Identification of Logistics 4.0 Maturity Levels in Polish Companies—Framework of the Model and Preliminary Research

Aglaya Batz, Joanna Oleśków-Szłapka, Agnieszka Stachowiak, Grzegorz Pawłowski and Katarzyna Maruszewska

Abstract The paper describes maturity model that have been developed in order to assess Logistics 4.0 level. The model is elaborated on the basis of literature review with respect to Logistics 4.0 and maturity models. Its objective is to propose measures that exhibit what solutions are recommended for companies as well as how they can improve their actual state of Logistics 4.0. This paper presents the actual review of literature referred to Logistics 4.0, Internet of Things as well as maturity models. Based on the aforementioned backgrounds, the novelty of proposed model is confirmed. The proposed model distinguishes three main dimensions to be assessed in terms of Logistics 4.0: management, flow of materials, and flow of information. Each dimension comprises particular identified areas such as degree of automation, degree of robotization, integration of value chains, data capturing and usage, the scope of autonomous decisions, and the others. The findings from survey enable classification of companies and assessment of their Logistics 4.0 maturity in each dimension. Furthermore, the authors distinguish five maturity levels: Ignoring, Defining, Adopting, Managing, and Integrated (Oleśków-Szłapka and Stachowiak in Intelligent systems in production engineering and maintenance. Springer, pp 771–781, 2016). The L4MM matrix makes possible a complex overview of the whole processes and finally gives guidelines on how to search for a higher maturity level. The preliminary research has been done within logistics companies and based on the conducted survey, it was possible to assess what is actual knowledge and implementation of Logistics 4.0 tools. The characteristics and areas of the model defined

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enable the assessment of maturity levels within companies providing Logistics services (transport and warehouses) in Poland. Identification of logistics maturity of companies will contribute data for analyzing correlations between the maturity level of a company, and its competitive position, size, development dynamics, number of services offered, structure of capital, and level of internationalization of operations (Oleśków-Szłapka and Stachowiak in Intelligent systems in production engineering and maintenance. Springer, pp 771–781, 2016). The model proposed by the authors will enhance static logistics maturity models adding to them a dynamic aspect.

Keywords Logistics 4.0 · Maturity model · Maturity levels · Logistics services

1 Introduction

In line with the World Economic Forum (Lanng 2017) by 2025, the whole global supply chain will mellow and develop into the network of interconnected companies, processes, and data flows that will support new business designs and models. The industrial Internet will help bring disparate processes from procurement through manufacturing to final delivery, under greater control and visibility, which is crucial for the manufacturing of high-individualized products and services (Oleśków-Szłapka and Lubiński 2016; Oleśków-Szłapka and Stachowiak 2018). The requirements for customized items are growing, thus, the logistics (inbound and outbound) has to adjust to this new dynamic and modifying environment and it cannot be organized by simple planning and control practices (Bowersox et al. 2000; Premm and Kirn 2015; Grzybowska and Lupicka 2017). The solution to enable the shift is called Logistics 4.0 and is inspired and based on the concept of Industry 4.0.

In global economy, in dynamic market environment, meeting customer expectations is, on the one hand, a key aspect of the business, and on the other hand, a constantly increasing challenge. Considering production, the solution that allows companies to cope with the challenge is Industry 4.0—a concept that changes the contemporary manufacturing processes and enterprises. Nevertheless, realization of production processes is impossible without logistics support, which enables efficient and effective implementation of material and information flows. Industry 4.0 elements related to the management of materials and information flow integrating complex global supply networks form a separate solution, referred to as Logistics 4.0, emphasizing the importance of this area. Logistics 4.0 is a set of solutions aimed at improving logistics processes by avoiding errors and disruptions in transport and storage processes, thanks to continuous data exchange between logistic system stakeholders. Hence, Logistics 4.0 is not only about replacing human work with machines and robots, but above all, about effective information exchange across the entire supply network.

Implementation of Logistics 4.0 solutions, so-called “intelligent logistics” seems to be crucial today for the effective and efficient functioning of companies providing logistic services. Hence, the choice of Logistics 4.0 as the subject of the research—on

the one hand to recognize the scope of Logistics 4.0 and identify a set of solutions constituting its essence, diagnose the implementation level of these solutions in companies providing logistics services in Poland, defining the condition of the industry, and on the other hand to determine the factors affecting the implementation these solutions and the consequences of this implementation and finally to develop a model showing causal relations of the implementation of solutions in the field of Logistics 4.0 and subsequent levels of maturity (improvement) in this area. The implementation of advanced solutions is, however, a gradual process that requires time and commitment on the road to excellence, hence the research aims to *develop a model covering subsequent levels of logistic maturity of enterprises, showing the determinants, and consequences of implementing solutions in the field of Logistics 4.0 and thus indicating the path of improvement in this matter.*

2 Related Work

In the available literature review, there can be found numerous examples of maturity models for business processes, as well as Industry 4.0 (Borenstein et al. 2011; Bowersox et al. 2000; Bubner et al. 2014; Caloghirou et al. 2004).

A thorough literature review shows that there is a significant research gap in the field of Logistics 4.0 (Camisón and Forés 2010). Logistics 4.0 definitions are imprecise as the concept is not consistent, *hence the need to develop coherent theoretical approach*. Publications on the subject deal with the data flow management and integration of decentralized complex systems (Grzybowska and Kovacs 2014; Barreto et al. 2017; Czaja 2016; Glistau and Machado 2018; Hompel and Kerner 2015; Jeschke 2016; Maslarić et al. 2016; Strandhagen et al. 2017; Szymańska et al. 2017; Timm and Lorig 2015; Wang 2016; Witkowski 2016; Wróbel-Lachowska et al. 2018a, b; Zentgraf 2017).

Logistics 4.0 is described in the reports by research centers and logistics service providers (DHL 2015; Dussmann Group 2016; Fraunhoffer 2016).

Hence, the authors decided to develop their own maturity model to complete the existing gap. The model relies on assumptions that make possible either assessing Logistics 4.0 actual state or define a roadmap for further steps in terms of three key domains: Management, Material Flows, and Information Flows. L4MM is elaborated based on the analysis of current literature items.

The literature search on Logistics 4.0 publications in Scopus and Web of Science databases gave the feedback presented in the diagram (Fig. 1).

The search proves that the number of references for "Logistics 4.0" is small but, on the other hand, it is still increasing. Therefore, this research domain has without doubt big potential. The total number of references comprises press material and professional trade publications.

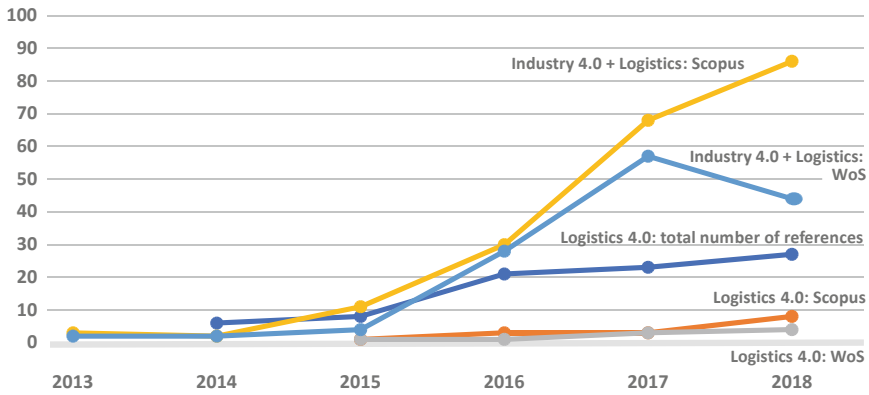

Fig. 1 The number of publications per year referring to Logistics 4.0 and "Industry 4.0 + Logistics". *Source* Own work based on Scopus and WoS

Apart from publications devoted directly to "Logistics 4.0", there are also selected works on the more general subject of "Industry 4.0" where some issues connected with logistics are discussed. The diagram presents scientific papers indexed by Scopus and by WoS. The full list of indexed papers with their brief description is presented in Table 1.

The biggest challenge for companies is to classify, comprehend, and appropriate use of the available knowledge and thus achieving a competitive advantage (Lev et al. 2008; Liao et al. 2007; Lichtenthaler 2009; Grzybowska et al. 2014). Considering the abovementioned issues, the authors of the study decided to research on the *absorptive capacity of companies* striving for implementation of advanced solutions.

Another important term within conducted research by the authors is maturity. Maturity can be defined as "the state of being complete, perfect or ready" (Karkkainen et al. 2014; Mettler 2009). Maturity is referred to growth, as in Maier et al. (2012), which defines maturity as a state of growth and development.

The subject of maturity is in the field of interest of scientists for a long time. One of the first scientists dealing with this subject was Crosby who in 1979 developed a quality management model with five levels of maturity (Kwak and Ibss 2002; Maslaric et al. 2016; Timm and Lorig 2015).

Maturity models are actually distributed and applied in Project Management (PM), Knowledge Management, Information Systems, and Supply Chain Management (Banyani and Then 2010; Vaidyanathan and Howell 2007).

Plenty of researchers also have defined Industry 4.0 maturity models (Cooke-Davies 2004; Fraser et al. 2002; Lahrmann et al. 2011; Rosenthal 1978; Schumacher et al. 2016; Wang et al. 2016), but the authors did not recognize any maturity models referring specifically to Logistics 4.0.

Thus, the authors proposed their own model of maturity believing that it would bring added value to existing literature and research in the field of logistics maturity of companies.

Table 1 Literature on Logistics 4.0 review

Authors	Title, Year, Journal	The scope of interest
Glistau, E., Machado, N.I.C. (2018)	Industry 4.0, logistics 4.0 and materials—Chances and solutions (2018), Materials Science Forum, 919, pp. 307–314	The paper defines the terms of Industry 4.0 and Logistics 4.0. It also outlines the big opportunities of this development. The paper provides an overview of important solutions and tools in this domain
Wrobel-Lachowska, M., Wisniewski, Z., Polak-Sopinska, A. (2018a)	The role of the lifelong learning in logistics 4.0 (2018), Advances in Intelligent Systems and Computing, 596, pp. 402–409	This paper describes the role of the lifelong learning in the Logistics 4.0. The paper shows the key competences needed by all groups of employees
Wrobel-Lachowska, M., Wisniewski, Z., Polak-Sopinska, A., Lachowski, R. (2018b)	ICT in logistics as a challenge for mature workers. Knowledge management role in information society (2018), Advances in Intelligent Systems and Computing, 605, pp. 171–178	This paper analyses the scope of ICT competencies required by employees—logisticians Conclusions of the study are the result of multi-faceted research conducted in 2012–2016 using grounded theory methodology
Strandhagen, J.O., Vallandingham, L.R., Fragapane, G., Strandhagen, J.W., Stangeland, A.B.H., Sharma, N. (2017)	Logistics 4.0 and emerging sustainable business models (2017), Advances in Manufacturing, 5 (4), pp. 359–369	This paper addresses challenges such as data flow, automated solutions, and real-time big data analysis. It proposes a model to understand and relate the different elements of business operations. The paper links the elements of sustainability, business models, Industry 4.0 and Logistics 4.0
Barreto, L., Amaral, A., Pereira, T. (2017)	Industry 4.0 implications in logistics: an overview (2017), Proceedia Manufacturing, 13, pp. 1245–1252	This paper presents some considerations on how to enable organizations to be efficient, and fully operational in Logistics 4.0 context
Hompel, M., Kerner, S. (2015)	Logistics 4.0: The vision of the Internet of Autonomous things [Logistik 4.0: Die Vision vom Internet der autonomen Dinge] (2015), Informatik-Spektrum, 38(3), pp. 176–182	This article attempts to elucidate some key aspects of ongoing development and convey a view of "Logistics 4.0"

(continued)

Table 1 (continued)

Authors	Title, Year, Journal	The scope of interest
Wang K. (2016)	Logistics 4.0—New challenges and opportunities (2016), Conference: 6th International Workshop of Advanced Manufacturing and Automation	This paper identifies the term "Logistics 4.0", tries to define it as well as make a list of its fundamental technical elements. It also deals with the question—how to address proactively challenges of Industry 4.0 revolution
Maslarić M., Nikoličić S., Mirčetić D. (2016)	Logistics Response to the Industry 4.0: the Physical Internet (2016), Open Eng. 2016; 6:511–517	This paper provides an overview of the different views in the field of Physical Internet trying to identify the biggest challenges (technological, societal, business paradigm) of proposed new logistics paradigm as a practical solution in supporting Industry 4.0
Timm I., Lorig F. (2015)	Logistics 4.0—a challenge for simulation (2015) Yilmaz L., Chan W.K.V., Moon I., Roeder T.M.K., Macal C. & Rossetti D. (Eds.), Proceedings of the 2015 Winter Simulation Conference, IEEE Press Piscataway, NJ, USA, pp. 3118–3119	The value of this paper can be summarized as follows: Integrating autonomous decision makers into conventional material flow simulation, as required for addressing the requirements of Logistics 4.0, results in increasing complexity

Source Own work based on Scopus and WoS

3 Proposed Work

The authors start from *literature analysis* in order to identify the elements of the Logistics 4.0 concept, its specific solutions, and tools. This stage will allow to develop a framework model of the logistics maturity of enterprises.

The next stage of the research will include *research on enterprises* carried out with the use of questionnaires (CAWI, CATI) addressed to enterprises providing logistics services in Poland, i.e., assigned to the H section of the Polish Business Activity Classification. The questionnaire will include questions about the knowledge of the solutions and scope of their application, as well as about the intentions to implement solutions and tools from the scope of Logistics 4.0. The results of the survey will allow to determine the degree of absorption of solutions from the scope of Logistics 4.0 and to determine the level of logistic maturity in the context of Logistics

4.0 in the population interview. The results of the research will be compared with the published research results on the implementation of contemporary solutions in companies providing logistic services around the world.

The third stage of the research will include the *analysis of correlations between* the identified absorptive capacity and the level of logistic maturity of companies providing logistic services, and their competitive position, size, development dynamics, offer range, internationalization of capital, and the degree of internationalization of business activity. This stage of the research will include enterprises included in industry rankings (TSL Ranking).

On the basis of the research conducted, conclusions will be drawn regarding the condition of the industry and the relationship between the abovementioned characteristics of individual companies, leading to identification of *causal relations* showing the dynamics of the system, which undoubtedly the company providing logistic services is, functioning, and the relationship between the enterprise's characteristics, implemented elements of the Logistics 4.0 concept and its competitive position. The feedback model that illustrates the behavior of the company providing logistic services will complement the static concept of logistic maturity levels in the field of Logistics 4.0, leading to the research goal realization.

The theoretical stage of the research based on review and analysis of publications on Logistics 4.0 will allow to develop an original maturity model, showing the evolution of logistic solutions and the scope of their application, as well as defining the reference level of logistic excellence. The Logistics 4.0 Maturity Model will contribute to the development of the discipline.

The research carried out among companies providing logistics services will help to gain knowledge about the level and scope of implementation of solutions of the Logistics 4.0 concept in Polish enterprises. It will also deal with the issue of absorbing knowledge in the field of Logistics 4.0 and will allow to determine absorptive capacity level, showing the ability to absorb knowledge and the potential of enterprises in the area of acquiring and implementing contemporary, intelligent and autonomous solutions and technologies. The diagnosis of the industry will complement the knowledge about the condition of enterprises providing logistics services in Poland with aspects related to the digitization and application of modern technologies. The results will help to validate the model and if necessary correct it based on the feedback from industry. Moreover, the data obtained and the conclusions drawn from them will be compared with the available materials describing solutions implemented other countries in this respect. The analysis will contribute to civilization development as it reflects the shift of paradigms, from traditional taylorism to contemporary, information-based industries, and societies (Zawadzka et al. 2010).

The analysis of the relations between the Logistics 4.0 maturity level and company's market position, its size, development dynamics, range of services offered, structure of capital, and level of internationalization of operations will lead the authors of the proposal to develop a cause-and-effect model in the form of a causal loop showing the relationships between the determinants of the decision to implement solutions in the field of Logistics 4.0 and the consequences of these decisions. Presenting the

dynamics of system behavior, the model will be a complement to the static model of logistic maturity, contributing to development of logistics as a discipline.

The research process planned includes the following actions:

A.1 Developing framework *Logistics 4.0 Maturity Model (L4MM)* based on literature review (objectives 1, 2, and 3).
A.2 Research on *absorptive capacity* of companies providing logistics services in Poland (objective 4).
A.3 *Assessment of Logistics 4.0 maturity* of companies providing logistics services in Poland (objective 5).
A.4 Analysis of *correlations* between the level of Logistics 4.0 maturity and company's competitive position, its size, development dynamics, range of services offered, internationalization of capital, and level of internationalization of operations (objective 6).
A.5 Developing dynamic model of behavior of a company providing logistic services based on relations between the identified level of maturity and company's competitive position, its size, development dynamics, range of services offered, internationalization of capital, and level of internationalization of operations (objectives 7 and 8).

And dissemination of project results in scientific papers (A.6) and a monograph entitled: *Logistics 4.0: challenge and opportunity* (A.7). The actions listed above will be continuously adding value to the project and the discipline, as presented in Fig. 2.

In order to define Logistics 4.0 Maturity Model based on the level of absorption of Logistics 4.0 solutions in companies providing logistics services, the authors have carried aforementioned literature survey in the scope of Logistics 4.0 domain. The next step was a pilot study on Logistics 4.0 among companies providing logistics services. Based on these research stages, it was possible to develop Logistics 4.0 Maturity Model. The Logistics 4.0 Model was used to select classification criteria.

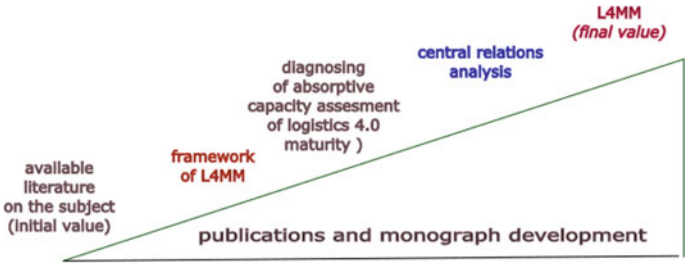

Fig. 2 The increase in value of the project. *Source* Own work

Table 2 Logistics 4.0 dimensions and areas of evaluation

Logistics 4.0 dimensions	Areas of evaluation
Management	Ongoing and planned investments, innovations management, integration of value chains
Material flow	Automation and robotization implemented in warehouse and inbound logistics, implementation of solutions such as Internet of Things, 3D printing, 3D scanning, advanced materials, augmented reality
Information flow	Implementation of solutions such as data-driven services, Big data (data capturing and usage), RFID, RTLS (real-time locating systems), IT systems (ERP, WMS, cloud systems)

Source Own work

The classification is based on the three aspects of logistics[1] including: (1) management (2) material flow, (3) information flow, which becomes naturally three dimensions for Logistics 4.0 solutions, as presented in Table 2.

The three dimensions of the model can be used to assess the maturity and awareness of managers concerning solutions within Logistics 4.0 implemented in a company. Based on the number and scope of solutions implemented, the conclusion on present Logistics 4.0 status can be drawn. Moreover, based on the gaps identified, recommendation concerning the Logistics 4.0 status improvement, and maturity increase, can be defined, making the model useful not only in terms of diagnosis, but also in terms of management.

According to the authors, the term "Logistics 4.0 maturity" reflects the level of Logistics 4.0 solutions implementation, the less solutions implemented, the lower Logistics 4.0 maturity level. The authors defined five maturity levels: Ignoring, Defining, Adopting, Managing, and Integrated. In Fig. 3 maturity levels are confronted with Logistics 4.0 dimensions.

The assessment of maturity level is based on analysis of solutions implemented within Logistics 4.0 dimensions. The authors decided that the most important determinant of maturity and dimension of logistics is management, and if integration level is coherent with at least one form of the flow (either material or information) the maturity level the two represent is the one that characterizes the company best, assuming in the same time that the latter dimension is soon to be upgraded. The gap identified and the steps to be taken to fill it in should be presented to the company, representing the general guidelines for reaching the next level of maturity.

[1]According to Council of Supply Chain Management Professionals (previously the Council of Logistics Management) logistics is the process of planning, implementing and controlling (altogether referred to as **management)** procedures for the efficient and effective transportation and storage of goods (**material flows**) including services and related information (**information flows**) from the point of origin to the point of consumption for the purpose of conforming to customer requirements and includes inbound, outbound, internal and external movements.

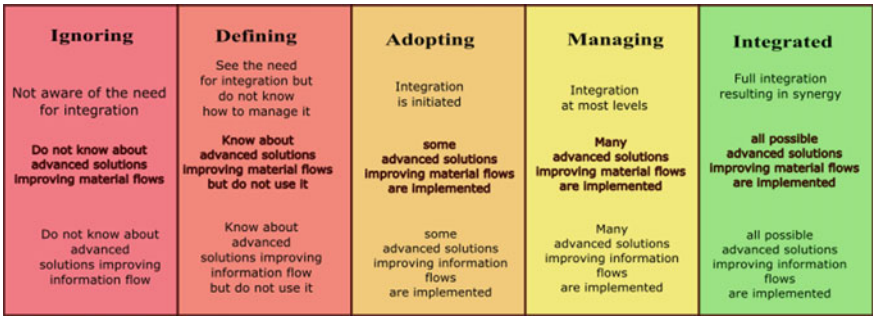

Fig. 3 Logistics 4.0 maturity levels. *Source* Authors' own work

4 Results

The first action taken was the search for the literature on Logistics 4.0 and its results are presented in the application form in the Sect. 2. The search showed a cognitive gap, as the term and the issue of Logistics 4.0 was referred to eight times only. According to the authors' opinion, it is the rationale for realization of there searches recognizing new term in logistics management is interesting and promising field of research.

The second step was the survey among Polish companies providing logistic services. The survey aimed to find out whether the companies know the term Logistics 4.0 and/or use solutions usually referred to as Logistics 4.0 solutions (identified based on the preliminary literature review).

The survey was a direct interview (CAWI—Computer-Assisted Web Interview) distributed among 17 companies. The sample included 17 enterprises (11 enterprises employing more than 250 people, 2 companies employing between 100 and 249 people, 2 2018 companies employing 50–99 people, and 2 companies employing 10–49 people) operating both, in Poland and internationally.

The survey research was being conducted for six weeks, from April, 1 to May 15, 2018. To identify the level of knowledge on Logistics 4.0 and the solutions within it, the respondents were asked whether:

1. they know the terms Logistics 4.0 and Industry 4.0?
2. their warehouse is automated?
3. their handling processes are automated?
4. their data flow and access to information is integrated in real time?
5. they analyze, store and process data with contemporary technologies (i.e., Big Data, Cloud Computing)?
6. they use RTLS in their logistics processes?
7. they know the term Internet of Things and/or Services?

The answers to the questions are presented in Table 3.

Table 3 Results of preliminary survey on Logistics 4.0 solutions

Question 1			
53% responses: never heard of Logistics 4.0 nor Industry 4.0	0% responses: know the concept of Industry 4.0 only	29% responses: know the concept of Logistics 4.0 only	17.5% responses: know the terms Logistics 4.0 and Industry 4.0
Question 2			
70.6% responses: warehouse partially automated	17.6% responses: warehouse not automated	11.8% responses: warehouse fully automated	
Question 3			
82.4% responses: handling operations partially automated	11.8% responses: handling operations not automated	5.9% responses: handling operations fully automated	
Question 4			
88.2% responses: benefit from integrated data flow and access to data in real time	5.9% responses: do not use integrated data flow and access to data in real time	5.9% responses: have no information on integrated data flow and access to data in real time	
Question 5			
52.9% responses: analyze. store and process data with contemporary technologies	23.6% responses: do not analyze. store or process data with contemporary technologies	23.6% responses: have no information on analyzing. storing or processing data with contemporary technologies	
Question 6			
17.6% of responses: use RTLS in their logistics processes	29.4% of responses: plans to use RTLS in their logistics processes	47.1% of responses: do not use RTLS in their logistics processes	5.9% of responses: have no information of using RTLS in their logistics processes
Question 7			
41.2% of responses: know the term IoT/IoS	47.1% of responses: do not know the term IoT/IoS	11.8% of responses: have no information whether they know the term IoT/IoS	

The highlighted boxes represent positive answers, meaning that the respondents know and implement the tools and methods within Logistics 4.0, disregarding whether they know the term itself. Nevertheless, the awareness of the Industry 4.0 (including some of the tools and methods within Logistics 4.0 range) and Logistics 4.0 is quite high (47% of respondents), proving that companies providing logistics services see the potential of contemporary solutions and are willing to benefit from them. The trend is even more visible among USA companies, where the potential of contemporary solutions such as IoT is recognized by 84% of companies (HP Report 2018). Referring the conclusion to the limited number of valuable literature sources proves that there is a significant gap and the need for dissemination of knowledge and research on the field, and that achieving the objectives of the research could contribute to both, science and economy development.

5 Conclusion

The goal and the requirement of contemporary economy are both agility and ability to learn—thanks to the connected digitization and solutions broadly referred to as Industry 4.0 and Logistics 4.0. The research carried out by the Ministry of Development and Siemens in the years 2016–2017 collected as part of the Smart Industry Polska Report (2018) prove that many enterprises have little knowledge about the characteristics of these concepts, the solutions they propose, as well as the benefits of using the latest methods of process digitization. The pilot research conducted by the author among polish logistics companies confirms the conclusion presented in the Smart Industry Polska Report.

The diagnosis is important and valuable when it becomes the basis for improving actions—thanks to knowing where companies are today, they can define their future goals and steps required to reach it. Thus, assessing Logistics 4.0 maturity will help visualize companies' path forward and set priorities for process improvement. Based on preliminary results from survey conducted by the authors in logistics and manufacturing companies from among the surveyed companies, only 33% know the term Logistics 4.0, 50% of companies know the concept of big data, and 83% companies want to apply automated data exchange systems and are willing to automate their processes as well as introduce partial robotization of the processes. The diagnosis shows that there is a need for education and space for improvement.

Consequently, the diagnosis of logistics maturity of companies will enable assessment of the logistics sector condition in Poland and will provide data for analyzing correlation between the maturity level of a company, and its competitive position, size, development dynamics, range of services offered, structure of capital, and level of internationalization of operations. The analysis is expected to be on the basis of general conclusion and development of original system dynamics model presenting behavior of a company providing logistics services in the form of causal loop. The model will add dynamic layer to the static concept of logistics maturity levels and contribute to the development of management science.

6 Future Work

The objective of the research will be the diagnosis of absorptive capacity of Polish companies providing logistic services. Based on the developed survey questionnaire, it will be possible to identify absorptive capacity of companies providing logistics services in Poland and define their Logistics 4.0 Maturity level. Furthermore, mapping the survey results on the developed Logistics 4.0 Maturity Model makes possible to assess logistics maturity of companies (individual, average, minimum, maximum, and dominant). Then, Logistics 4.0 maturity of Polish companies providing logistics services will be compared with the correspondent data on companies representing the same industry but operating on different markets. At this stage, the authors plan to apply statistical analysis: multidimensional comparative analysis using basics statistics and Multiple Correspondence Analysis (MCA) to detect and represent similarity and diversity across countries.

The next stage will be statistical analysis: (1) chi-square independence test to verify the relation between the level of maturity and factors indicated (competitive position, size, development dynamics, range of services offered, internationalization of capital, and level of internationalization of operations) and assumption of selected measures of association adjusted to nominal and ordinal data (Pearson's contingency coefficient C, Cramér's V, Gamma, Somers' d, Kendall's tau-b, and nonparametric Spearman's rank-order correlation coefficient) with testing correlation significance using the data from published reports ranking the companies providing logistics services; (2) Multi-criteria Decision Analysis (MCDA) to analyze the importance and the relations among the main determinants of Logistic 4.0 solutions and rank data; using the technique based on the Decision-Making Trial and Evaluation Laboratory (DEMATEL) method to build the structural model with position and relations among the determinants showed at the Impact-Digraph-Map. Finally, the authors want to develop the causal loop with feedbacks between the determinants and consequences of Logistics 4.0 solutions implementation and combine Logistics 4.0 Maturity Model with dynamic model of behavior of a company providing logistic services based on feedbacks between the level of maturity and company's competitive position, size, development dynamics, range of services offered, internationalization of capital, and level of internationalization of operations.

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