

## NEW LOGISTICS AND PRODUCTION TRENDS AS THE EFFECT OF GLOBAL ECONOMY CHANGES

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**Abstract:** The growing market globalization, increasing global competition, and more complex products results application of new technologies, methods and business processes. Fast changing market environment and fluctuating customer demands require efficient operation of logistical processes. In this study the logistical tendencies and challenges are introduced with reasons and driving forces. Tendencies in the changes of customer demands, production requirements, formation of supply chains, inventory strategies, transportation activities and activity of the logistics service sector are analyzed. Finally the Industry 4.0 conception is introduced which will change the production and logistical processes drastically.

**Key words:** logistics, tendencies, supply chain, production, industry 4.0

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### Introduction

Logistics is a common word nowadays, since it has an important role in supply chains and also in the competition of enterprises. There are several existing definitions for logistics. Logistics is the planning, organizing and coordinating of the flow of materials, information, energy, money and values inside a logistic system. Beyond the realization of these processes logistics is also an interdisciplinary discipline that synthesizes and utilizes the state-of-art knowledge and methods of several disciplines connected to logistics in order to realize a given logistical task. Therefore, the goal of logistics is to provide things in adequate quality and quantity at a given destination, in an appropriate time, from an appropriate origin, with an appropriate method and equipment, and with an appropriate minimal cost. The quality and availability of the offered services by the logistics sector are of capital importance for the economical growth and for increasing employment potentials (Supply Chain Digital, 2016; Speranza, 2016; Karcz and Ślusarczyk, 2016, Grabara, Tănăsescu, 2014).

Last years, the globalization processes has accelerated and the uncertainty about how markets will evolve has made it increasingly important for companies to be aware of the supply chains they participate in and to understand the roles that they

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play (Kot, 2014). Globalization, enhanced competition in the global market, more complex products with shorter lifecycle, constant aspiration to the reduction of costs (Slusarczyk and Golnik, 2015) and fluctuating customer demands gave rise to new technologies, business processes and the application of global supply chains (Gereffi, 2011). Therefore, the logistic sector is currently meeting and will meet in the future new practical challenges, and the fast respond to them is the key of success for the economic operators.

### Introduction of the European Logistics Sector: Influencing Factors and Challenges

The logistical performance of the European Union is nearly 1,000 billion Euro (Figure 1). The logistic sector is in constant growth. The Western-European countries (and Poland) are the leading countries, while Hungary is dropped behind with its 4.9 billion Euro (which is 0.5 % of the total European performance).

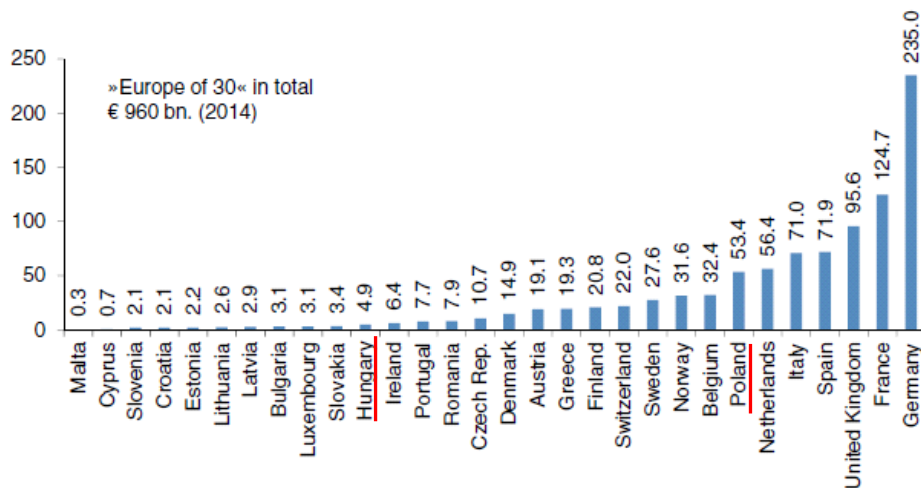


Figure 1. Logistics market size in Europe in billion Euro (Fraunhofer Institute, 2015)

The Hungarian logistical sector gives 6 % of the GDP of Hungary, while in case of Western-European countries it reaches up to 10-13 %. Therefore – as emerges from the statistics – it can be concluded that an efficient logistical sector in a country strongly promotes a successful economy. According to a study of Fraunhofer Institute from 2015 mostly 10 driving forces listed in Table 1 influence the logistic sector of Europe.

Furthermore it is clear that the logistic sector of Hungary has to meet high standards because our geographical location and our economical-cultural role as a joint of East and West Europe would provide significant opportunities in this sector.

**Table 1. 10 main driving forces that influence the logistic sector**  
(*Fraunhofer Institute, 2015*)

Driving Forces	
1. Globalization	Drivers which can be hardly influenced
2. Demographic development	
3. Sustainability	
4. State intervention	
5. Rising risk	
6. Professionalization – efficiency	Drivers which can be adopted for successful business options
7. Focusing on core competencies – effectiveness	
8. Service oriented	
9. Innovative technologies	
10. Faster ticking clocks	

### Introduction of the Development Objectives in Global Logistics

The logistic goals are originated from general corporate goals, of which maximal customer satisfaction is one of the most important. Actually all the other goals can be derived from this, which are listed in the following paragraph (logistic goals are underlined). With shorter lead time the customer would get the ordered product in the shortest time possible. Economical and profitable corporate operation can be achieved by utilizing the maximal production (or service) and logistic capacities, which includes the optimal utilization of human sources and equipments. Flexible production (or service) and logistic processes is needed to answer the demands of the rapidly changing economics and dynamic customer demands. The development of business processes can be realized only by high transparency and by the continuous monitoring of the efficiency of the systems, since which process can be measured is can be improved.

Ensuring and enhancing the quality of the processes is of priority for customer complacence. Nowadays sustainability and the use of environmental-friendly materials and technologies are also defined as a goal, as well as green waste management and recycling. In terms of cost reduction the main goal is to decrease stocks and to operate production and service processes efficiently throughout the whole supply chain and at each individual party in the supply chain. The optimal formation of the global, intercontinental supply chains can also be an element for success in competitiveness.

### Global logistic tendencies

The following short introduction of the global logistic tendencies focuses on the changes in the main logistic processes and activities, and reveals the driving forces and reasons behind them. In this section the analysis is executed by the following aspects, which influence the logistic processes:

- Change in the customers' demands and product characteristics, since generally these demands pull the whole production and service sector as well as logistics.

- Changes in production philosophy and production processes, which poses new challenges to the logistic processes.
- Trends in the formation of supply chains, which changes the core of the tendencies of logistics.
- Stocking trends, which results in the need for drastically smaller stock levels, posing even more challenges to the logistic processes.
- Changes in the shipping sector, which activity is one of the most expensive logistic process.
- Tendencies of the logistic service sector, which sector is an organic part of the logistic processes.

#### ***Change in the Customers' Demands and Product Characteristics***

Due to the more unique and rapidly changing customer demands nowadays many industrial sector has completely different strategies than few decades or even few years before. The traditional mass production is replaced by the production of unique products in case of several industries, the variation of finished products that can be chosen by the consumers is almost infinite, and the customer can freely determine the composition of the ordered finished products. For instance in case of a vehicle the finished product variations can reach up to 1000 (a combination of color, type of engine, other accessories etc.). At the same time the acceptable shipping time has decreased while the demand for quality has increased. Typically the production of products with shorter lifecycle but more complexity requires novel, more flexible production technologies and logistic processes, and their sales need new business approaches.

#### ***Changes in Production Philosophy and Production Processes***

The traditional mass production is replaced by unique production (or smaller batches), or from the philosophical point of view the 'Push' approach (make to stock) is replaced by 'Pull' approach (make to order). In case of push philosophy production planning is based on forecasted data (not actual customer demand), so that the result is high amount of products, including unsalable stock is created. On the contrary, the uniqueness of production with pull philosophy lies in the fact, that production starts only when an actual customer demand appears (with detailed specification), which starts acquisition and manufacturing processes (Dima and Grabara, 2013; Gubán, 2014). Based on the fundamental differences between the two approaches it is clear the unlike push approach the pull approach results in the realization of the above described logistical goals, which are the followings: 1) shorter lead time; 2) production is scheduled based on the customer's demands; 3) only small amount of stock is realized before (raw materials), during (semi-finished products) and after (finished product stock) the production process; 4) flexible reaction to the changing customer demands; 5) dedication to continuous improvement; 6) smaller place for production; 7) higher utilization of human resources and equipment; 8) higher productivity, etc. The Lean production

philosophy utilizes the advantages of Pull philosophy, and it is spreading throughout the many sectors, both at production and service companies in automotive industry, electronic industry, offices and health industry as well.

The focus is to decrease the cost of production, to cut activities which do not add value to the product from the customer's point of view. The main perspective of the Lean production system is to improve quality, decrease wastes and optimize the cost of production processes in order to increase competitiveness (Kovács, 2012). The focus of the Lean methodology is to create value-adding processes, and to realize only value-adding processes throughout the whole production system. The possibilities and advantages of the Lean Production System is described by the following key performance indicators (KPI): shorter lead times, shorter set up times, smaller stocks, increase of free production area, increased quality of products, general increase of the efficiency of production, increase of productivity.

### ***Trends in the Formation of Supply Chains***

The rapidly changing market environment and global competition resulted in more complex networks of supply chains. The value chains are globalized, the cooperation between corporations became more dynamic. The key of success for chains is to understand the customers' needs, and to fulfill it with the highest quality, and at the same time to adapt to the expected changes of market demands. The competitiveness of each chain originates from the utilization of and synergy between the partners. Although on the global market the supply chains compete as well to fulfill the customer demands with high quality products. Customers choose also between the supply chains by buying a finished product. The main points of decision are the cost of the product, lead time, quality, customizability, and the quality of services connected to the product. Novel supply chain conceptions are introduced besides the traditional ones in order to retain the competitiveness of the company (Kovács, 2016):

- 1) The main goal of the application of „Lean Supply Chains” is to minimize losses in the whole supply chain, by eliminating non value-adding activities, and to improve the processes continuously. These goals are supported by several Lean strategies, such as shortening waiting times and switching times etc. (Kovács, 2012). This results in the realization of production smaller in volume, but more economical and flexible. This strategy can be applied mostly in case of products with relatively longer lifetime (more than 1-2 years), and the members of the chain work in traditional networked organizational form.
- 2) Agile Supply Chain is an other new concept in the formation of supply chains, which are already applied in many sectors. Agility refers to the connection between the finished-product producing company and the customers' market, in other words how fast can the supply chain respond to the customers' demands. The competitiveness and profit of Agile Supply Chain originates from the fast response of the supply chain to the new challenges of the market. The produced goods are more custom designed, more unique, produces in smaller

quantities, shorter lead time and with reduced cost. This strategy can be applied mostly in case of innovative products with relatively shorter lifetime (maximum 1 year). The partners of an agile supply chain usually form a dynamic cooperation in the framework of virtual corporate networks, (Kovács, 2016) which supports the fast fulfillment of the dynamically changing customers' demands. Camarinha-Matos (2001) interpreted the virtual enterprise as a temporary alliance of enterprises that come together to share their skills, core competencies, and resources in order to better respond to business opportunities, and whose cooperation is supported by computer networks.

- 3) Hybrid Supply Chain is a combination of Lean and Agile supply chains, which utilizes the advantages of both strategies. This approach typically applied in case of 'assembled for order' type of products, where the customer forecasts are mostly correct and incorporating innovative components can enhance the uniqueness of the finished products. This strategy allows the realization of a wide, custom-designed product portfolio. This strategy utilizes Lean techniques during the production throughout the chain, and at the same time apply the elements of Agile Supply Chains to form advantageous strategic cooperation, in order to adapt to the dynamically changing customers' demand.

#### ***Inventory Management Trends***

In the perspective of cost reduction the main logistical goal is to decrease stocks. The spatial concentration of inventory is the most important tendency of the last decades (Bokor, 2005). Fewer stocking units result in significant saving. The operation of centralized inventory bases is mostly supported by factors such as integration of supply chain or the development of information technology. Both enhance the speed of processes and decreases stocking time. The most efficient way of stock reduction is the application of Pull philosophy at the production companies, or if possible, throughout the whole supply chain. As a result the so called 'Just in Time' supply and inventory strategy, but the stock reduction and scheduled flow of goods are also supported by Cross Docking and Vendor Managed Inventory (VMI) strategies as well.

#### ***Changes in the Shipping Sector***

The intensity of the transport activities connected to production and services is constantly increasing, due to the economic performance growth and the appearance of bigger supply chain networks. The observation of the tendencies in transport demand it can be concluded that basically the acceptable shipping time by the customer shortens. The formation of global supply chains increases the ratio of international shipping, the shipping distances become longer, while locally the volume of delivery decreases and the frequency increases (JIT principle). The expectations for the quality of shipping are higher. The cooperation is enhanced between the transport sectors (road, rail, water and air), the importance of cooperation and coordination is emphasized in order to realize economic and fast

transport, and the advantages and synergies between the different methods can be combined. Putting more emphasis on the optimal design of transport loops, more effective transport coordination, and optimized utilization of vehicles reduces the cost of transport. The spreading and application of logistic informatics tools improves the efficiency of shipping tasks, and ensures better monitoring and tracking. The ratio of road transport in Europe is nearly 80 % of the total transit volume, and this ratio is increasing. This road transport method is economical mainly in local or regional scale, but it is widely used for distances as well due its many advantages. The dense road network, shorter shipping time and the high level of adaptation to the demands of customers can explain this high ratio compared to the other methods during transportation.

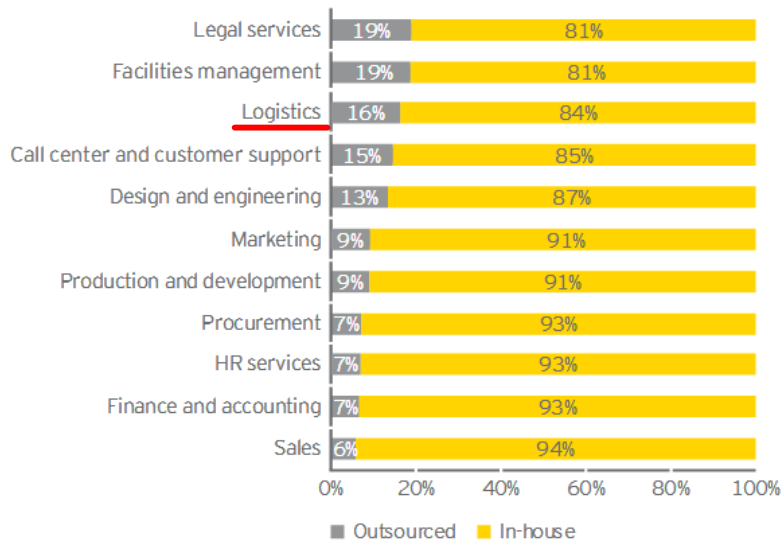
The spatial concentration of production and stocking as well as global supply chains increases the ratio of railways and water transportation because of the required long-distance shipping. Air transport is only used in case of high-value low-volume products. The intentions of the transport policy of the European Union – due to the harmonized rules and regulations – are to build sustainable transport systems, liberalization, increase transport safety and to increase the ratio of combined shipping methods. The goal of the utilization of combined shipping methods (such as containers or huckepack systems) is to realize the cooperation of different transport sectors by which the advantages of each transport modes can be combined and at the same time the drawbacks can be eliminated. The goal of this aspiration of the European Union is to decrease the contribution of road transport, and as a consequence environmental pollution and noise pollution can be decreased together with traffic jams, and potentially accidents as well, the deterioration of roads can be postponed, globally more favorable use of resources as well the capacity of railway and water transportation could be better utilized.

The capacity efficiency of vehicles is constantly growing. This can be derived from trends such as the increased of load factor or the decrease of idle loads. The capacity enhancement during transport planning can be supported by tendencies such as rationalizing product flows, logistical and consolidation-transformation centers that focuses on size-economy, and inverse logistics that guarantee back-transports. The shipping time – despite of the longer distances – will decrease because of the development of control systems based on vehicle technology and telematics (Bokor, 2005; Bakhtizin et al., 2016).

### **Tendencies of the Logistic Service Sector**

The main activities of the logistic service providers: warehousing and stock management, transport operation and shipping, financial and other value-adding activities, etc. A general tendency for production companies to put more emphasis on the core activities, main tasks and the ratio of outsourced activities is higher and higher. In 2013 3700 companies were asked in a survey in 8 countries (Denmark, Finland, Germany, the Netherlands, Norway, Spain, Sweden, Great-Britain), and as emerges from Figure 2 logistics is amongst the most commonly outsourced

activities, 16% of the companies outsourced logistics (EY, 2013) (see Figure 2). The role of integrated logistic service providers with diverse activities is ever increasing (3PLP – 3<sup>rd</sup> Party Logistics Provider, 4PLP – 4<sup>th</sup> Party Logistics Provider). Due to the logistical trends promoting integrated solutions increases the role of cooperation between service providers. This tendency is also supported by the several fusions (merging or buying-in companies and strategic partnerships) observed in the logistical service provider market (Bokor, 2005). The growth of production sector and the resources of European Union support the creation of more industrial parks and logistics centers, which provide more complex and high quality services so that they catalyze the improvement of other industrial sectors in the region as well.



**Figure 2. Proportion of outsourced activities**  
(EY, 2013)

### Industry 4.0 Concept

The tendencies of the 21<sup>st</sup> century – such as the s life-cycles of products are shorter while consumers demand more complex, unique products in larger quantities – poses many challenges to the production. There are many sings that show that the current practices in the utilization of resources is not sustainable, which will limit the production. The industrial sector is going through a paradigm shift, which will change the production drastically. The traditional centrally controlled and monitored processes will be replaced by decentralized control, which is built on the self-regulating ability of products and workpieces that communicate with each other. The essence of Industry 4.0 conception is the introduction of network-linked intelligent systems, which realize self-regulating production: people, machines, equipments and products will communicate to one another (Jay at al., 2015; Tabor,



2015; Stock and Seliger, 2016). This paradigm shift includes the conception of Industry 4.0, which is widely used in Europe, especially in Germany. The name of the conception forecasts the upcoming 4<sup>th</sup> industrial revolution, because according to the theory of the conception the 1<sup>st</sup> industrial revolution introduced automation, the 2<sup>nd</sup> mass production, the 3<sup>rd</sup> is the utilization of robots. Industry 4.0 will bring intelligent production robots. The goal of the conception is to make flexible, custom production economical, and to use resources efficiently. It requires each equipment that take part in the production to communicate with one another. The organization of information flow is executed by a central production control system. Products control their own production, since to communicate with unique product codes with the machines and equipment, which mean virtual and actual reality merges together during the production (Ulewicz et al., 2016). The scheduling of the production will be also controlled by the communicating products. Factories will be self-regulating and optimize their own operation.

#### ***The 5 Main Components of Networked Production***

The 5 main elements of the networked production can be defined by the following (Husi, 2016):

- 1) digital workpieces – the dimensions, quality requirements and the order of technological processing is given for the digital workpieces;
- 2) intelligent machines communicate simultaneously with the production control system and the workpiece under processing, so that the machine coordinate, control and optimize itself;
- 3) vertical network connection – when processing the unique specifications given by the customer for the product to be manufactured the production control system forwards the digital workpiece created by automated rules to the equipment. The products control their own manufacturing process, since they communicate with the equipment, devices and the other workpieces about the conditions of the production;
- 4) horizontal network connection – the communication is realized not only within one factory, but also in the whole supply chain; between the suppliers, manufacturers and service providers. The main purpose is to enhance the efficiency of production and to utilize the resources in a more economical way;
- 5) smart workpieces – the product to be manufactured senses the production environment with internal sensors and controls and monitors its own production process in order to meet the production standards, since it is able to communicate with the equipments as well as the components already incorporated and to be incorporated

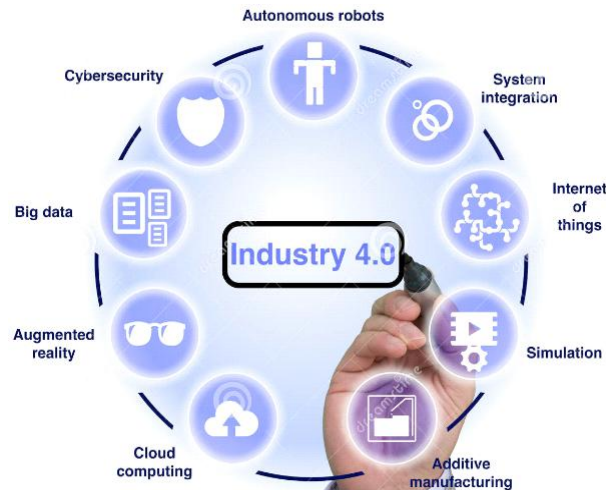
#### ***The main technologies of Industry 4.0***

The importance of production arranged in global network is that the manufacturing process can flexibly adapt to the unique customer demands, to the activity of the other parties of the supply chain and to the rapidly changing economic

environment. The term Industry 4.0 is getting global recognition and the survey of PwC (2016) from 2016 defines three main areas, where it affects the corporate world:

- integration and digitalization of horizontal and vertical value chains,
- digitalization of products and services,
- the formation of digital business model and customer relations.

This framework and the connected new technologies are shown in Figure 3.



**Figure 3. The main technologies of Industry 4.0**  
(<http://www.industry40summit.com/about/what-is-4-0/>)

The production technology of Industry 4.0 is not a technology from the far-away future. In July 2015 the Changing Precision Technology (Dongguan, China) became the first factory where only robots work. Each labour process is executed by machines: the production is done by computer operated robots, the transport is implemented by self-driven vehicles, even the storage process is completely automatic.

### Summary

Globalization, changing economic environment and customers' demands and the ever increasing competition in the market emerged the need for new manufacturing technologies and business processes. These changes constantly confront the practice of logistic with new challenges. This study described the global logistic tendencies and changes of the main logistic processes and activities, as well as the driving forces and reasons behind them.

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### NOWE TRENDY LOGISTYKI I PRODUKCJI JAKO EFEKT ZMIAN GOSPODARKI ŚWIATOWEJ

**Streszczenie:** Rosnąca globalizacja gospodarki, wzmagająca się konkurencja światowa oraz bardziej złożone produkty prowadzą do zastosowania nowych technologii, metod i procesów biznesowych. Szybko zmieniające się otoczenie rynkowe i zmieniający się popyt wymagają sprawnego funkcjonowania procesów logistycznych. W niniejszym badaniu omówione zostały tendencje i wyzwania logistyczne wraz z ich uzasadnieniem i siłami, które wpływają na ich rozwój. Analizowane są tendencje zmian wymagań klientów, wymagań produkcyjnych, tworzenia łańcuchów dostaw, zapasów, strategii działań komunikacyjnych oraz aktywności sektora usług logistycznych. Wreszcie omówiona została koncepcja Przemysłu 4.0, która drastycznie zmieni procesy produkcyjne i logistyczne.

**Słowa kluczowe:** logistyka, tendencje, łańcuch dostaw, produkcja, przemysł 4.0

#### 新的物流和生產趨勢作為全球經濟變化的影響

**摘要：**不斷增長的市場全球化，日益增長的全球競爭和更複雜的產品導致新技術，新方法和業務流程的應用。快速變化的市場環境和波動的客戶需求需要後勤過程的有效操作。在這項研究中，物流趨勢和挑戰被引入了原因和驅動力。分析客戶需求變化，生產要求，供應鏈形成，庫存策略，運輸活動和物流服務部門活動的趨勢。最後，介紹了工業4.0的概念，這將大大改變生產和物流過程。

**關鍵詞：**物流，趨勢，供應鏈，生產，工業4.0