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THEORY OF CONSTRAINTS IN DESIGNING THE LOGISTICS INFORMATION SYSTEM IN AGRIBUSINESS

Summary. Information flows in logistics and their capacity become a starting point for consideration in the field of the Logistic Information System. In order to select the most significant information in the perspective of decision accuracy, of the greatest value and in a short time, there is a need to employ proper information means and techniques. Only computer techniques are capable of dealing with such a large amount of data, and transform them into valuable and useful information. Purpose of the work is to present significance of logistics in agribusiness enterprises, and the logistic information itself.

Keywords: logistics, agricultural logistics, agribusiness, information system.

TEORIA OGRANICZEŃ W PROJEKTOWANIU SYSTEMU INFORMACJI LOGISTYCZNEJ W AGROBIZNESIE

Streszczenie. Przepływy informacyjne w logistyce i ich objętość stają się punktem wyjścia do rozważań na temat logistycznego systemu informacji LIS. Aby wybrać informacje najistotniejsze z punktu trafności decydowania, o największej wartości i w krótkim czasie, należy zastosować odpowiednie środki i techniki informacyjne. Tylko techniki komputerowe są w stanie uporać się z tak olbrzymią ilością danych i przetworzyć je w wartościowe, użyteczne informacje. Celem niniejszego artykułu jest wykazanie ważności znaczenia logistyki w przedsiębiorstwach z sektora agrobiznesu oraz samej informacji logistycznej w agrologistyce.

Słowa kluczowe: logistyka, agrologistyka, agrobiznes, system informacji.

1. Introduction

Information flows in logistics and their capacity as well as intensity become a starting point for consideration in the field of the Logistic Information System (LIS). In order to select the most significant information in the perspective of decision accuracy, of the greatest value and in a short time, there is a need to employ proper information means and techniques [2]. Only computer techniques are capable of dealing with such a large amount of data, and transform them into valuable and useful information. Purpose of the work is to present possibilities and significance of proper selection, collection, as well as processing of logistic information in enterprises from the agribusiness sector. The authors concentrated on literature review in the scope, and suggested the manner, in which the agribusiness companies can apply the information systems for processing of information related to physical flows of goods. There are numerous IT solutions functioning on the market, which serve only for some of the areas of the enterprise operation. Therefore, it is hard to point to a single systemic solution, which will provide complex information and IT operation for each company, thus ensuring efficient realization of logistics. The ERP (Enterprise Resource Planning) IT systems are close to perfection, aiming at complex operation of the organization, and integration of such solutions. When planning the architecture of the logistic information system, application of the Theory of Constraints becomes useful. The theory of constraints developed by Goldratt poses a breakthrough in the scope of knowledge and practice related to projects management. Thanks to its application, it is not only feasible to observe the projects deadlines, but also to reduce the time needed for their implementation (by 30 to 50 percent), as well as to keep the realizations within the assumed budget. Now the time has come for the critical chain notion, the central term in the Theory of Constraints by Goldratt. It is a tough task to find a definition of this term in literature of this subject, or in other words, there are not many of them. Thus, the critical chain is a term defined in an algorithmic or at least functional manner - for a given project network, a critical chain is a specific sequence of events - but a notion that is based on intuitive choice made by a project manager. Purpose of the article is to identify the manners for improving the logistic information management system in an agribusiness enterprise, based on methods for projects management, encountered in the Theory of Constraints. In the contemporary competition conditions, the companies that launch their products on the market seek for solutions that are effective from the perspective of project management, but which are also related to reduction of the project implementation time. Regarding a unitary character of the configuration process of the logistic information system, it may be treated as a project.

This observation has become a basis for application of the projects management method based on the critical chains, in the developed concept. Regarding the constraints identified within the production system of the analyzed enterprise, the authors decided to apply the Drum - Buffer - Rope method, in order to improve its performance. While seeking for

solutions that are to improve organizational effectiveness, it is necessary to integrate the operation of both presented management tools. The growing expectations of customers, both towards fulfillment of their expectations by the enterprises from the agribusiness sector, and the realization time of orders, lead to an increase of those companies' interest in the undertakings as methods for realization of the tasks they need to face. The Theory of Constraints offers a project management tool, which enables planning of resources utilization. The described method is based on application of the so-called critical chain (Critical Chain Project Management - CCPM) [5]. The critical chain is a collection of interdependent tasks with the longest duration, considering the constraints of the system resources. The system constraints are among others, availability of financial resource, time of work, multi-task nature, etc. Within the process of planning utilization of resources, particular tasks within the critical chain are deprived of time buffer, and they are planned in advance (at the last date possible for realization) in order to eliminate the student syndrome - the dedicated time reserve is used before realization of the task is commenced. Introduction of the latest dates for commencement of tasks, and reduction in their duration through removing the time reserve, requires determination of its size and a record in the project schedule, in order to compensate natural deviations and multi-tasking cases.

Design/methodology/approach – We propose an approach applying the methodology of the critical chain suggested by Goldratt, for characterization of the logistic information system implementation in an enterprise from the agribusiness sector.

2. Logistics and contemporary agribusiness

Nowadays, logistics is becoming inevitable for optimum operation of each enterprise. Therefore, it is worth asking a question - are there any premises for the logistics to become a significant area of theory and practice in contemporary agribusiness, and what are they? First of all, a considerable role of logistics in agribusiness can be related to specificity of the agri-food sector, manifested among others in [8]:

- significant time imbalance for supply and demand for agricultural products (especially related to plant production);
- low transport and storage possibilities for numerous agricultural products (e.g. milk, meat, fruit and vegetable);
- numerous and independent cells intermediating within the whole supply chain “from the farmer’s field to the consumer’s table”, what causes strong exposure to interferences in information flow, and as a consequence excessive supplied, growing upstream the supply chain.

In the era of globalization, the efficacy of physical flows of deliveries poses a necessary condition for provision of international competitiveness of supply chains. Introduction of modern solutions by certain companies triggers a necessity for the cooperating enterprises to adjust to them [11]. In the era of globalization, the efficacy of physical flows of deliveries poses a necessary condition for provision of international competitiveness of supply chains. Introduction of modern solutions by certain companies triggers a necessity for the cooperating enterprises to adjust to them. Bearing in mind the above, a considerable increase in interest in logistics in agribusiness is noticeable.

Agribusiness is a national economy segment, which includes plenty of sectors and types of operation. The following can be distinguished: the sector of production and distribution of production measures for agriculture, agriculture, food industry and wholesale of agricultural raw materials, wholesale of food products, retail of food products and the sector of food services [3]. Operation of the agribusiness enterprises depends on numerous factors of a macro and microeconomic character [8]. One of the more important competitive factors for the agribusiness enterprises is efficacy of the logistic system [12]. Proper operation of a logistic system in an enterprise, including companies from the agribusiness sector, is increasingly more dependent on the applied technology [1]. In case of the agribusiness sector, great significance is especially ascribed to transport. This results from specificity of transport raw materials and finished products, which are characterized with low transport and storage vulnerability [14]. Therefore, the resource food industry often operates on a local or regional scale [4]. Another specific feature of agribusiness is presence of vertical contractual relationships between a supplier and a recipient [13]. Hence, the agribusiness enterprises are different from the companies from other sectors of economy. Purpose of the work is to present significance of logistics in agribusiness enterprises, and the logistic information itself. Operation of the logistics information system. The logistics information system shapes the enterprises' actions through consideration of significant economic, social, geographic, etc. problems. The essence of the logistics information system is accumulation of data and information, storage, adequate processing and distribution of information, presenting and making optimum decisions that coordinate the logistics actions [6]. The undertaken decision must be related to all elements and cells of a logistic chain, with consideration of phenomena taking place within the whole supplies chain, and changes taking place in the enterprise's surroundings. A necessary condition for operation of the logistic systems in an optimum manner is application of IT in those systems. Computer aided IT systems are of strategic importance for an enterprise. The applied IT techniques and measures, skilfully implemented and applied, enable, by competitive advantage, maximization of profits, both in the company, in the logistics chain cell as well as in the whole chain. Operation of the logistics information system starts from collection of data necessary within the decision making process [15]. Data for the logistic system should be acquired from numerous various sources. They should embrace all logistic operations, i.e. they should be related, among others, to supply,

warehousing, production, distribution, marketing, sales, costs generation processes. What is more, data coming from all enterprises that pose basic elements of the supply chain are inevitable, with consideration of: suppliers, intermediaries, forwarders, distributors, carriers, i.e. all economic entities that take part in provision of logistic services, as well as data from the financial surrounding [4]. The gathered information is stored in integrated databases of companies that belong to the supply chain. These databases are complemented by local and personal ones. General databases can be divided into external and internal ones, which are complemented and modified on current basis.

The logistics information system makes use of the latest achievements in the scope of IT and telecommunication. The teleinformation infrastructure covers both the technical means (hardware), as well as software solutions adequate for those means (algorithms, programs, coding systems etc.) [10]. All known transfer media are applied here, such as: commuted, radio and satellite connections. When it comes to the enterprises' territories, local networks are the ones applied most often. They are of a limited range, and they refer to buildings located close to each other. An example may be an intranet functioning within a single company, or an extranet combining two economic entities with an intranet network functioning. In Poland, the main network system is still Novell Net Ware. Wide area networks employ commuted phone connections, satellite connections, as well as package networks and cellular networks. A technical equivalent of the wide area network is the so-called information highway, providing a possibility for global communication of a systemic character. Both these functions are held by the Internet. In order to make the logistics information system work effectively and guarantee quick data transfer and acquisition, it must be an open system, enabling connection with both local and wide area networks [9]. Taking into consideration the deliberations presented above, it must be stated that the most significant task of the logistics information system is to collect and process data, related to the whole logistics operation of the enterprise, its macro-environment and competitive surroundings, employing all possible sources. Furthermore, the LIS is responsible for provision of collected and processed data, and proper information to the decision-making teams, on each organizational level.

Another important feature of a logistics information system is uniformity of all its elements, regardless whether they are components of a single enterprise or a group of enterprises, and their information network should be characterized with clear feedback, and serve for the purposes of both unilateral transfer and bilateral exchange of information in various forms, between any market partners [13]. A feature of the logistics information system, contributing to cohesion of particular elements and modules combined with relationships and connections, and as a result for optimization of the whole system, is integration. Its purpose is to coordinate logistic operations of the enterprise, realizing the systemic approach in the logistics, with consideration of structural and functional openness and flexibility [10].

Information of the enterprises guarantees effectiveness of the logistic system operation. Proper implementation and application of IT measures and techniques, which support functioning of the logistics information system, guarantees improvement in the enterprise's efficiency, made visible in: improvement of the pace of actions, improvement of production quality and customer service level, reduction in costs, and therefore improvement in competitiveness on the market. Regarding dynamic development of IT means and techniques in the scope of computer hardware, databases systems, technologies for processing and transferring information, operational, system and tools software, enables to achieve a synergy results, both in the logistic system and in the logistic information system of an enterprise, when the final functionality of the IT solutions mentioned above becomes fuller, and it gives greater effects than the algebraic sum of the components [12]. Summing up, the drawing presents a block diagram of the logistic information system, together with information channels and techniques of collection of information from various cells of the supply chain.

3. Logistic information in agribusiness

Currently, information is perceived as a highly significant production factor. The information is most often defined twofold. Its first meaning is to inform about something, communicate something, a message, a clue, an instruction [3]. According to the second definition, information is each factor, thanks to which people of automatic devices can act more effectively and purposefully. In turn, the information product is a finite collection of information reflected in a specific language, on a relatively permanent, separated and identifiable material carrier, such as: books, magazines, CDs with recorded information etc. This information results from organization of data [6]. This organization is carried out through an IT system, i.e. A tool, which serves for integration of data that come from numerous sources, into a specific information flow. The flow of information is related to their transfer between organizational cell of an organization that carries out subsequent operations, and communication with the environment (clients, offices, media, contracting parties, competition etc.) [10]. Efficiency of information processes depends to a great extent on infrastructure applied in the information systems.

According to Osterloh M. and Frost J. information and knowledge belong to - apart from manufactured products and relationships with third parties - fundamental and basic elements necessary in creation of an added value of items in transactions with recipients. They influence the condition of differentiation from the competition and improvement of the enterprise's market value[15]. For proper realization of fundamental and basic processes, also the supporting processes are inevitable, which also encompass actions related to preparation

of the business processes infrastructure, creation of information systems, transportation, storage, human resource management, accounting and finances, reporting and controlling.

On the operational level of the enterprise's operation, logistics is first of all understood as a tool for controlling realization of the entrance supply processes and exit results distribution, while utilizing technical logistic processes. At the managerial level, logistics plays a coordination role for such processes as, e.g.: orders acquisition, production planning, supply or distribution. Detailed tasks of logistics on this level are related to information processes in the planning areas (e.g. sales and delivery, material need, the level of supplies), development of instructions (related to the size of orders, production and dispatches, minimum supplies and rotation periods, corrections in cases of lacks and interferences), control (over confirmation and introduction of production orders into the plan, orders for materials and products, monitoring of dates), and service of customers' orders [8].

Thus, the logistic processes are often separated on the basis of functional division of the organization's operation areas (supply, production, distribution). The processual approach in logistics is focused on coordination, with simultaneous integration (merging) of functions and cells that realize specific actions in the enterprise. The most important goal of the logistic processes is to provide proper effectiveness of flow and adequate customer service, with minimization of the incurred costs [12]. Achievement of the assumed objectives is possible thanks to the IT system, which is a tool integrating the data coming from numerous sources, into a single flow of information [4]. The logistic information systems are composed of hardware, software, and trained employees used for control and assessment of logistics operations undertaken by the enterprise. The logistics of information should be effective both inside and outside the company [2]. Implementation of proper IT tools allows the employees to perform planned actions in a proper sequence, and to save time [6]. The market offers programs that enable optimization of production and logistic processes, performance of simulations, planning and scheduling in real time. A purpose of such IT support is help with decision making processes [13]. An important constraint for implementation of such systems are high costs, but also narrow knowledge in the field of solutions offered by such systems, or lack of acceptance from the side of final users [7]. For plenty of companies, the outlay for IT systems can be too high, but they can employ the software-as-a-service solutions, i.e. outsourcing of IT services [10]. Research companies that support measurement of effectiveness and efficacy of the enterprise, provide their solutions in the following sectors: data integration, expert systems for decisions support, exploration of data and risk management [8]. The enterprises from the agribusiness sector remain unidentified in terms of logistic solutions, including those related to application of IT systems.

However, one of the basic factors that influence the competitive position of the enterprise is the speed of information transfer. Decisions related to purchase must be made quickly and accurately - based on reliable and verified information [11]. Majewski writes about the pace of access to information, stating that: "an IT system does not generate business processes; it

only accelerates their operation in an enterprise” [6]. While “a good IT system fulfills all information needs on subsequent management levels, in a manner that allows the enterprise’s managerial staff to make proper decisions” [6]. Therefore, there is a need for the enterprises to implement the Integrated IT Systems, what is not yet an obvious solution for all managers of organizations. Such a system, apart from realizing purely formal tasks, should also play an information role. Therefore, another conclusion by Majewski is adequate, namely: “contemporary Integrated IT Systems support the planning process of sales, its prediction, production scheduling, planning of material needs, balancing the available resources (human, production, transport, storage, financial) to the fullest extent”. Information systems are inevitable in operation of every enterprise. Their application in particular branches in the agribusiness sector has still not been recognized. A factor that differentiates the scope of application of the IT systems is the branch. Introduction of modern IT solutions is related to sizable investment outlays. There are numerous IT solutions functioning on the market, which serve only for some of the areas of the enterprise operation. Therefore, it is hard to point to a single systemic solution, which will provide complex information and IT operation for each company, thus ensuring efficient realization of logistics. The ERP (Enterprise Resource Planning) IT systems are close to perfection, aiming at complex operation of the organization, and integration of such solutions. The information system that is based on teleinformation environment elements, which is composed of a communication system, first of all its quality, determines the possibilities to create connections between enterprises, influences the possibility to configure logistic networks and enables realization of particular strategies for material flow management. Such a system provides exchange of information and data that support the materials flow process, in logistic processes realized inside enterprises, but also - what decides about its significance for logistics - supply chains and logistic networks [3].

A role of the IT system in agricultural logistics is provision of competitiveness of the agribusiness enterprises. Crucial importance for an effective communication system is borne by standards, application of which is a condition of trouble-free exchange of information, reduction of time devoted to communication, reduction in the number of errors. Tools allowing realization of logistic processes are automatic identification and electronic data exchange. In case of efficient operation, a significant role is played by “good and effective information, posing a strategic resource in an economic organization” [9]. Such information is understood as “an ordered and analyzed message, a signal received by the recipient, handed to him in a proper (understandable) form, which he requests in accordance with realization of specific purposes” [10].

4. Conclusion

Significance of logistics for operation and development of the agribusiness enterprises is high. A problem is lack of awareness in this scope. Companies from the sector of agribusiness are focused on manufacturing operations. A highly significant sphere of logistic actions in each enterprise is transport. In case of food processing industry, its significance is even greater as large amounts of resources are transported, often in a limited time, in the so-called high season. The technical advancement is present in all spheres of life and operation. Development of enterprises is impossible without implementation of modern information technologies. At a certain moment, the scale of action poses a barrier that cannot be overpassed without proper IT support. Development of enterprises is impossible without implementation of modern information technologies. An important element, without which a modern company cannot act effectively, is existence of an IT system for the whole enterprise, or individual systems dedicated to particular spheres. The larger the enterprise the greater the logistic support. In case of sizeable enterprises, modern solutions (including those in the scope of logistics) are a necessity, without which they cannot function properly, and their development is impossible.

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Omówienie

Przepływy informacyjne w logistyce i ich objętość stają się punktem wyjścia do rozważań na temat logistycznego systemu informacji LIS. Aby wybrać najistotniejsze informacje (pod względem trafności decydowania), o największej wartości i w krótkim czasie, należy zastosować odpowiednie środki i techniki informacyjne. Z tak olbrzymią ilością danych i ich przetworzeniem w wartościowe, użyteczne informacje są w stanie uporać się tylko techniki komputerowe. Celem niniejszego artykułu jest wykazanie ważności znaczenia logistyki w przedsiębiorstwach z sektora agrobiznesu oraz samej informacji logistycznej w agrologistyce.

Autorki skupiły się na przeglądzie literatury z tego zakresu, a także wskazały, w jaki sposób przedsiębiorstwa ze sfery agrobiznesu mogą wykorzystywać systemy informacyjne w celu przetwarzania informacji dotyczących przepływów fizycznych dóbr. Autorki proponują podejście, w którym wykorzystana zostanie metodologia łańcucha krytycznego, zaproponowana przez Goldratta, do scharakteryzowania projektu wdrożenia systemu informacji logistycznej w przedsiębiorstwie ze sfery agrobiznesu.