

CONCEPTUAL ASPECTS OF EVALUATION OF THE COMPANY'S E-LOGISTICS DEVELOPMENT

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Abstract Paper media in business are progressively replaced by electronic, and the time of receiving information is reduced. With the use of certain information and communication tools and technologies information in electronic form becomes available to all the interested parties almost instantly. In particular, due to this there occurs a need for effective management of information in electronic form (electronic information flows) in the company. This can be done within e-logistics (e-logistics), which is a subsystem of information logistics. This article investigates the term "e-logistics" and shows that at the moment there is no generally accepted definition. It is proposed to distinguish the following main constituents in the term "e-logistics": "Internet", "Delivery", "Information and communication tools and technologies". In this paper, the author shows the layout of different definitions in the triangle of the concept of "e-logistics" regarding its main components. The article proposes the approach to the evaluation of the company's e-logistics development, which can be used in different enterprises of different areas. It is offered to evaluate the level of the company's e-logistics with the corresponding complex indicator, which in itself accumulates information on the level of implementation of information and communication tools and technologies in the logistics system of the company. The proposed complex indicator allows the company management to receive a single number which reflects the level of development of e-logistics in the company and takes into account the number of aspects of its functioning.

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1. INTRODUCTION

Successful business is not possible without the use of a number of innovations. In particular, the continuous development of information and communication tools and technologies leads to permanent changes in existing and the introduction of new approaches and methods of production, the occurrence of new characteristics of supply chain interactions, reorganization of the management structure of various logistics systems and so on. For example, on the physical level the processes of delivery of the products to consumers have not changed over the past decade, but the information component of such processes varies from year to year, particularly paper media are increasingly replaced by electronic media, and time for receiving any information is reduced. The company's proper organization of information exchange with the contractors allows it to increase its own competitiveness.

An average enterprise can be considered as micro-level logistics system consisting of purchasing, sales, marketing, warehousing, information, financial, service, transport subsystems and subsystem of inventory management. One of the important places in the work of any company is occupied by information logistics, which is a subsystem of management and organization of information flows in general. This type of logistics is currently very important because there is a need to combine different types of information flows (oral messages, documents in paper and electronic form) at different levels of management (within the company, between the company and customers, between the company and other organizations including delivery services). It is within the information logistics of the company that its e-logistics operates.

2. E-LOGISTICS: DEFINITION OF THE CONCEPT AND ITS MAIN CONSTITUENTS

Today there are many various definitions of "e-logistics", some of which are listed in Table 1. Analysis of the existing definitions of "e-logistics" showed that all the words found in them can be placed in the following areas (which we will consider the main components in the formation of the concept "e-logistics"): 1. "Delivery"; 2. "Flows"; 3. "Information and communication tools and technologies" (Fig. 1).

Table 1 Definitions of e-logistics

#	Author	Definition
1	Groznik Ales (2005)	E-logistics is wide-ranging topic related to supply chain integration that has effect of eliminating intermediaries (such as wholesaler or retailers) and also fosters the emergence of new players like logisticians, whose role is to adapt traditional logistics chains to take into account the requirements of e-business.
2	Bukreev M., (2006)	E-logistics is combination of certain functions of the process of management of the logistics chain which are connected with electronic information flows.
3	Chukhrai N.I., Hirna O.B., (2008)	The essence of e-logistics is the effective management of information and cooperation between all participants of the supply chain based on rapid and detailed information flow transmission from the retailers who transfer data in the agreed information standard to the supplier - producer of raw materials.
4	Zhang L.-J. at al. (2001)	E-logistics is defined to be the mechanism of automating logistics processes and providing an integrated, end-to-end fulfillment and supply chain management services to the players of logistics processes.
5	Plączek E., (2010)	E-logistics consists in the use of modern information technology solutions in particular the Internet to coordinate and integrate logistics actions by all supply chain links, leading to delivery of the products from the upper (supply) to the lower (demand) segment in the supply chain (from manufacturers to retailers or consumers).
6	Gunasekaran A., Ngai W. T. E., Cheng T. C. E., (2007)	E-Logistics is an logistics community network consisting of third-party logistics service providers including warehousing and transportation networks with suitable information technologies such as EDI, the Internet, wireless and mobile communication technologies, WWW and Radio Frequency Identification (RFID) with the objective of providing one-stop value-added services to customers. E-logistics is Internet-enabled logistics.
7	Palonka J., (2008)	E-logistics is coordinated and integration logistics actions with the use of Internet.
8	Auramo J., Aminoff A., Punakivi M., (2002)	E-logistics simply means processes necessary to transfer the goods sold over the internet to the customers.
9	Valkova N.V., (2013)	E-logistics is an integrated system of optimization of flow processes based on Internet technology at all levels.
10	Kisperska-Moron, D., Krzyaniak, S. (2009)	E-logistics means the use of systems, informatics tools and the Internet as communication medium to service logistic processes.
11	Bolseth S., Solem O., (2003)	E-logistics is holistic solutions integrating information- and communication technology (ICT) and logistics in the new strategic landscape opening up. E-logistics can also be seen as the physical fulfillment of the new transaction possibilities created through e-business.
12	Viswanadham N., Gaonkar R., (2001)	E-logistics is a dynamic set of communication, computing, and collaborative technologies that transform key logistical processes to be customer centric, by sharing data, knowledge and information with the supply chain partners.

<p>13 Author's definition</p>	<p>E-logistics is a management subsystem for forecasting, planning, decision making, coordination and control of electronic information flows through information and communication systems and technologies (especially the Internet) with application of mathematical methods and models (in agreement with the material, service, and financial flows and the flow of intellectual and labor resources) at the macro-, meso-, microeconomical levels to facilitate delivery of the necessary product in the right quantity, of good quality and at an agreed price, at an agreed place and time to the relevant consumer.</p>
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Schematically, the concept “e-logistics” is a triangle the vertices of which are its component parts. By “Delivery” we will mean the possible ways of flowing of various logistics flows from source of generation to their consumers. E-logistics should facilitate the effective flow of these flows. We distinguish separate component of “Flows” in order to show that e-logistics primarily works with electronic information flows, as for other flows, it assists in their flow. The component “Information and communication systems and technologies” shows the use of various innovations which can be grouped as follows: Internet and mobile communications; Information integration systems; Electronic data exchange; Products barcoding etc.

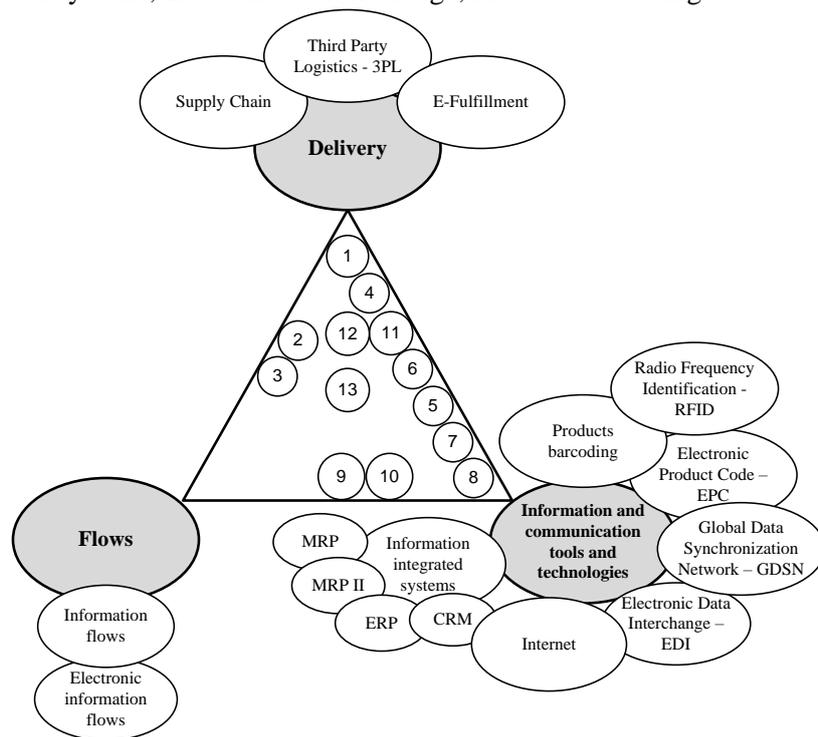


Fig. 1 The scheme of location of the definitions of different authors (from Table 1) in the triangle of the concept of “e-logistics” regarding its main components, developed by author

In Fig. 1. the numbers in circles correspond to the sequence numbers of definitions from Table 1. Location of circle with a number displays the place of the definition in the triangle of "e-logistics" concept. The closer is a specific definition to the top of the triangle, to the greater extent is this component reflected in the definition. Analyzing the scheme in Fig. 1. we can draw a conclusion that the majority of definitions of "e-logistics" from Table 1 combine two components: "Information and communication tools and technologies" and "Delivery". The "Flows" component is in fact ignored in the definitions, which in our view is not quite correct.

3. EVALUATION OF THE LEVEL OF THE COMPANY'S E-LOGISTICS DEVELOPMENT

It is offered to evaluate the level of the company's e-logistics development by the corresponding indicator. This should be a complex indicator, which in itself accumulates information on the level of implementation of information and communication tools and technologies in the processes of the company's logistics system. In our view, the concept of e-logistics can be attributed not only to e-business enterprises, but also to the common traditional production, industrial-commercial or commercial enterprises. Certainly, the companies vary by their organizational structure and the system of business processes. However, in terms of the functioning of e-logistics at such enterprises we can identify both common and identical as well as specific characteristics. For example, a national online store (that delivers goods to customers within just one country) and transnational corporation are different in their organizational structure and system of business processes, but some elements of their e-logistics may be quite common.

According to our approach to evaluation of the level of development of the company's e-logistics we propose to divide information and communication tools and technologies into the following categories:

1. Internet;
2. documents management (Information integrated systems, Electronic Data Interchange – EDI, Global Data Synchronization Network – GDSN etc.);
3. products identification (Electronic Product Code – EPC, Radio Frequency Identification – RFID, products barcoding etc.).

3.1. Internet

Internet on the one hand is a physical network, on the other hand – a complex of different information from around the world. One can connect to the Internet through different wired, optical and wireless technologies. Using the Internet one

can unite all participants of the supply chain into a single information and communication network regardless of physical location. Exchange of information among them may occur almost instantly. The speed and reliability of Internet connection and the number of working stations that have connection are preconditions for the emergence of e-logistics at the enterprise. The larger these indicators are the better. Especially, it is critical when using cloud technologies at the enterprise.

The absolute value of the speed of Internet connection (Mbit/s) can be defined by standard means of the operating system on the computer and using special Internet sites. For relative comparison of the absolute value of this speed we can select, for example, the index of data transfer rate Web Index, that is designed and produced by the World Wide Web Foundation at various levels (country, part of the world, or the world at a whole).

Internet speed is an indicator with positive ingredient (i.e. we aim to maximize it), therefore it is relevant to use natural normalization by the formula:

$$v_{norm} = \frac{v - v_{min}}{v_{max} - v_{min}}$$

where v is specific speed of the Internet connection at the enterprise (Mbit/s); v_{max} , v_{min} are the maximum and minimum Internet connection speed, ex. in the world (Mbit/s) for the studied period; v_{norm} is a normalized value of speed equal from 0 to 1. The closer v_{norm} is to 1, the better.

The quality of Internet connections can, for example, be calculated as the ratio of time when there was no connection, and the working hours of the enterprise for the studied period (day, month, year, etc.). The value of this ratio will be equal from 0 to 1. The closer the value of this ratio to 0, the better the connection and vice versa.

The ratio of the number of the working stations connected to the Internet to the total number of jobs in the company will show the degree of Internet penetration at the enterprise. The value of this ratio will be equal from 0 to 1. Let us assume that Internet penetration is absolute when the ratio is 1, and decreases when the ration gets the closer to 0.

3.2. Documents management

Information integrated systems. In any modern company there is information system, through which its operating activities are carried out. One of the main tasks of this system is to provide comprehensive and timely information to the relevant person for performing certain actions and / or making decisions etc. If we regard, for example, an Internet store, its integrated information system unites its website and mobile application (which are designed primarily for communication with the buyer) and its information system (serving the office and warehouse and provides interaction among departments inside the store and with its contractors, etc.).

Due to this information system generation, promotion, reception and processing of electronic information flows is carried out. Investigation of the efficiency of an integrated information system is quite a challenge on the one hand, and on the other – in fact, all up-to-date enterprise management systems include in their configurations the standard subsystems and modules by default. Therefore, it seems that there is nothing to compare. However, we consider it appropriate to pay attention to the availability and performance of new modules and subsystems in the context of the company's e-logistics. For the Internet store these can be the following subsystems and modules: 1) associated with the completion of the order by the buyer on the site independently or in mobile application (choice of product and adding it to the cart, ordering, payment, order confirmation, etc.); 2) connected with the exchange of information with third-party delivery services and distributors (producers), etc.

It is offered to perform the evaluation involving the experts and corresponding mathematical tools of their suggestions procession. For example, the experts receive a questionnaire in which the existing modules of the information system are pointed out and the question is asked as for functionality of such modules in the context of e-logistics. Experts put up their own evaluation. Such experts' evaluation may be carried out through verbal and numeric scale which contains substantial (verbal) description of the specified gradations and corresponding to these gradations numeric values: very high level (0,8 – 1,0); high level (0,64 – 0,8); medium level (0,37 – 0,64); low (0,2 – 0,37); very low level (0,0 – 0,2). Then one can, for example, calculate the estimate for each of the modules, as well as for information integration system as a whole as the arithmetic average or weighted average in order to use means of fuzzy sets and fuzzy logic.

Electronic Data Interchange – EDI. The use of EDI is called to reduce to a minimum a number of errors in the exchange of information between the participants of the logistic chain. So in terms of evaluation there may be 0 (a scheme of data interchange by the system EDI is not implemented in the) or 1 (in case the EDI is applied).

Global Data Synchronization Network – GDSN. Databases of various participants of the logistics supply chain can be different and not connected with each other. Therefore, there is a need to synchronize these databases. This can be done by using the GDSN. Due to this the movement of electronic information flow is accelerated and the number of errors in the presentation of information in databases is reduced. In terms of evaluation here it may be 0 (the company has not implemented GDSN), or 1 (when using GDSN).

3.3. Products identification

Among the electronic information flows there are those that are directly associated with the products. In particular, the products can move in the material flow

in a single form (retail sales) and in group form (for example, from the producer to the distributor or wholesalers). Using different methods of products identification allows speeding up both material and electronic information flows and diminishing the number of errors in the data compared to manual input of information. Today various methods of identification products are used among which the most common are barcoding, Electronic Product Code – EPC, Radio Frequency Identification – RFID. Each of these types of identification we will evaluate as 1 (if applied) or 0 (otherwise).

If we sum up all the received evaluations of the above mentioned categories of information and communication tools and technologies in the context of their impact on e-logistics of the company, we get the following:

1. “Internet” – from 0 to 3;
2. “Documents flow” – from 0 to 3;
3. “Identification of products” – from 0 to 3.

Overall evaluation will take values from 0 to 9, where 0 would mean no e-logistics in the enterprise, and 9 - a very high level. The closer the value is to 9, the higher the level of e-logistics of the enterprise is.

If we enter some weights that reflect the importance of their contribution to the development of the company’s e-logistics, the overall figure will take values from 0 to some maximum possible. For example, if we assume that each of the categories of information and communication tools and technologies affects the state of the company’s e-logistics, and we take the coefficient 0.33333... (sum of all coefficients equal to 1), the total score will range from 0 to 3. In this case 0 would mean there is no e-logistics in the company and 3 - a very high level. The closer the value is to 3, the higher the level of e-logistics is in the company.

Thus, the result is a single number that reflects the level of e-logistics development in the company. This can be used in the management of the company to improve its efficiency.

4. CONCLUSION

The concept of "e-logistics" now is not as commonly used as "e-business" or "e-commerce". However, examining the essence of this concept we can draw a conclusion that the e-logistics as a management subsystem for managing electronic information flows exists now in any company. This is due, in particular, to the wide spread of information and communication tools and technologies not only in everyday life, but also in business. The mentioned in the article list of definitions of the concept “e-logistics” is not comprehensive. However, analyzing these definitions we can get a general idea of the trends in understanding the nature of e-logistics by various academics and practitioners in the world.

The proposed article in the approach to evaluation of the development of the company's e-logistics is new and can be a guide for further research, which is considered appropriate to be conducted in the following areas: 1) the structure of the complex indicator of evaluation of the company's e-logistics development; 2) the processes of evaluation as constituents of the indicator and the indicator as a whole. For the first direction it is necessary to investigate in detail the issue of selecting experts and agreement on their suggestions etc. The second direction is the formation of a set of components of the complex indicator, determining of scales of assessment and weighting coefficients etc.

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