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LOGISTICS 4.0 IN SELECTED LOGISTICS COMPANIES IN POLAND- PRELIMINARY REVIEW

ABSTRACT

Background: Logistics 4.0 is a concept that strives for improvement of performance of logistics processes. It encompasses many solutions dedicated for both, isolated logistics functions (such as warehousing, transport etc.), and integrated physical and information flows. Their implementation usually requires some investments (purchasing technology and/or infrastructure), as well as organizational changes. Since there is always risk emerging from implementation of new solutions, companies, especially SMEs, due to their limited resources, are cautious when it comes to the decision on introduction of changes to their structure or processes. On the other hand however, SMEs are believed to be flexible and opportunity-oriented seeking for chances to improve and increase their competitive edge and implementation of state-of-the-art solutions are undoubtedly such a chance. Nevertheless, they need support to increase their will and strengthen their need to implement contemporary innovative solutions.

Methods: Authors designed survey consisting of 25 questions. An invitation to participate in a survey was sent to randomly selected transport and logistics companies in Września county. The study was conducted on a very small random sample, so the accuracy of the test results is

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limited. The study covered randomly selected enterprises due to the scope of the study. The survey has been conducted in August and September 2019.

Results: 19 enterprises located in Września county participated in the survey. Chapter presents preliminary research that has been done within logistics companies and based on conducted survey it was possible to assess what is actual knowledge and implementation of Logistics 4.0 tools. The preliminary results contributes that selected polish micro and medium transport enterprises are not yet fully ready for the revolution of transport through Logistics 4.0. They focus on traditional methods of contact and conducting business, claiming that they are developing their business properly and do not need to make changes. Only a few have knowledge about Industry and Logistics 4.0.

Conclusions:. The problem with the implementation of the 4.0 logistics concept appears in many enterprises and results from the lack of clear information about what "thinking in category 4.0" can actually mean for the company in terms of real benefits. Research proved that there is a huge cognitive gap in transport and logistics companies in the scope of Logistics 4.0. Lack of knowledge can be eliminated by developing appropriate guidelines, roadmap and Logistics 4.0 maturity levels.

Keywords: Logistics 4.0, Transport and Logistics Sector

INTRODUCTION

Interest in Logistics 4.0, which is a form of reaction of enterprises, to changes in industry at the level of the fourth industrial revolution has been growing for several years. Industry 4.0 are those enterprises that created production lines that are a combination of mobile automation and process control information systems. The development of new generation production companies and their cooperation with logistics companies have led to the creation of a new supply chain structure (Gajdzik, 2019; Pfohl, 2016)

Hereby chapter presents preliminary research results with respect to Logistics 4.0 in selected transport companies. Authors describe either theoretical background or practical part based on surveys.

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Explaining what logistics is, is not easy. In the collective imagination, this term is commonly associated with freight transport. Conferring to the logistic term an exact definition is not at all simple, according to the field of application its meaning changes. Nowadays it is applied in different sectors, above all to the productive and commercial one.

What is Logistics 4.0? It can be said that it is a term referring to modern logistics, including mutual data exchange, digitization and cloud computing. Therefore, the tasks of logistics are no longer limited - as before - to the transport itself and its operation, but are based on managing functions and coordinating activities between logistics companies in the supply chain. Logistics 4.0 is a reflection of the Industry 4.0 concept in supply chain processes, which, according to the idea of revolution 4.0, are gradually connected into a network and subject to constant monitoring. The effect of these activities is to be a significant increase in the efficiency of these processes. Logistics 4.0 provide for modern communication and information technology. Intelligent and digitally connected systems are to enable communication between people, machines, equipment, logistics solutions and products. When logistics is integrated at an early stage in the supply chain, just-in-time optimization is achieved. On the other hand, carriers have an even better planning basis, better utilization of their fleets and shorter waiting times at charging points (Timocom, 2019)

Authors use the term “Logistics 4.0” to refer to the combination of using logistics with the innovations and applications added by CPS. Logistics 4.0 is related to the same conditions as Smart Services and Smart Products. We have then to consider that the technology driven approach used to define “Smart Products” and “Smart Services” is used to define “Smart Logistics” (Barreto et al., 2017).

“Smart Logistic” is a logistics system, which can enhance the flexibility, the adjustment to the market changes and will make the company be closer to the customer needs. This will make possible to improve the level of customer service, the optimization of the production and make lower the prices of storage and production. As the “Smart Logistics” will change accordingly to the actual technology driven, it has a time dependency and thus it is essential to define the state of the art of the technology (Uckelmann, 2008).

The Logistics 4.0 technological solutions are based on using drones, self-steering vehicles, sensors, Big Data, GPS, RFID, M2M. As part of the concept, the technologies dedicated to

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modern enterprises use i.e. virtual reality glasses, intelligent transporters, gates, forklifts and automatic vehicles (DHL, 2015).

Delineated the citations listed above, which constitute only a part of those in the literature, an attempt is made to give an explanation that is summarized and suitable for the study: *Logistics 4.0 means a process of digitalization of communication systems employing innovative technological solutions, to increase the connection and sharing of data along with all the links in the supply chain, with considerable benefits in saving time.*

Relevant technologies of Logistics 4.0 are, e. g. identification, mobile communication, localization, electronic data interchange, data analysis methods, and data analytics processing. In short, the Smart Logistics frees humans from carrying out logistics activities that can be delegated to Smart Products or Smart Services (Uckelmann, 2008).

Logistics 4.0 enables process improvements through a variety of technological innovations, including smart robotics, driverless transport vehicles, automated systems for handling parts inside warehouses and factories, sensor systems, smart products, etc. Nowadays, the concept of smart products defines the products which have the ability to do computations, store data, communicate and interact with their environment (Schmidt, Möhring, Härting, Reichstein, Neumaier, & Jozinović, 2015).

The potential of Logistics 4.0 is far from being exhausted due to the deepening digitization and the growing amount of collected data that will need to be analyzed.

The problem with the implementation of the 4.0 logistics concept appears in many enterprises and results from the lack of clear information about what "thinking in category 4.0" can actually mean for the company in terms of real benefits. Along with the development of the concept, the questions inevitably arise: Is Logistics 4.0 a response to the trend associated with the growing requirements of customers to the increasingly tailored needs for a fast and flexible way of adjusting the flow of materials? Will implementation in Logistics 4.0 allow it to gain an advantage in a highly competitive logistics market? For many Logistics 4.0 is the opportunity to use new IT systems, for others an introduction to robot warehouses. These are certainly network systems and processes (Dataconsult, 2019)

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TRENDS IN THE TSL INDUSTRY

As in the previous period, automation and digitization of supply chains, along with e-commerce, determine changes in logistics. Robotization of warehouse works, autonomous vehicles, electromobility, Internet of Things (IoT), Big Data, artificial intelligence (AI), sharing resources and blockchains are a growing challenge in the TSL industry. However, as can be seen, most companies in the TSL industry are at the stage of recognizing the suitability of new information, analytical and hardware solutions or are analyzing the pace and scale of their introduction. However, all these breakthrough innovations are intensively tested by leading global logistics companies such as Amazon and DHL. In the field of e-commerce, Poland remains one of the fastest growing markets in Europe. Eurostat data shows that 45% of Poles over 16 years of age were shopping online in 2017. In the leading countries over 80% of citizens were shopping through this channel. Factors stimulating the growth of e-commerce were certainly the ban on Sunday trade coming into force in 2018 and the possibility of shopping and making payments from mobile devices. Customers of the e-commerce market are exerting increasing pressure on logistics companies for delivery on the day of placing the order (same day delivery). To meet this, logistics operators offer the delivery and collection of shipments (returns) via extensive networks of service points located: in parcel machines, shops, gas stations, etc. To meet the expectations of recipients, the courier industry has entered the world of non-cash payments. It is estimated that in 2017, approximately 400 million parcels were delivered to recipients in Poland, which represents only 2.6% of the European market (Fechner, Szyszka, 2018)

The polish transport, shopping and logistics sector is facing numerous problems posed by the authorities and other contries. Selected transport and logistics companies are trying to explore and implement the best possible solutions to overcome obstacles and foster the further development of the sector.

ANALYSIS OF CONDUCTED RESEARCH

The concept of Logistics 4.0 presented above should be present in most Polish enterprises which, in order to be competitive and stay on the market, must move with the times. However, in practice it varies and there are many more companies that do not follow this approach.

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Therefore, there is a need to carry out research on Polish enterprises from the TSL sector in the field of knowledge about Logistics 4.0 and its solutions in its operations. To this end, surveys were carried out. The survey was conducted using CAWI qestionnaire in order to obtain a set of data suitable for further quantitative analysis. Research group was made up mainly for small and micro enterprises.

It is characterized by the fact that it allows to acquire knowledge of a large population by examining only its representation, i.e. sample representation. These studies are among the most commonly used. Because they let you get to know a large community in a relatively short time. The data obtained are suitable for quantitative analysis.

The main goal of the survey was:

– learning the knowledge of owners and forwarders of enterprises on Logistics 4.0,

– applying IT support in enterprises,

– analyzing how data is identified and stored,

– determining the demand for the concept of Logistics 4.0.

According to the criterion of type and detail of marketing decision problems, the research is investigative. It was conducted as an auxiliary in identifying the problem, determining the direction of further research and formulating conclusions. However, from the point of view of the nature of the information obtained, they are qualitative research due to the small sample size. They explain and allow to understand the analyzed phenomena, which, nevertheless cannot be confirmed statistically. Research results cannot be generalized to the whole population due to the small and unrepresentative research sample. Undoubtedly, they are an assessment and characterize the examined population.

The research subjects are the owners and forwarders of transport companies. Defining the studied population:

- entity - preferably the owner or forwarder,
- sample unit - transport companies,
- spatial scope - Września[1] county,

[1] Września County (Polish: *powiat wrzesiński*) is a unit of territorial administration and local government (powiat) in Greater Poland Voivodeship, west-central Poland.

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- time - August and September 2019.

The study was conducted on a very small random sample, so the accuracy of the test results is limited. 19 enterprises located in Września county participated in the survey. The study covered randomly selected enterprises due to the scope of the study. The survey was conducted as indirect interview using questionnaires, which were answered by 19 companies 47.5% of 40 participating in the survey. The remaining 21 companies did not complete and did not return the survey. Questionnaire consisted of 25 questions divided on four main parts: management, material flow, information flow, additional questions.

The questionnaire was answered mainly by business owners 79%. The remaining respondents are forwarders 21%. In 100% they were service companies, exclusively with Polish capital and having one branch.

19 surveyed enterprises were divided in order to obtain information on knowledge of Logistics 4.0 and use of the latest IT methods in the process. The criteria of division were the size of the enterprise, its place in the supply chain and scope of activity (see Table 1).

Table 1. Criteria characterizing 19 surveying companies

Criterium	Share %
Company size:	
– 1-10 employees	84
– 11-49 employees	16
– 50-199 employees	0
– 200-499 employees	0
– 500 and more employees	0
Partipant in supply chain:	
– supplier of raw materials	5
– supplier of components	22
– Suppier of final goods	63
– flow integrator (partial)	10
– global integrator (supply chain integrator)	0
The scope of activity:	
– local/regional	5
– national	47
– european	48
– global	0

Source: own elaboration based on conducted syrveys

Research prove that there is no connections between the scope of activity, participant in the chain and size of the surveyed enterprises, and knowledge of the concept of logistics 4.0.

The competitive position of the surveyed enterprises is stable and the companies have only Polish capital. When asked whether the flow of documents is electronic and automatic

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identification of data only 11% answered in part and the remaining 89% answered in the negative.

Regarding data storage, all surveyed companies replied that internal documents are stored in chapter version in binders and on standard carriers. None of the respondents put information on the disk in the cloud or data warehouses. If the surveyed enterprises analyze the data, then only using spreadsheets. Respondents do not use automatic and autonomous solutions supporting the flow of materials in the form of forklifts, conveyors, storage devices or drones. They believe that they do not need such solutions as of today.

Currently, there are many IT systems on the market supporting management in enterprises, e.g. MRP, ERP, WMS, CRP, SCM, transport exchange. To the question: "What elements of IT support are used in the enterprise?" 74% of respondents indicated that the freight exchange and the remaining 26% do not use any IT support. This is due to the fact that 5 of the surveyed companies provide services for only one production company and therefore they do not need any support. However, some respondents in the future intend to introduce software into a smartphone (AR technology imposed by the transport company) that will be combined with freight forwarding in the company for which they provide services. This will help inform you about errors, delays or failures, and will speed up the unloading and loading process.

Due to the fact that the main goal was to learn the respondents' knowledge about logistics 4.0, there could be a question related to its knowledge. Well, only representatives of 21% of the surveyed enterprises read in publications and scientific articles about industry and Logistics 4.0. However, the remaining 79% have not heard of these concepts. It can be concluded that the lack of knowledge about Logistics 4.0 is associated with the lack of opportunities offered by this concept. In addition, according to respondents, the perception of the Logistics 4.0 paradigm is a goal that the company must reach, but will not affect logistics processes. Of course, the surveyed companies did not take any action regarding the company's position in comparison with the adoption of the Logistics 4.0 paradigm.

Respondents were also asked how they make decisions about the implementation of solutions supporting the service process. The surveyed enterprises could choose from one to three answers, which are as follows:

- in search of savings,

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- in search of innovation,
- to increase competitive position,
- as a result of recommendations from related enterprises.

All respondents pointed to the search for savings, because this is the most desirable goal of every enterprise. As for the remaining answers, 79% of respondents also indicated the search for innovation and increased competition, and only 21% have to listen to the recommendations of related enterprises.

The preliminary results of research presented in hereby chapter contributes that Polish micro and medium transport enterprises are not yet fully ready for the revolution of transport through Logistics 4.0. They focus on traditional methods of contact and conducting business, claiming that they are developing their business properly and do not need to make changes. Only a few have knowledge about Industry and Logistics 4.0.

CONCLUSIVE REMARKS AND FURTHER DIRECTIONS OF THE RESEARCH

Logistics 4.0 changes the principles and solutions for logistics. Holistic cyber-physical systems (CPS) are important results of Logistics 4.0. They realize the networking and automation of transportation, allocation and if necessary, the use of storage systems based on digitalization of processes and decentral software control. With the help of the Internet of Things (IoT) the networked connection of physical objects to enable real-time data visualization and the automation of logistics flows.

The critical issues related to Logistics 4.0 are mainly related to investments (payback times), the complexity of communication between information systems and the lack of adequate skills. Companies are facing problems connected with the lack of courage to achieve a radical change and with the lack of necessary talents. Are required new skills, there will be many job losses in some work categories, whereas also some gains in others, such as IT. Moreover, one of the most important barriers, as said, is related to the lack of clear business cases that justify such investments. The money required for new technologies are significant, and so accurate and clear plans for their expenditures are needed, especially for those companies with concerns about their ability to cover the necessary investment.

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These are some of the main components of the digital transformation applied to corporate logistics processes. The sample cannot be used for statistical evaluations as the number of companies involved is insufficient and the differences in size as well as in the sector to which they belong make it a heterogeneous sample. However, the replies to the assessment questionnaire were useful for making general observations. Such a far-reaching vision would bring many problems to companies that intend to keep pace with technological changes. Companies are uncertain about the financial effort required for the implementation of such new technologies and the consequent impact that they could cause to their business models. The massive problem for companies is to determine their status quo in relation to the issues they are facing, the ability to know how to self-evaluate and determine a domain which they belong. For this reason, it is difficult for them to identify concrete fields of action, programs and projects.

Transport and logistics companies are going forward Logistics 4.0 solutions if they are big companies. Logistics companies, especially those large, dynamic and wishing to compete in the rapidly growing market, need to strive to be a market leader by all means if they want to maintain their status and position in the market.

Surveyed companies were rather small and micro sized therefore there is a lack of knowledge about potential modern tools and directions of evolution with respect to Logistics 4.0/ Industry 4.0.

There is no doubt that the transport and logistics sector is undergoing an important transformation as new technological solutions come into everyday use, driven by market trends. It can be expected that this trend will also affect Polish enterprises. Logistics 4.0 requires ease of access, quick information processing, security, and, most importantly, all of this in one place.

Furthermore authors will extend survey in order to gain data adequate for statistical analysis. Companies included in research will be evaluated based on L4MM (Logistics 4.0 maturity model) developed by Oleśków-Szłapka and Stachowiak (Oleśków-Szłapka, Stachowiak, 2019). The L4MM matrix allows an organization to gain insight into the current situation of its processes, and how it should pursue the desirable situation (i.e. a higher maturity level). Moreover authors will propose a maturity roadmap – steps to facilitate the implementation of a logistics 4.0 tools.

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