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Influence of Megatrends on Logistics Development

Robert Rogaczewski[1], Monika Muszyńska[1], Mariusz Wojciechowski[2]
[1]University of Applied Sciences in Konin,
Przyjaźni Str.1, 62-510 Konin, Poland
[2]AMZ-KUTNO S.A.
Sklęczkowska Str. 18, 99-300 Kutno, Poland

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Abstract
In the so-called TSL industry we can observe numerous trends that affect the future shaping of transport and logistics chains. The last decades have been a time of trends that have shaped and influenced logistics. Spreading globalization, growing customer requirements, production of "tailor-made" products, lean management, shortened production cycles or rapidly developing information technologies are putting ever greater demands on enterprises which are forced to cope with these challenges to gain a competitive advantage. The purpose of these considerations is to analyse selected trends shaping logistics development. The article uses a research method based on analysis and criticism of literature. Furthermore, the interplay between these trends highlights the dynamic and complex nature of the logistics industry. For instance, digitization has revolutionized supply chain management by enhancing transparency and operational efficiency. Similarly, lean management practices have reduced waste and optimized resource allocation in logistics operations. Customization and individualization of products have pushed companies to adopt more flexible and customer-centric logistics strategies. Moreover, the growing emphasis on sustainability has encouraged the integration of eco-friendly practices across transport and logistics networks. Lastly, the article underscores the importance of adapting to these trends to ensure long-term success and resilience in a highly competitive global market.

Keywords: logistics development, lean management, internationalization, supply chain management, megatrends

1. Megatrend in the modern economy

When analysing the literature, it is essential to consider the connotations and precise meaning of the term "megatrend." This term is often mistakenly used interchangeably with "trend," despite the significant differences between the two. The primary distinctions lie in the broader scope and longer-term influence of megatrends compared to trends. Megatrends are transformative forces that shape industries and societies over extended periods, often spanning decades. In examining the subject of megatrends, several recurring themes are frequently highlighted by authors, particularly in international publications. The most commonly discussed megatrends include

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globalization, technological innovation, sustainable development, the shortening of production cycles, urbanization, and demographic shifts. Among these, specific megatrends have a direct and profound impact on the development of logistics. Notably, globalization and the internationalization of business processes have redefined supply chain dynamics, necessitating more integrated and adaptive logistics systems. Similarly, innovation, particularly the digitization of enterprises, has revolutionized logistics operations, enabling real-time data tracking and more efficient decision-making. Furthermore, sustainable development has emerged as a critical driver, compelling companies to adopt eco-friendly logistics practices and optimize resource utilization. Lean management techniques, with their focus on minimizing waste and maximizing efficiency, also play a crucial role in shaping modern logistics strategies. Finally, evolving consumer behaviour, including the demand for personalized and faster services, has led to a shift towards more agile and customer-centric logistics models. Overall, the interplay of these megatrends underscores the necessity for enterprises to remain proactive and adaptable, ensuring their logistics systems are equipped to meet the challenges of a rapidly changing global economy.

2. Globalization and internationalization as determinants of logistics development

The overriding feature of globalization processes is overcoming increasingly distant spatial distances, thanks to which international logistics networks and 3PL service providers are gaining importance (Rudberg & Olhager, 2003; Ganesan et al., 2009). The effects of globalization within the changing "economies of scale" and "economies of scope" are expressed by expanding markets, which on the one hand allows a higher sales volume for standardized products, while on the other they are larger markets for products that could previously be serviced local markets.
From a logistics point of view, several important drivers of globalization should be highlighted. On the one hand, the increase in international trade leads to an increase or at least to a shift in the importance of sales channels. The process of distributing enterprise products through various international channels should be treated as a joint venture in marketing and logistics (Abrahamsson & Berge, 2005, p. 85; Wirtz, 2007, p. 19).

On the other hand, due to globalization, fragmentation of production takes place. This process can be considered the cause of the so-called 'Economies of scope', as it results in new possibilities of concentration of the main areas of the company's activity and outsourcing activities as a result of growing markets of cooperation and business activity (Robinson, 2001, p. 253). Thirdly economies of scope" allows not only global markets to increase the sales area for their products and services, but also gives companies the opportunity to meet and fulfill the wishes of local customers. This refers to increasing regionalization.

Increasing globalization and internationalization of enterprises opens up new opportunities through new sales and supply markets. At the same time, the requirements for planning and organizing the movement of raw materials, materials or products along the entire supply chain are increasing. As the globalization processes increase, the demand for transport, storage, reloading and communication services increases. That is why logistics is nowadays a superior

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link for the implementation of logistics and warehouse processes as well as a success, and sometimes even a strategy in times of global competition.

The management of logistics processes in times of increasing globalization and the associated internationalization of supply, production or distribution processes, as well as due to geographical and cultural dispersion requires optimization actions. The international expansion of enterprises leads to increased requirements for the creation of international logistics networks. Globalization enables enterprises to access new markets, which means offering services and goods. The consequence of this is the increasing sales opportunities. With the expansion of the foreign activity of the enterprise, economies of scale can be achieved. The possibility of undertaking foreign expansion, establishing subsidiaries abroad or taking them over, exporting manufactured goods nowadays becomes possible to be defined in terms of choice of markets or supplies. In addition to the issues mentioned and the opportunities offered by modern globalization processes, account should be taken of those that contemporary enterprises should face. It is mainly about including transport costs in the projects resulting or increasing from the relocation of production abroad, which may partly be offset by lower remuneration costs.

Apart from trade liberalization, development can be seen in the areas of transport, information and communication technologies, which in the long term can significantly reduce geographical and time gaps.

3. Lean management

The concept of lean management is another megatrend that shapes logistics processes and is perceived as a stimulator of logistics management. Currently, it becomes particularly necessary to link logistics management methods with lean management concepts. While many of them can be found in the literature on the subject, the concept of Lean Management (LM) should be mentioned (Blaik, 2010, p. 97)

Knowing that in the lean management philosophy, issues related to logistics and production processes play an important role, it is worth paying attention to the differences in the area of traditional and modern production control system as well as material and information flows within it. In traditional approach higher inventory costs or large stocks of work in progress should be highlighted, which of course results in the need of involving higher number of logistics operations. In modern, lean and agile management systems situation looks quite differently, where, in addition to low levels of inventory and production in progress, quality problems are reduced and more accurate planning of production volumes and thus logistical activities is possible.

It can even be stated that lean management has caused a revolution in the implementation of production and logistics processes in modern enterprises. Therefore it is worth mentioning a different management concept, i.e. in this case lean production management. This concept, originating in Japan, aims to coordinate and increase the efficiency of production and logistics

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processes. Its overarching goal is to organize the company's production in such a way as to reduce and eliminate waste.

It needs to be underlined that in the production area, after implementing lean manufacturing tools, production cycles are shortened. These, in turn, should not be seen as an independent phenomenon, because it may arise due to innovation (new product or service) or due to changing consumer behaviour.

Lean Management is a management strategy that also finds application in other areas of the company's operations, such as lean supply, logistics operations (lean logistics) or lean administration (Kummer et al., 2009).

4. Information technologies and digitization

Information plays an important role, especially in the process of shaping and optimizing the links in the supply chain. In fact, it is difficult to imagine an enterprise that would not use integrated IT systems that affect the formation and efficiency of the enterprise. What's more, in the era of the industrial revolution 4.0, the flow of information in production or logistics processes is particularly important and, in principle, this phenomenon is more and more often the cause of the digitization process. In addition, the growing importance of services, miniaturization and cost-effective production in microelectronics have an impact on the growing interest in digitization issues. The issues related to the possibility of saving, transferring and processing large amounts of data should also be emphasized (Cieślak
& Rogaczewski, 2019).

For the abovementioned aspects particularly important role play other megatrends, which, on the one hand, influence logistics, and on the other, influence each other. It is worth pointing out at this occasion lean management, which is focused on the organization process and is an area of tools used to improve the productivity of processes and logistics and production systems. Its functioning is determined by the processes of digitization of production enterprises and is based on the already mentioned IT technologies and the concept of "Internet of Things". For comparison, in relation to globalization processes, digitization and digitization strengthen the flow of goods between enterprises and final recipients in globalizing supply chains (Pocket, 2016).

Thanks to digitization and networking, it is possible to reduce many sales channels and thereby reduce transaction costs. Logistics have a special task here, as they shape and determine the shape of distribution channels and their effectiveness. It should also be mentioned the rapid development of electronic commerce (eCommerce).

Due to the simplified possibility of purchase, sale or distribution based on commercial platforms via the Internet, the demand for supply and distribution structures increases not only in the area of industry. Also in the area of consumer markets, supply chain networks are created that connect production markets with sales markets.

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5. Customization and individualisation of requirements of customers

For many enterprises, good customer service and reliable, efficient logistics systems are central foundations of their strategy (Bundesvereinigung Logistik 2008, p. 2). Increasingly, to meet customer expectations and remain competitive among leading enterprises, companies must adapt their portfolios by introducing new products. This adaptation process is accompanied by ever-increasing demands in order processing, packaging, and transport logistics. However, achieving a balance between meeting customer requirements and maintaining the comprehensiveness and efficiency of distribution processes remains crucial.

To deliver products as quickly and cost-effectively as possible, enterprises often face a strategic dilemma: whether to produce goods in-house or outsource their production. Outsourcing can offer cost savings and flexibility, but it also introduces challenges related to quality control, supply chain coordination, and brand consistency.

The need to cater to individualized customer demands and diversify offerings to remain competitive leads to the creation of numerous variants, increasing logistical and operational complexity. This complexity primarily manifests in the management of national or international supply networks, coordination of transport systems, and optimization of shipment connections to achieve specific goals such as cost efficiency or speed of delivery. The rapid pace of economic development further necessitates the shortening of production cycles, enabling enterprises to respond more swiftly to changes in the market environment.

Individualization and customization demand that production companies adapt to current market conditions dynamically. To do so, enterprises must enhance their processes and increase the efficiency of production systems. Typically, businesses employ one of two production control methods: the "push" and "pull" principles.

Under the "push" principle (production push) (Figure 1a), goods are manufactured and delivered to the market without specific demand inquiries. This approach necessitates the creation of dedicated logistics chains, including extensive distribution channels. While traditional strategies used in procurement may reduce material and transport costs, they often require maintaining high inventory levels, which can result in increased storage costs and the risk of surplus inventory if customer demand is overestimated (Gleissner & Femerling 2008, p. 26).

In contrast, the "pull" principle (production pull) (Figure 1b) begins with the final recipient. Production is initiated only when specific demand for a product is identified. This approach eliminates the need for stockpiling, significantly reducing inventory costs and minimizing the risk of unsold goods. Initially applied to high-value goods, this system has gradually been adopted for lower-value consumer products as well. The pull method offers advantages such as limited transport cycles, faster information exchange, and streamlined logistics and production processes. Key tools supporting this approach include the Kanban system and Just-in-Time (JiT) delivery strategies.

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Additionally, digital technologies such as real-time data analytics and advanced forecasting systems have enhanced the efficiency and precision of both "push" and "pull" strategies. These tools enable businesses to respond more flexibly to shifts in demand and supply chain disruptions, making them invaluable in today's rapidly evolving markets. By integrating digital solutions with traditional logistics principles, enterprises can strike an optimal balance between cost efficiency and customer satisfaction while maintaining a competitive edge in the global economy.

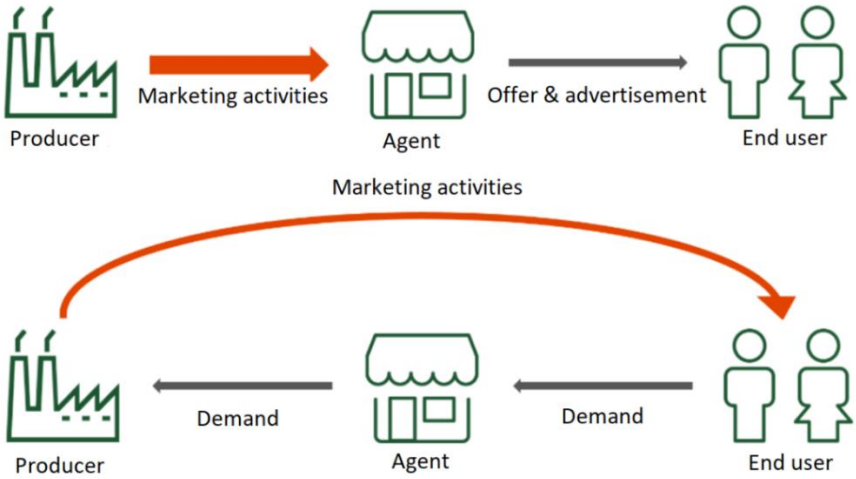

Figure 1. Differences in strategies of production
Source: own study

Attention should be paid to differences in the systematic structure of these systems (Table 1):

Table 1. Push and pull strategy - differences

	Push strategy	Pull strategy
1	Centralized planning	Decentralized planning
2	On order production	On dem and production
3	Information on production and product are connected	Information and product are not connected (system Kanban)
4	High storage cost	Lack of storage cost or minimal

At present companies have to face a dilemma what kind of production organization should be chosen in order to be more and more competitive and respond to the demand of environment and customers. Generally we should talk about make to order (MTO) and make to stock. These 2 approaches aptly describe the production control strategy „push" and „pull"

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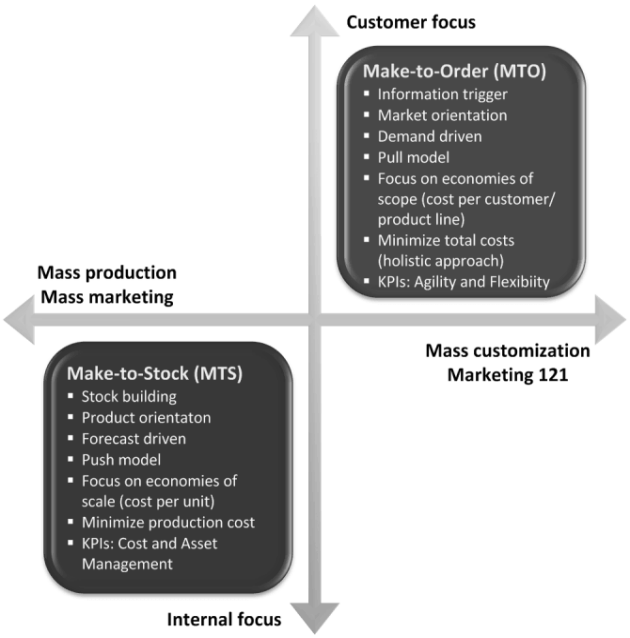

Figure 2. Make to order vs make to stock
Source (Krupp 2007)

In the case of individualization of customer requirements, the products are tailored to the customer's needs, while production starts after the customer orders. The result is a lack of finished goods inventory, a very low inventory cost, and a small storage space. High process stability is required and a very high risk of implementation of this type of processes is visible (Rogaczewski & Wojciechowski 2018). Products are manufactured individually or sometimes with a certain repetition, which occurs at irregular intervals. This results in the fact that it is impossible to effectively predict their occurrence. It is worth emphasizing that the specificity of production determines the high frequency of changes, which often causes high costs.

6. Impact of megatrends on logistics development

It is worth making a summary and pointing to the more important aspects of the impact of the above mentioned megatrends on the development of logistics. One of the most important, most often appearing in the literature, is globalization.

Globalization has an impact on logistics and supply chain coordination. The concept of logistics in an enterprise is indispensable for the coordination of supply chain activity, especially when these are geographically dispersed. Internationalization processes also show a high impact on the supply chain, which is confirmed, for example, by the fact that companies differ quite significantly in the scope of logistic activities undertaken (Stock et al., 2000; Fernie & Staines, 2001). When making decisions about the foreign activity of an enterprise, it is necessary to internationalize logistics systems, as there is a strong relationship between effective internationalization of business processes and logistics. For this reason, logistics should be planned and implemented from the first phase of the company's foreign activity (Straube et al.,

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2008; Sen 2008). Logistics should be assigned the role of the precursor of internationalization. There is often a question about the role and tasks carried out by logistics when the company enters foreign markets. In order to present better analysed issues, a strategic and functional plane should be highlighted, under which the implementation of logistics activities can contribute to the success of the enterprise (Rogaczewski, 2014, pp. 201-203).

Increasing competition due to globalization and changing demand behaviour are affecting the effects of the supply chain. External environmental factors and internal mechanisms of enterprises entail the development of comprehensive supply networks (Ganesan et al., 2009; Li et al., 2009). Globalization contributes to the fact that the implementation of logistics processes is associated with overcoming spatial distances, which is impossible without cooperation. Therefore, international logistics networks are created that require coordination. Due to the high and constantly increasing complexity, it becomes necessary to place logistics as the central function of managing international enterprises in a globalized world.

Another megatrend that influences the shaping of logistics processes and adapting production to a changing environment is the changing consumer demand and innovations related to information technology. For this reason, supply chain management in the future will be confronted with various trends and will have to be adapted to them accordingly. It is obvious that to meet high demand expectations it is necessary to use available information technologies. Integration within the supply chain is also a particularly important aspect, especially for process (logistics and production) and product activities. It should therefore be emphasized that decisions on configuration and management of the supply chain are a fundamental success factor in competing with other enterprises, which entails the need to even control individual links in the chain or suppliers, as well as the development of direct relations with customers or ensuring an adequate level of information flow.

IT solutions, resulting from the fourth industrial revolution and a peculiar standard in modern enterprises, involve all internal dependencies of the supply chain and should be taken into account at all stages of its management in order to improve business processes occurring in the enterprise. The role of information in logistics management should be of strategic importance. This will have a positive impact in the implementation of operational management (Ballou et al., 2000). The Internet and its use within the supply chain breaks traditional structures and contributes to increasing the profitability and efficiency of the supply chain (Rahman, 2003), for example in the implementation of procurement processes, production plans, risk management, CRM or JiT.

Automatic data identification called EDI plays a special role in information management in the supply chain. The use of this solution leads to significant improvement in the area of SCM and contributes to the reduction of the Bullwhip Effect (Machuca & Barajas, 2004).

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7. Conclusion

Megatrends in logistics are not a novel concept, but their influence is growing as the global economy continues to evolve. Phenomena such as globalization, the internationalization of enterprises, digitization, the Internet of Things, lean management, and customization are no longer just trends; they have become critical drivers of the logistics sector's transformation. These megatrends stimulate innovation and demand new approaches in the planning, execution, and optimization of logistics and supply chain processes. Global trends play a pivotal role in integrating the flows of goods, information, and resources across the entire supply chain. Suppliers, manufacturers, distributors, and final customers are increasingly interconnected, emphasizing the need for logistics systems that are both agile and resilient. This integration is influenced by external factors such as technological advancements and environmental challenges, as well as internal factors like organizational strategies and consumer expectations. Moreover, the growing importance of sustainability has introduced a significant paradigm shift, pushing enterprises to balance economic efficiency with environmental and social responsibility. Logistics has thus emerged as a strategic function that not only supports operational goals but also aligns with broader objectives such as reducing carbon footprints and enhancing global supply chain transparency. Technological advancements, particularly in digitization and automation, have further enabled logistics operations to become smarter and more efficient. These technologies facilitate real-time decision-making, reduce costs, and improve customer satisfaction by optimizing the delivery process. Additionally, the proliferation of e-commerce and changing consumer behaviours continue to redefine the logistics landscape, requiring continuous adaptation to remain competitive. In summary, megatrends underscore the necessity for enterprises to rethink their logistics strategies, emphasizing adaptability, sustainability, and technological integration. By doing so, companies can not only navigate the challenges of a dynamic global environment but also capitalize on the opportunities it presents to achieve long-term growth and success.

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