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ORIGINAL PAPER

ANALYSING THE EFFICIENCY OF LOGISTIC ACTIONS IN COMPLEX SUPPLY CHAINS - CONCEPTUAL AND METHODOLOGICAL ASSUMPTIONS OF RESEARCH

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ABSTRACT. **Background:** Efficient management of dispersed and varied structure of supply chains is a complicated process both in terms of organisation and decision making. Merged companies forming groups with integrated capital consolidate to achieve internal coherence, also in the area of logistics. Overcoming differences resulting related to the fact that individual entities employ different rules of operation in carrying out logistic processes and their integration into one efficient system are the most challenging tasks the companies have to face. The purpose of the article is to present a concept of analysis of logistic actions efficiency in complex supply chains.
Material and methods: The results of studies of economic practice in 2016-2017 and literature studies carried out as part of research and optimisation projects prove the insufficient degree of employing the analysis of efficiency of logistic actions in complex supply chains. On the basis of explorations performed, the methodology of studies focused on the analysis of logistic actions' efficiency was developed. The methodology is now the conceptual basis for analysing efficiency in enterprises.
Results: The study resulted in the development of the concept concerning the performance of efficiency analyses focused on logistic actions, the particular elements of which have been verified in terms of their usefulness in economic practice.
Conclusions: Despite numerous references in literature, analysis of logistic actions' efficiency remains insufficiently defined. It makes it difficult to apply it in the economic practice of companies. The present article focuses on describing the concept of applying analysis of efficiency of logistic actions providing for the specific nature of dispersed supply chains.

Key words: supply chain efficiency, dispersed supply chain, decision making process.

INTRODUCTION

As a result of observed intensification of mergers and acquisitions among companies operating in Poland and in Europe, there is an increasing number of entities with complex production ad warehousing structure, which form extensive supply chains. Examples include manufacturers or distributors with a broad network of warehouses to distribute their products to Customers in different locations, and with an extensive base of trade partners, including both suppliers and recipients. Company acquisitions also result in the formation of capital groups, which comprise many subsidiary entities. The groups integrate entities which differ in terms of rules of operation and process organisation, and which are territorially dispersed.

Newly established, complex structures undertake actions to develop and optimise broadly-interpreted logistics: they expand their logistic resources, implement new process management concepts and develop new technologies. It results from the fact that in the recent years, companies' awareness of the

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significance of logistic process management in building competitive advantage has considerably grown. As a consequence, companies seek solutions which will allow them to create efficient and effective logistic structures that will guarantee the satisfaction of customers' needs and bring expected profits. With regard to this fact, economic practice has developed a need concerning assistance in making decisions on the construction of functional logistic structures.

The increasingly complex structure of economic entities causes the growing number and the higher degree of complexity of problems with making decisions concerning the management of logistic processes [Trojanowska et. Al, 2017]. Actions undertaken by companies, aimed at the reduction of costs and the construction of functional logistic structures, encounter a number of difficulties in terms of organisation and management of logistic actions.

THE METHODOLOGY OF SCIENTIFIC RESEARCH RELATED TO ANALYSING EFFICIENCY IN DISPERSED SUPPLY CHAINS

Due to the conceptual nature of the publication, the authors have decided to present the methodology of research on the holistic development of the concept of analysing and evaluating the efficiency of logistic actions taking the specific nature of dispersed supply chains into account.

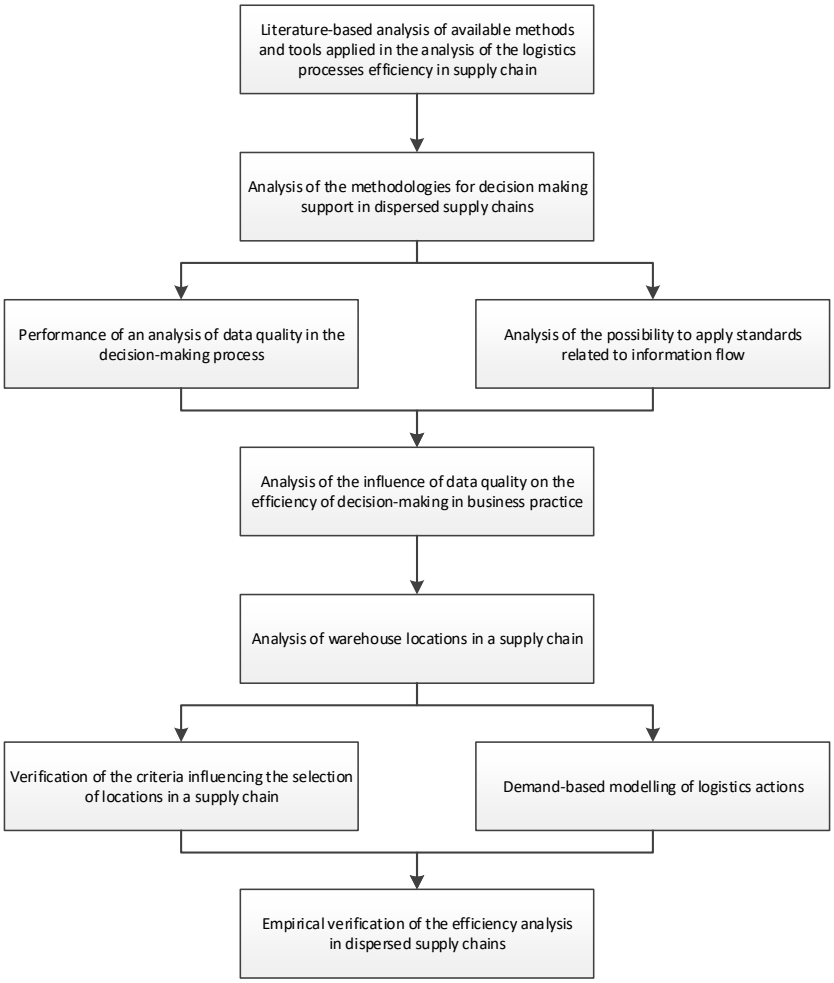

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Fig. 1. Methodology applied to the analysis of logistic actions in dispersed supply chains

The scientific research process described in the article is based on the logic of structural analysis of the identified research problem. The purpose of the adopted research work methodology is to duly organise the proceedings based on scientific rules of research. The logic applied to the solution of the research problem is shown in Fig. 1.

In the presented work, the Authors have applied the following research methods:

- analysis of reference books, the purpose of which was to assess the status of the research problem to be solved, and to obtain scientific explanations concerning the cognitive problem in question,
- quantitative analyses aiming at the empirical verification of developed processes (case studies) as part of analysing the efficiency of logistic actions in economic practice.

The development of basic methodological assumptions related to analysing the efficiency of logistic processes required performing tests with use of the critical literature review method. Critical literature review allows specifying the object of research, indicating weaknesses of conceptual categories and theoretical concepts and identifying similarities and dependencies between them. It makes it possible to suggest modifications of existing approaches.

Taking the specific nature of the problem into account, the literature review covered both publications concerning the management of logistics, assessing the efficiency of processes occurring in a company, flow of information in a supply chain and application of information standards to achieve business integration.

THE ISSUE OF ANALYSING THE EFFICIENCY OF LOGISTIC ACTIONS IN SUPPLY CHAINS

A supply chain is more effective when it is oriented towards creating values, which has direct impact on its efficiency. In the concept of supply chain management, value does not have to be an economic category such as added value, which it is frequently mistaken for. Value may take a number of different forms. Orientation to the development of such value suggests that a new method of relations between suppliers and recipients, i.e. the need to build non-confrontational relations, be established in such a company [Europe ECR 2003].

Reference books also present a contention that customer service should be treated as the most important element influencing the efficiency of modern logistics [Beamon 1999, Li and O'Brien 1999]. Such attention drawn to the level of customer service is mostly conditioned by progressing globalisation and implementation of new customer service strategies. All customer service methods characteristic for a specific company are a factor influencing a specific company's competitive position in the market.

The efficiency of logistic actions is a very meaningful issue from the perspective of the organisation of processes occurring in a company and in a supply chain. Efficiency is a term which is relatively difficult to define clearly, which is visible in a number of publications [Li, O'Brien 1999, Beamon 1999, Mishra 2012, Lichocik and Sadowski 2013, Geunes et al. 2016, Brandenburg 2016, Sohrabpour et al. 2016, Govindan, et al. 2017] discussing the aspect of efficiency of logistic processes in supply chains.

These theoretical considerations are also confirmed by studies carried out in logistics companies in the first quarter of 2016, which have been presented in the publication [Bigaj, Koliński, 2017]. It is also shown in the research carried out as part of research and development projects, and in consultancy projects executed at ILiM for business entities, aimed at developing a concept of efficient organisation of logistic actions (The analysis of the application of GS1 standards in the TSL sector, Research and development project of Institute of Logistics and Warehousing and the GS1 Polska Foundation, 2017. The structure and market verification of a localisation

register prototype based on GLN identifiers, Research and development project of Institute of Logistics and Warehousing and the GS1 Poland Foundation, 2017).

The multiple-criteria analysis, both in terms of methodology and possibility to use it in economic practice, shows not only the complexity of the issue discussed, but also its business relevance.

ANALYSIS OF THE METHODOLOGIES FOR DECISION MAKING SUPPORT IN DISPERSED SUPPLY CHAINS

A key element of the decision-making process is the development of such a methodology in order to take into account the largest possible number of factors influencing individual optimisation options. For this reason, multi-criteria decision making is therefore opposed to a single-criteria analysis in the sense that it seeks to express a coherent family of criteria as an instrument of comprehensible, acceptable and comprehensive communication, which should enable the creation, justification and transformation of preferences in the decision-making process.

One of the most effective methods of multi-criteria decision-making is the AHP method. The analytic hierarchy process (AHP) is a mathematical method for analysing complex decision problems under multiple criteria [Saaty 2013]. The management options for a particular decision problem are characterised by their attributes with respect to a set of detailed criteria [Qureshi, Harrison 2003]. Another effective method is the Methodology of Network Thinking (MNT). MNT was developed for the specific purpose of supporting managerial problem solving and has been widely applied to all kinds of organizational issues [Probst and Gomez 2012]. Table 1 shows a comparison of these methodologies with the methodology of logistic actions analysis in dispersed supply chains (MLADSC), presented in this paper.

Table 1. Analysis of the choice of methodology

Criteria	MLADSC	AHP	MNT
Modelling of logistics actions	X		X
Qualitative analysis of logistics actions	X		X
Quantitative analysis of logistics actions	X		
Qualitative analysis of data	X	X	
Quantitative analysis of data	X	X	
Trade-off analisis	X	X	X
Analysis of possibilities of implementing organisational changes	X	X	X

Source: own research

The methodology of analysis of logistics actions efficiency in dispersed supply chains discussed in this article includes an extended conceptual scope of other methodologies used in logistics management. Other methodologies presented in this article are widely known and applied in economic practice, however, taking into account both the needs and specificities of distributed supply chains, they are not sufficient to perform a comprehensive analysis of the logistics actions efficiency.

THE IMPORTANCE OF DATA QUALITY IN MAKING DECISIONS ON IMPROVING THE EFFICIENCY OF LOGISTICS – THE POSSIBILITY TO APPLY STANDARDS

Both at the stage of designing the structure of a logistic network, and at a later stage of managing it, data describing a company's activity in terms of logistics, such as data concerning the flow of goods/materials, stock level, availability of stock in individual links of the chain, or current availability of means of transport, are of fundamental significance. The

central task of integrated supply chains is to ensure access of all of the links of the supply chain to updated, consolidated and coherent information on actions currently in progress. Having access to reliable and valid information anywhere and any time is a significant factor affecting competitive advantage and efficiency of actions. The exchange of information between cooperating entities, ensuring appropriate identification level and current updates of data on actions undertaken in the network by its individual links requires implementing a single data exchange standard [Prajogo, Olhager 2012].

Identification and communication standards play a very important role - they allow establishing a homogenous and coherent basis for information transfer [Mattern and Floerkemeier 2010, Fabbe-Costes, Jahre, Rouquet 2006, Gleissner, Femerling 2014]. Access to such data enables companies to streamline transactions related to the flow of goods in supply chains, facilitates the coordination of actions and ensures efficient use of logistic resources. Implementation of standards in a supply chain will allow all its participants to perform clear and automatic identification of information concerning logistic resources (e.g. vehicles, shipments, locations) and related events, and to share this information with other participants of the supply chain.

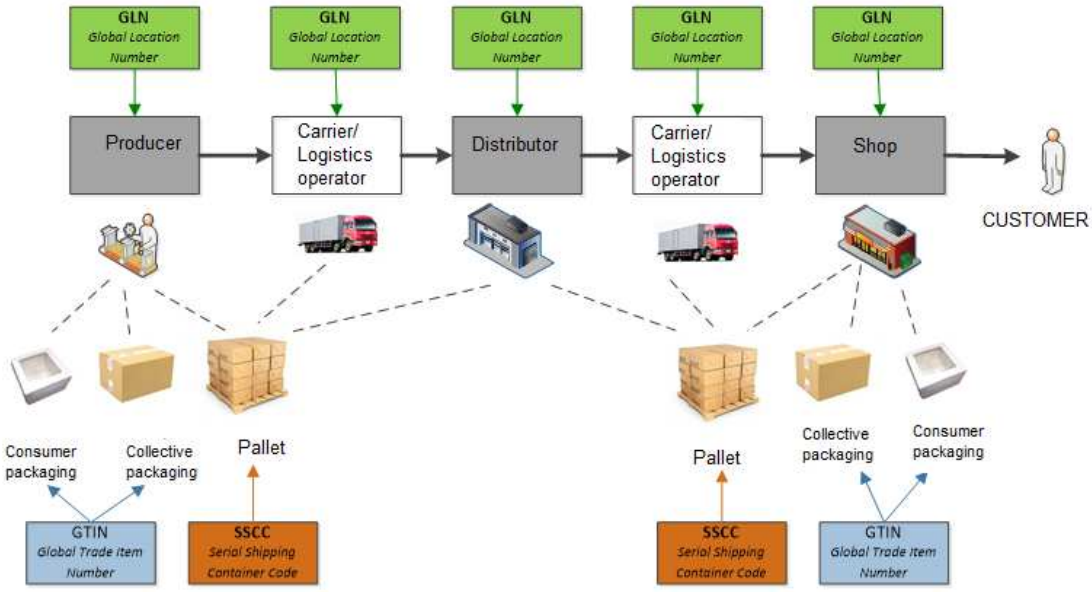

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Fig. 2. Scheme of a supply chain providing for the possibility to apply GS1 global identifiers

The GS1 organisation provides a number [Dujak, Zdziarska, Koliński 2017] of solutions in terms of standardisation. It is an international system of business standards and solutions. The system has existed and has been under constant development since 1973. GS1 standards are agreed rules and guidelines applied by all entities to streamline operations in supply chains in various sectors. The GS1 system offers many tools and solutions applicable in transport and logistics. They include solutions such as the Global Identifier for Consignment Number, standard bar codes or radio tags, logistic label or electronic messages serving the exchange of information and data.

Some of the standardisation solutions offered by GS1 include selected global GS1 identifiers which are the core of the GS1 system, allowing companies to mark and differentiate goods, locations and other objects being a part of a supply chain throughout the world in a clear and coherent manner. The figure below (Fig. 2) shows three of them,

together with the context of their application in supply chains.

GLN (Global Location Number) is a globally unique number which serves as an identification code to recognise any location (physical, digital, functional or legal). A GLN assigned to legal entities and functions allows their unambiguous identification, whereas assigned to physical and digital locations, it makes it possible to indicate where a specific location (geolocation) is and what its operating conditions are. The latter meaning is particularly significant from the perspective of improving the efficiency of distribution and warehousing processes in developed and territorially dispersed logistic chains. Labelling and unambiguous identification of locations in processes executed in supply chains can be considered one of key activities the efficiency of these processes relies upon [Niemczyk, 2016]. This context of applying GLN numbers is an object of separate analyses carried out by the Authors.

GTIN (Global Trade Item Number) ensures unique identification of commercial units throughout the world [Liu, et. al. 2016]. A commercial unit may, in this case, be interpreted as any unit (product or service) which is valuated, ordered or invoiced for commercial purposes between supply chain participants. Entities characterised by highly complex logistic structures usually frequently offer a broad variety of products for trade. In this context, clear identification of goods in the scale of all links comprising a supply chain gains in significance. Marking goods with the GTIN identifier allows their easy and unambiguous identification and description (including their physical properties) in the scale of an entire company or a group of companies.

From the perspective of the optimisation of warehouse and distribution processes in complex supply chains, the SSCC (Serial Shipping Container Code) identifier, serving unique identification of logistic units, is extremely important [Loebbecke 2007]. A logistic unit is created for the purpose of storage or transport of goods, and its identification and tracking throughout the entire supply chain is an important factor influencing the efficiency of logistic actions. Scanning a SSCC number applied on every logistic unit makes it possible to recognise the unit's features and to track it along its physical flow, even if it is territorially dispersed.

The application of global identifiers and standards has a considerable impact on improving the efficiency of logistic actions in supply chains, which is proven by a number of research works carried out in this scope and published, among others, on the website of GS1. The standards are also more and more commonly applied in the business environment. Nevertheless, research works performed by such entities as the Institute of Logistics and Warehousing prove the existence of complex supply chains which employ individual solutions of companies (individual companies, e.g. links of supply chains) to record locations, goods or logistic units. As a consequence, there are still problems with unambiguous identification of logistic resources in a company or a group of companies on the level of organisation of logistic processes, including the ones related to warehousing, distribution or stock management.

An external project run by consultants of the Institute of Logistics and Warehousing, aiming at developing an optimum model for the organisation of logistics at an international producer of packaging, may be an example. In this case, capital structure was formed by a number of individual companies. The project covered central and eastern part of Europe. The first and extremely significant part of the project was the analysis of input data describing goods, their stock, flows and locations. At the further stage of the project, historical data in this scope was a basis for multiple-criteria simulations which allowed indicating the most efficient distribution network. The quality of fundamental data in such a context is a condition affecting the quality of results and their reliability in terms of making business decisions. The fact that the company did not apply any standards significantly influenced the quality of input data, making them unreliable. Examples have been presented below. The first example refers

to the absence of a standard in the scope of description of goods and their features as part of the studied group. Flow volume was expressed in a different unit than the type of packaging defined for a particular item (Fig. 3). That situation caused a lot of difficulties in expressing flows in pallets, which was critical for assessment of total quantity of flow. If consultants made the conversion based on the source data base, using the same calculation method for all commodities, the annual turnover (all flows) in pallets would amount up to 36 million, which is unreal. After verification, many explanations and amendments, project team achieved the total volume of flow about 2 million, which was realistic. Applying one standard for the verification and description of commercial goods (GTIN) would have effectively prevent such situations.

Location	Code of commodity	Quantity of flow [packaging]	Packaging	Number of pieces per packaging	Number of packaging per pallet
Ritt	1006669	22400	BX	800	28
Ritt	1016377	18	BX	600	9

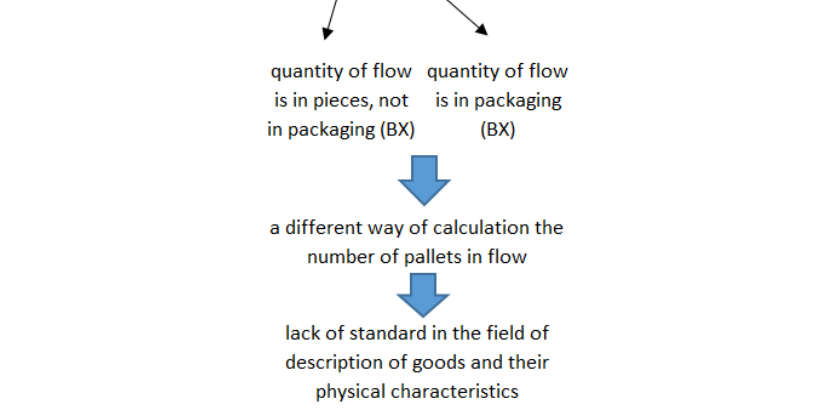

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Fig. 3. An example of absence of a standard applicable to the description of commercial goods

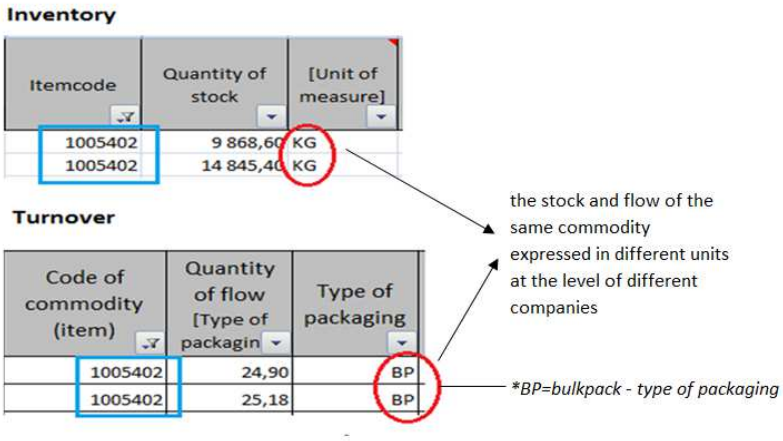

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Fig. 4. An example of absence of a standard applicable to the description of commercial goods

The case studied involved other, numerous examples of wrong marking of logistic resources. One of the companies from the group used different measurement units for a stock keeping unit in stock accounting. The example has been shown in figure (Fig. 4) below.

Another example refers to the incoherent marking of locations. Companies of the capital group used completely different location identification systems. Each of the companies organised flows to/from one location (production plant), which was marked differently by each company. At the global level, it prevented the performance of an analysis and caused compulsory introduction of unique markings for a location. A GLN identifier, which, apart from indicating the location's geographical position, might have harmonised descriptions of its physical features, could have been an effective solution to this problem.

It should be emphasized that the application of identification and communication standards to increase the efficiency of identification, collection and exchange of data requires the use of specialised computer systems assisting management and control that work equally well with all of the partners in the chain.

CRITERIA OF SELECTING LOCATIONS IN SUPPLY CHAINS – A DEMAND-BASED MODEL OF DISTRIBUTION CHAIN OPTIMISATION

Coherent and standardised data identifying logistic resources, flows and stock in supply chains form a basis for analyses and for making decisions related to the optimisation of logistics in complex supply chains. The complex nature of logistic systems and decision-making problems they deal with is shown in Fig. 5.

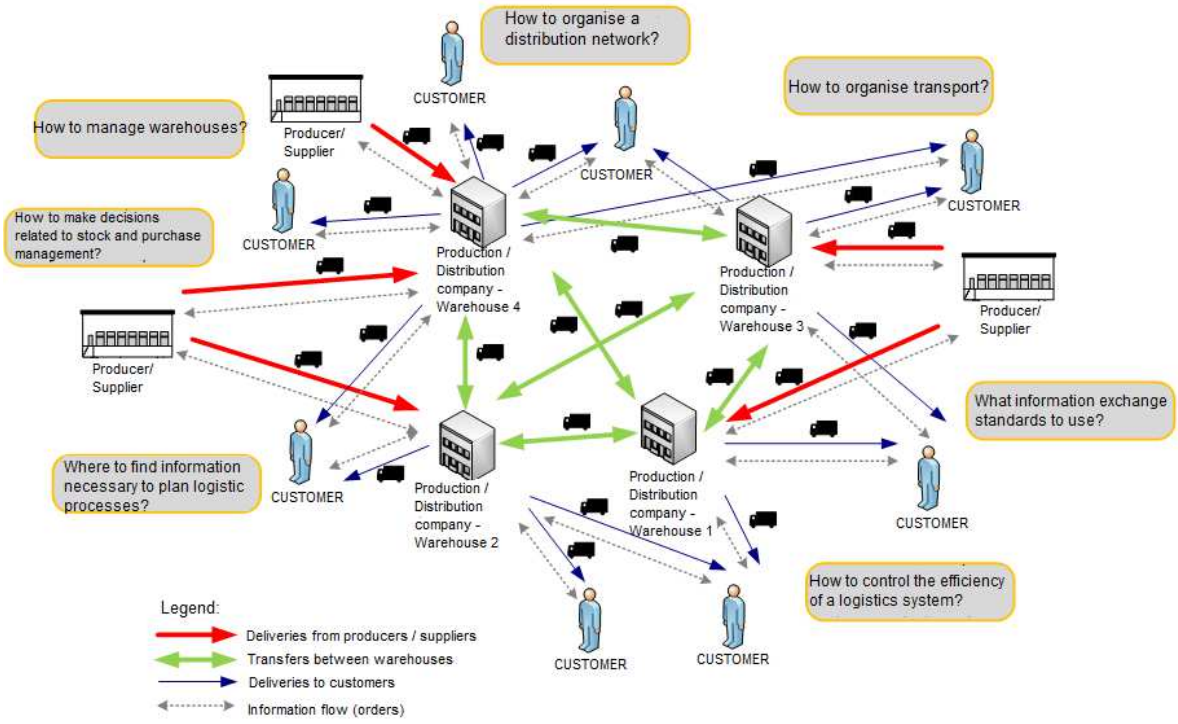

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Fig. 5. The complex nature of logistic systems and decision-making problems they deal with

The central decisive problem is related with the planning of supply chain structures, and it applies to the determination of the number, the locations and the roles of individual links (warehouses) in a logistic chain [Hanssmann 1959; Daskin, Coullard and Shen 2002; Sherbrooke 2006]. Companies seek optimum solutions that will help them plan a supply

chain in territorial terms, taking current streams of customers (their size and source), internal and external conditions influencing logistic actions into account. A starting point for making a decision on locating a warehouse or organising logistics in complex supply chains have always been the locations of end customers and their demand, the satisfaction of which, provided that acceptable level of cost is maintained, is the chief objective of the existence of logistic systems. Thus, we may speak of demand-based logistics modelling. In the context of making a decision on the territorial structure of a supply chain, it means that warehouse and centres must be located in a place that will ensure the shortest distance (or the shortest transport time) between a warehouse and a recipient. It is therefore important to properly assign recipients to production and distribution centres, so that the assignment meets the criterion of distance (or delivery time). Here again one should emphasize the meaningful role of location identifiers, including the location of recipients which the supplies are addressed to, in supply chains. At the same time it should be remembered that the criteria regarding the shortest distance or delivery time may not be the only criteria influencing the location of warehouses in a distribution network or the assignment of recipients to existing locations. Applying the criterion of shortest distance between recipients and warehouses will most probably have a positive effect on the organisation of distribution processes and transport costs. However, one should also verify how optimisation will affect costs related to the organisation of warehouse operation, stock volume or costs related to tied-up capital.

Decisions concerning the arrangement of locations within a supply network should provide for integrated optimisation of all areas of logistics, such as warehousing, transport or stock management, which has been shown in Fig. 6. However, logistic costs in individual areas of logistics shown in Fig. 6 depend directly on the decision specifying which customers (i.e. demand) will be served from specific warehouses.

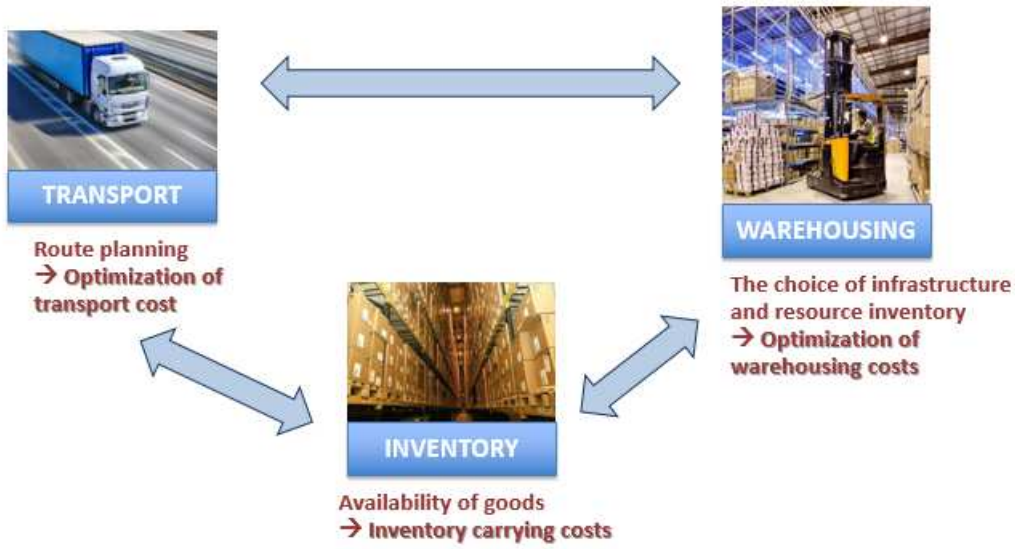

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Fig. 6. Integration of logistics areas in a supply chain

It should be noted that areas listed in Fig. 6 function on the basis of a trade-off relation. This means that making a decision that would optimise the functioning of one of the areas may bring negative results in another area [Cudzilo, Kolinska 2011]. It considerably complicates the decisive process of selecting solutions that would optimise logistics in complex supply chains. The said complex nature of the decisive process determines the obligation to develop and market tools assisting companies in the multiple-criteria

modelling of the distribution network. These tools should allow testing alternative solutions concerning locations, leading to the integrated optimisation of logistics and avoiding actions leading to suboptimisation. The Authors are currently running a number of studies related to the multiple-criteria optimisation of supply chain logistics, the article will, however, concentrate on the aspect of the optimum assignment of recipients to warehouses. Subsequent stages of improving efficiency of logistics in complex distribution networks will be an object of the Authors' separate publications.

Failure to assign recipients to appropriate warehouse locations in a supply chain or failure to consider the location of delivery points and demand volume at the stage of selecting locations of warehouses or distribution centres determines the inefficiency of logistic processes. Consequences include high logistic costs and unsatisfactory level of customer service. Examples of such situations occur in consulting works of the Institute of Logistics and Warehousing. The case of the producer of packaging, illustrated in the figure (Fig. 7) below, is one of such examples. The figure shows relations between warehouses and recipients, showing which warehouses served specific customers, based on data concerning annual flows. As Fig. 7 shows, it was possible to serve the same recipient from several warehouses. There are also cases where a specific recipient was served from a very distant warehouse, despite its location in the vicinity of other warehouse. The structure is inefficient not only from the perspective of high complexity of distribution processes, but also because it affects the complexity of warehouse processes in individual locations and prevents efficient stock management. In the case discussed, the inefficiency of customer service in logistic terms was influenced by the independent operation of individual companies comprising the capital group. Each of the companies operated autonomously, willing to obtain the best sales results possible. It had a clearly negative effect on the organisation and cost of logistics from the perspective of the entire group.

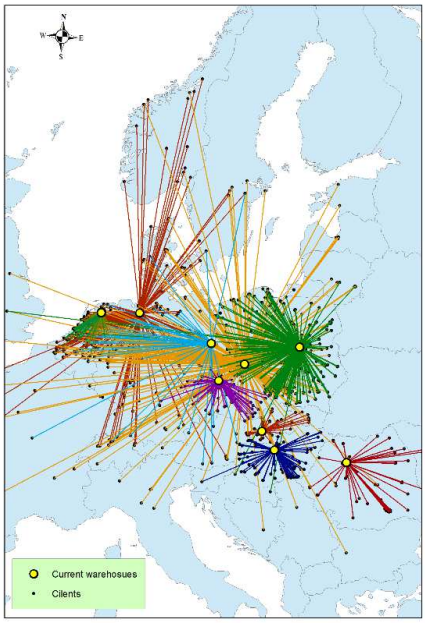

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Fig. 7. An example of inefficient assignment of recipients to warehouse locations

In this case, recipients were assigned to existing locations on the basis of the shortest distance criterion. The effects are shown in Fig. 8.

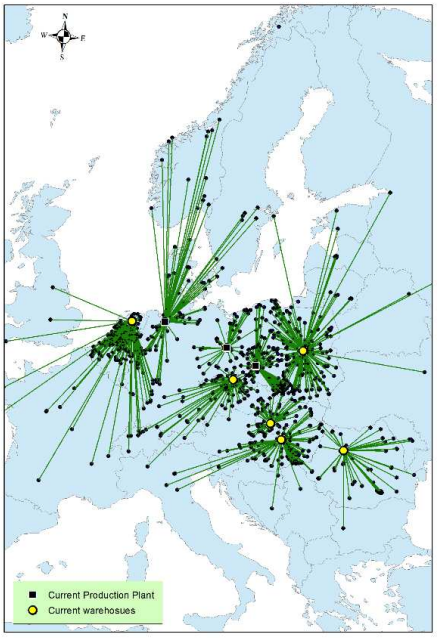

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Fig. 8. An example of efficient assignment of recipients to warehouse locations

As Fig. 8 shows, recipients are served from the closest warehouses. Such an assignment shortens distribution routes, but, on the other hand, it determines, among others, an obligation to have the full variety of products available in every warehouse, which influences stock level in each of them. Thus, the issue of trade-off relations reappears. The present article concentrates on analysing the aspect of comparing the results of two alternative methods of assigning recipients to warehouses. The comparison of both methods (the one presented in Fig. 7 and in Fig. 8) is shown in Fig. 9.

Summary

Warehouse	Number of clients	Number of pallets	Average number of pallets for one client	Average KM	Maximum KM	Sum KM
Scenario 1	**1 807**	**474 438**	**263**	**325**	**2 005**	**587 037**
DOM	1361	234 342	172	209	816	285 098
EXP	446	240 096	538	677	2 005	301 939
Scenario 2	**1 503**	**474 438**	**316**	**206**	**1 810**	**308 934**
DOM	1222	327 960	268	151	614	184 889
EXP	281	146 478	521	441	1 810	124 045

Number of clients	Number of routes "warehouse - customer"
Average KM*	Average distance for the route "warehouse - customer"
Maximum KM*	Maximum distance for the route "warehouse - customer"
Sum KM*	Total distance (number of kilometers) for all "warehouse - customer" routes
Average MIN*	Average travel time
Maxiumum MIN*	Maximum travel time
Sum MIN*	Total travel time needed to service all customers

*Data about distance and travel time are given taking into account actual road network

Source: own study

Fig. 9. The comparison of selected result parameters in two alternative methods of assigning recipients to warehouses in the studied business case

In the table in Fig. 9, Scenario 1 represents a model of assigning recipients to warehouses as presented in Fig. 7, whereas Scenario 2 represents the model from Fig. 8. Indicators provided in the table are different for domestic (DOM) and exports flows (EXP). It should be emphasized that in both cases, the same number of pallets will be handled (474 438), and the same group of customers will be served. In Scenario 2, however, length of the "recipient - warehouse" route is shorter. It should be also noted that route lengths provided in the table do not apply to distances in a straight line, but they provide for a network of roads in a specific region and reflect actual routes. In Scenario 2, the total number of kilometres driven between specific warehouses and individual recipients is also significantly lower, both for domestic transport (a drop by 35%) and exports (a drop by nearly 60%). Such a situation will most probably contribute to a considerable reduction of distribution costs in both models of assigning recipients to warehouse locations.

The described case of improving the efficiency of logistic actions by optimising the assignment of recipients to warehouses is the first step towards demand-based modelling of logistics. Further steps will involve studying the influence of changes introduced in this area on other logistic areas (such as warehousing or stock management). A model of integrated optimisation of logistic actions in complex supply chains will be the final result. Further research works undertaken by the Authors will involve developing successive stages of the model.

CONCLUSIONS

Improving the efficiency of logistic actions in complex supply chains is a complicated issue which requires a multiple-aspect and multiple-criteria analysis of data and conditions that characterise the operation of companies and their micro- and macroeconomic environment. The quality of

source data describing flows, stocks or locations plays a particular role in the process of modelling and affects the reliability of obtained results. Identification and communication standards are a solution leading to streamlining the recording of logistic actions and their further optimisation. Trade-off relations between actions undertaken in particular areas of logistics also significantly influence the improvement of logistic actions' efficiency. The complex nature of the analysed subject of study encourages the Authors to carry out further research works aimed at the development of a coherent concept of analysing the efficiency of logistic actions and its verification in terms of its application in business practice.

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ANALIZA EFEKTYWNOŚCI DZIAŁAŃ LOGISTYCZNYCH ROZPROSZONYCH ŁAŃCUCHACH DOSTAW - ZAŁOŻENIE KONCEPCYJNE I METODOLOGICZNE BADAŃ

STRESZCZENIE. **Wstęp:** Zarządzanie rozproszoną i zróżnicowaną strukturą łańcuchów dostaw w sposób efektywny jest procesem skomplikowanym zarówno organizacyjnie, jak również w ujęciu podejmowania decyzji. Połączone firmy, współtworzące zintegrowane kapitałowo grupy, podejmują działania konsolidacyjne w celu uzyskania wewnętrznej spójności między innymi w obszarze logistyki. Pokonanie różnic związanych ze stosowaniem przez poszczególne podmioty różnych zasad działania w realizacji procesów logistycznych oraz ich integracja w jeden wydajny system stanowi wyzwanie dla firm.. Celem artykułu jest przedstawienie koncepcji analizy efektywności działań logistycznych w rozbudowanych łańcuchach dostaw.
Metody: Wyniki badań praktyki gospodarczej w latach 2016-2017 oraz badań literaturowych realizowanych w ramach projektów badawczych i optymalizacyjnych, świadczą o niezadowalającym stopniu wykorzystania analiz efektywności działań logistycznych w rozbudowanych łańcuchach dostaw. Na podstawie prowadzonych eksploracji dokonano opracowania metodyki badań nad analizą efektywności działań logistycznych z uwzględnieniem specyfiki rozbudowanych łańcuchów dostaw, która stanowi podstawę koncepcyjną do prowadzenia analiz efektywności w przedsiębiorstwach.
Wyniki: Wynikiem prowadzonych badań jest koncepcja prowadzenia analiz efektywności działań logistycznych, której poszczególne elementy zostały zweryfikowane pod kątem przydatności w praktyce gospodarczej.
Wnioski: Analiza efektywności działań logistycznych pomimo licznych odniesień literaturowych, wciąż jest niejednoznacznie zdefiniowana. Utrudnia to jej wykorzystanie w praktyce gospodarczej przedsiębiorstw. W niniejszym artykule skoncentrowano się na prezentacji koncepcji zastosowania analizy efektywności działań logistycznych uwzględniających specyfikę rozproszonych łańcuchów dostaw.

Słowa kluczowe: efektywność łańcucha dostaw, rozproszony łańcuch dostaw, proces podejmowania decyzji

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DIE ANALYSE DER EFFIZIENZ VON LOGISTISCHEN, IN LIEFERKETTEN VERSTREUTEN AKTIVITÄTEN – EINE KONZEPTUELLE UND METHODOLOGISCHE ANNAHME FÜR DIE FORSCHUNGEN

ZUSAMMENFASSUNG. Einleitung: Das effektive Management der verstreuten und differenzierten Struktur von Lieferketten stellt einen, sowohl organisations- als auch entscheidungsmäßig komplizierten Prozess dar. Miteinander verbundene Firmen, die kapitalmäßig integrierte Gruppen bilden, nehmen zwecks der Erzielung einer inneren Verbundenheit u. a. im Bereich Logistik unterschiedliche Konsolidierungsaktivitäten auf. Die Überwindung von Differenzen, die mit der Anwendung unterschiedlicher Prinzipien bei der Durchführung von logistischen Prozessen durch einzelne Subjekte verbunden sind sowie deren Integration in ein effizientes System stellen eine große Herausforderung für die betreffenden Firmen dar. Das Ziel des Artikels ist es, ein Konzept für die Analyse der Effizienz logistischer Aktivitäten innerhalb der ausgebauten Lieferketten zu projizieren.
Methoden: Die Resultate der innerhalb der Wirtschaftspraxis in den Jahren 2016-2017 durchgeführten Forschungen und einer betreffenden Literaturübersicht, die im Rahmen von unterschiedlichen Forschungs- und Optimierungsprojekten vorgenommen wurden, bezeugen den nicht zufriedenstellenden Grad der Inanspruchnahme von Analysen der Effizienz logistischer Aktivitäten innerhalb von ausgebauten Lieferketten. Anhand der durchgeführten Erforschung wurde eine betreffende Forschungsmethodik zur Effizienz-Analyse von logistischen Aktivitäten unter Berücksichtigung der Eigenart der ausgebauten Lieferketten, die eine konzeptuelle Grundlage für die Durchführung der Effizienz-Analysen in Unternehmen bildet, ausgearbeitet.
Ergebnisse: Als Resultat der ausgeführten Forschungen gilt das Konzept für die Durchführung von Effizienz-Analysen innerhalb logistischer Aktivitäten, deren einzelne Bestandteile auf die Brauchbarkeit in der Wirtschaftspraxis verifiziert wurden.
Fazit: Die die logistischen Prozesse anbetreffende Effizienz-Analyse bleibt trotz zahlreicher Literaturbezüge immer noch nicht eindeutig definiert. Dies erschwert ihre Anwendung in der Wirtschaftspraxis der Unternehmen. Im vorliegenden Artikels konzentrierte man sich auf die Projizierung des Anwendungskonzeptes der Effizienz-Analyse, die die Eigenart logistischer Prozesse innerhalb der verstreuten Lieferketten berücksichtigt.

Codewörter: Effizienz der Lieferkette, verstreute Lieferkette, Prozess von Entscheidungstreffen

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