intelligent formulas by converting predefined preferences into quantitative measurements. The application results of this system show that there is a high level of success in choosing the most appropriate suppliers in a short time by using this technology.

The key to success in an extremely volatile and demanding environment is undoubtedly flexibility in Supply Chain Management, combined with the ability to accurately and quickly respond to changing customer preferences and macroeconomic factors. These observations confirm hypothesis H1: Megatrends contribute to the intensification of the pace of transformations taking place in the areas of logistics.

Moreover, effective management of goods, financial and information flows is important. However, analysis of logistic and economic indicators requires having the right tools. Effective management and analysis of the supply chain should be conducted in real time, which in turn requires introducing certain organizational changes, using modern tools and IT systems that have been created for fast processing of large amounts of data and their transparent visualization (Duan et al., 2021).

The above considerations present the latest trends and issues related to the logistics industry. It is particularly important to focus on issues related to the diversification and flexibility of Supply Chains (changes in this area were largely influenced by armed conflicts and the COVID-19 pandemic), analysis of Big Data sets, the IoT and Edge Analytics. Equally important issues are Decarbonization, the Circular Economy, Green Logistics or the development of AMR, AGV, drones or Supply Chain Visualization. We cannot also forget about the elements occurring in the background of these changes: the development of AI, e-Commerce, Omnichannel, Data Minig, etc. The occurrence of these phenomena confirms hypothesis H2: Changes in logistics areas cause changes in the demand for specialized skills in the labour market.

Dynamic changes that occur in the logistics industry environment require the development of strong resistance to emerging obstacles, unforeseen phenomena or shocks. Analysis of changes that have occurred recently indicates a significant reduction in the tendency to implement schemes based on Just-in-Time policy, and an emphasis on the approach known as just in case or Traditional Inventory Management (Inventory for Emergencies) (cf. Gontarczyk & Marcinkowska, 2020). The just in case approach assumes that the company should maintain significant amounts of inventory to minimize the risk of shortages or delays in deliveries. This contributes to the development of a network of warehouses close to the company (or the expansion of own warehouses and storage of raw materials and semi-finished products necessary for production at its own expense).

Dynamic socio-economic processes are reflected in the changing principles of operation of logistics enterprises. A key element of these changes, apart from

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undoubtedly significant technical and technological changes, is the identification of needs in the area of adapting the competences of labour resources to the effective use of modern technologies and the implementation of innovative principles of operation.

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