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LOGISTICS AND SUPPLY CHAIN MANAGEMENT

Received:
11 June, 2019
1st Revision:
11 July, 2019
Accepted:
15 July, 2019

UDC: 334:658.7.01:005.336.1

DOI https://doi.org/10.26661/2522-1566/2019-3/09-08

DESIGN OF LOGISTICS SYSTEMS AS A COMPOSITION OF EFFECTIVE FUNCTIONING OF ENTERPRISE

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Abstract

Given the fact that logistics activity takes place in a very dynamic environment the state of the logistics system should be constantly monitored, analyzed and evaluated. The research is devoted to an important and at the same time complicated issue – the process of designing logistics systems as an important component of the operation of the enterprise. This problem is not fully understood both at the theoretical level and in the field of practical application of design principles. The **purpose** of scientific research is to determine the essence, tasks and features of the processes of designing logistics systems. The authors use such research **methods** as descriptive, comparative and systemic. The essence of the concepts of "project" and "design" is considered in the article. The main tasks of designing logistic systems are determined and possible conditions of their implementation are given. The study found the most important factors determining the success of the project on design of logistics systems. A system of branch logistic functions has been proposed. The factors that determine the success of logistics systems implementation are systematized. On the basis of the research, general recommendations for the design of logistics systems at any type of enterprise have been generated. The list of solutions that are accepted in the process of designing logistics systems has been proposed. Stages and steps in the design of logistics systems have been identified according to the tasks of designing logistic systems. Research results have shown that designing logistics systems should take into account the possible risks of implementing a solution and calculate with the help of mathematical models, possible benefits and losses for the enterprise. In addition recommendations to boost the efficiency of designing logistics systems have been distinguished.

Key words: project, designing, logistics systems.
JEL Classification: D24, L23, L90.

INTRODUCTION

A demanding market and growing competition mean that enterprises need to look for new solutions in the manufacturing process, adapting to customer requirements through systematic product improvement and after-sales service. Measures to improve should be characterized by efficiency, that is, achievement of results, not worse than competitors, but with less costs. Exactly because of this reason entrepreneurs seek to achieve new management and information technology

solutions, as well as in other interdisciplinary areas such as telecommunications, automation, robotics, flexible manufacturing systems, materials science and microelectronics. The constituent increase in the efficiency of the enterprise is the development of a logistics system that requires careful preparation. Above all, the key to the efficient operation of logistics systems is the high level of their design.

LITERATURE REVIEW

Theoretical substantiation of project management and designing is at the core of the studies of domestic and foreign researchers, among them: Razu (2006), Bjeg'juli (2002), Burimenko et al (2017), Denysenko et al. (2016), Larson and Gray (2011), Mykytiuk (2014), Rumjanceva et al (1996), Balakrishnan et al (2017), Morris (2013), Schwalbe (2004), Söderlund (2004), Turner (1996) etc.

Implementation of logistics systems and their impact on the functioning of enterprises is considered in the works of: Hemamala et al (2017), Ballou (1995), Bostel et al (2005), Kuhn and Schmidt (1988), Multaharju and Hallikas (2015), Göpfert and Wellbrock (2016), Han (2019) and others.

PAPER OBJECTIVE

The paper purpose is to study the essence of the design of logistics systems, the definition of its objectives, the characteristics of its stages and the development of practical recommendations for its implementation at enterprises of all types.

RESULT AND DISCUSSION

In modern conditions of functioning of enterprises, aspects related to optimization of their activities play an important role. The introduction of logistics systems in a market economy is an important factor in the development of entrepreneurship. When designing and refining logistics systems, it is necessary to have a sufficient level of data, the accounting of which, as well as collection and processing, must be continuous. However, for further familiarization with the essence, features and methods of designing logistics systems, the definition of the term “project” must be done (Table 1):

Table 1

Approaches to the definition of “project”

Concept	Definition
Project	System complex of planned (financial, technological, organizational, etc.) documents containing a complex system model of actions aimed at achieving a certain goal (Razu, 2006)
	A sequence of interrelated events occurring during a limited time period, which are aimed at achieving a unique, but at the same time, certain result (Bjeg'juli, 2002)
	A comprehensive, one-time event, limited in time, budget, resources, as well as clear performance guidelines tailored to the needs of the customer (Larson and Gray, 2011)
	The project is one that includes the idea (problem), the means of its implementation (all solutions of the problem) and the results obtained in the process of implementation (Mykytiuk, 2014)
	The project always focuses on the result, on the achievement of certain goals, on a specific subject area (Burimenko et al, 2017)

Consequently, the project is a plan, a scheme, a goal that should be implemented. In turn, designing is the process of creating a project – a prototype of the predicted or possible object (state).

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Designing a logistics system is a multi-faceted, multi-criteria and multi-stage process. This task requires taking into account a number of conditions and technological assumptions, and should:

- characterized by a systematic approach;
- use the knowledge of many disciplines in scientific fields such as: management, sociology, science of safety and defense, mathematics, computer science, transport, telecommunications, engineering, information technology, automation and robotics;
- be interdisciplinary;
- use mathematical models and simulations.

Designing logistics systems at the enterprise is possible under different conditions and may have different end goals:

- designing logistics systems in an existing company that has not yet had such a solution (internal transport subsystem, storage, procurement, distribution);
- development of a functioning logistics system (for example, automatic identification, packaging, palletizing, flow control of the material on the production line);
- development of the logistics system as part of the newly created company;
- design of logistic objects (for example, modern warehouses based on WMS);
- design of the flow of material goods and information in the logistics system, which includes participants in the upper and lower parts of the supply chain (for example, using the concept of "JIT" and automatic identification);
- development of logistics processes, including ERP class systems (transport, storage, packaging, customer service and ordering).

In the design process, there are various options for solutions in those or other areas, each of which can reach the logistical goal. Most importantly, in combination with each other in one system, they will give a synergistic effect (Razu, 2006). A list of possible solutions related to this or other aspect of the design process of logistics systems is presented in Table2.

Table 2

List of solutions that are accepted in the process of designing logistics systems

The component of the process	Questions that need to be addressed
Transport	- Choice of vehicle type - Definition of travel routes
Stocks	- Storage strategy - Registration of documents - The size of the buffer stock - Short-term forecasting of sales
Services	- Collect information about customers' needs and expectations - Response to needs and expectations
Making orders	- Ordering - Data processing - Data analysis
Storage	- Use of warehouse space - Distribution of assortment - Configuration of the warehouse
Inland transport	- Selection of equipment - Storage / reception
Packaging	- Movement - Storage - Protection
Production planning	- Aggregation of volume of production - Planning time to perform certain operations
Distribution	- Location, number and size of objects - Demand for objects

Project management involves achieving the goal in accordance with the defined requirements, taking into account the constraints on terms, cost and quality indicators (Rumjanceva et al, 1996). The main precondition for the development and implementation of logistics solutions is the expected benefits of improving the company's performance. An undisclosed issue is the development of an integrated logistics system for the enterprise. The essence of the project is to integrate the branched activity, which is classified as a logistical enterprise. Consequently, the development and implementation of the logistics system is related to the restructuring of the company and applies to all areas of its operation. Therefore, we can assert that the design of logistics systems is intended to perform a number of tasks at the micro and macro levels (table 3).

Table 3

Tasks of designing logistic systems

At the micro level	At the macro level
Tasks of optimal progress of the material flow in the production system	Tasks for placing elements of logistic infrastructure (warehouses, terminals)
Tasks of placement of capacities, equipment, workplaces, goods in the warehouse	Tasks for the design of cargo delivery systems
Task designing warehouses	Complex tasks of distribution systems design

The process of designing the logistics system must be preceded by:

- definition of the goals, place and role of the developed system in the company's strategy and its tasks;
- definition of logistics solutions used at similar enterprises;
- determination of criteria for evaluating the developed system;
- definition of the budget of the developed system.

The following stages and activities can be distinguished in the process of designing logistics systems (table 4).

Table 4

Stages and steps in the design of logistics systems

Stage	Name of the stage	Actions
1	2	3
I	Determining external conditions, defining the problem and determining the quality pattern of the designed system	- definition of the design purpose and its utility functions; - business case for system design; - determining the number and structure of streams of entrances and exits of the system; - defining the system quality standard; - defining financial, technical, legal and ecological restrictions.
II	Development of the system concept	- identification of material goods and information flows in the system; - description of the transformation processes of material goods and information; - determining storage needs and methods of storing material goods and storage parameters; - determining the needs of means of transport, transport technology and parameters of transport routes; - establishing parameters of logistics processes; - determining the costs of logistics processes; - establishing system management methods.

Table 4 continuation on the next page

Table 4 continuation

1	2	3
III	Analysis and evaluation of system opportunities	- system functioning analysis; - system assessment in terms of costs, technical capabilities, time, parameters of management and executive processes; - selection of the most advantageous system opportunities.
IV	Implementation of the selected opportunities and development of the system functioning technology	- detailed analysis of the selected system opportunities; - developing technology for implementing executive processes; - defining information flow technology; - developing management process technology

After the completion of the project, which is preceded by an analysis and evaluation of possible options, the technology of the system is being implemented and developed. Since the implementation of the logistics system will affect all the company's functions, it must be carefully prepared and implemented in a very short time.

The most important factors determining the success of the project can be included (Larson and Gray, 2011):

- mutual understanding and trust in the organization that manages the project;
- the correct definition of project constraints: the scale of the project, time, cost, quality;
- responsibility, trust and honesty of senior management, real support of the project by the senior management;
- focusing on people in project management (taking care of their knowledge development, raising competencies, creating an appropriate incentive system and ensuring an adequate flow of information);
- the ability to make the right decisions from the top management;
- rapid response of the main management to emerging problems;
- appointment of competent people to the position of project managers;
- experience in implementing projects (both employees and managers), proper control over timely progress of work;
- identification of risks in the project, risk management skills, monitoring and control of project costs;
- clearly defined project implementation strategy, depending on the nature of the project, the project's organizational structure, specificity and scale of tasks (correct definition of the principles of cooperation, hierarchy and subordination);
- proper management of relations with the project stakeholders;
- use of IT tools that support project management in an organization.

Logistics system design is primarily aimed at minimizing logistical risks at all levels of the hierarchy of management of the logistics system (table 5). Incorrect configuration of the logistics system leads to increased costs for logistics and lower customer service, in which case it is necessary to decide on the improvement of the logistics system of the company. This is a complex issue with an interdisciplinary nature and therefore the improvement of the logistics system requires multidisciplinary analysis.

Table 5

Risks at different levels of logistics chain management

Levels of logistics chain management	Risks of logistics chain management
Strategic management	Inadequate choice of enterprise strategy, inadequate goals and objectives, incorrect or inefficient planning
Planning and coordination	Deviation from implementation schedules, inefficient allocation and provision of necessary resources
Operational management	Inconsistency of actual indicators with planned values, late adoption of corrective actions, etc.

Realization of separate logistic purposes can be provided by system of branch logistic functions, namely:

- planning of the production program;
- planning of the production process;
- planning of the use of power;
- planning of material flow;
- internal production transportation;
- production control;
- operational management of production;
- ecology of production processes;
- packaging.

Logistics activity takes place in a very dynamic environment, so the state of the logistics system should be constantly monitored, analyzed and evaluated. The goal of improving the logistics system of the company is to increase the efficiency of logistics processes and improve the company's image on the market. The effect of optimizing a logistics system can be as follows: limiting the number of objects, for example, by consolidating them, changing their location or expanding the system by increasing the number of exploited distribution objects. The main criterion for change is to increase the efficiency of the logistics system and minimize overall logistics costs while maintaining the desired level of customer service.

The modern organization and operational management of production (material flows) must meet certain requirements, namely (Denysenko et al, 2016):

- providing rhythmic, coordinated work of all production units on a single schedule and even output;
- ensuring maximum continuity of production processes;
- ensuring the maximum reliability of planned calculations and the minimal complexity of planned work.

A prerequisite for optimizing the logistics system is the availability of a diagnostic system that would provide the enterprise management apparatus with the necessary data on the state of the subject, which would be the basis for decision making and forecasting for the future. The diagnosis of the operating system will have the effect of detecting its defects. Designing logistics systems should take into account the possible risks of implementing a solution and calculate with the help of mathematical models, possible benefits and losses for the enterprise.

In order to increase the efficiency from the practical results of designing logistics systems, the following recommendations should be distinguished:

1. Intelligent demarcation and correct decomposition of project objectives.
2. When designing a logistics system of an enterprise it is recommended to use information technologies that would allow visualization of the future logistic model for all its participants.
3. Development of an integrated diagnostic system for defects in the functioning of the logistics system.

CONCLUSIONS

The subject of research combines engineering issues with the expected level of efficiency of the movement of material flow and related information. The issue of minimizing mistaken decisions during the design of logistics systems remains relevant. The problem needs further study, in particular the study of the application of innovative technologies in the field of process simulation and the development of an integrated model for assessing the state of the logistics system.

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ПРОЕКТУВАННЯ ЛОГІСТИЧНИХ СИСТЕМ ЯК СКЛАДОВА ЕФЕКТИВНОГО ФУНКЦІОНУВАННЯ ПІДПРИЄМСТВА

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Зважаючи на той факт, що логістична діяльність відбувається в дуже динамічному середовищі, стан логістичної системи слід постійно контролювати, аналізувати та оцінювати. Дослідження присвячено важливому і водночас складному питанню – процесу проектування логістичних систем як важливої складової функціонування підприємства. Ця проблема не повністю вивчена як у теоретичному рівні, так і в області практичного застосування принципів проектування. Метою наукового дослідження є визначення сутності, завдань та особливостей процесів проектування логістичних систем. Предмет дослідження поєднує інженерні питання з очікуваним рівнем ефективності руху матеріального потоку та супутньої інформації. У роботі використані наступні методи дослідження: описовий, порівняльний, системний. В статті розглянуто сутність понять «проект» та «проектування». В ході дослідження визначено основні завдання проектування логістичних систем та наведено можливі умови їх впровадження. Систематизовано чинники, що зумовлюють успіх впровадження логістичних систем. На основі проведеного дослідження сформовано загальні рекомендації щодо проектування логістичних систем на підприємствах будь-якого типу, запропонована система галузевих логістичних функцій. Запропоновано список рішень, які приймаються в процесі проектування логістичних систем. В ході дослідження були визначені етапи проектування логістичних, відповідно до можливих завдань проектування логістичних систем. Результати досліджень показали, що при проектуванні логістичних систем слід враховувати можливі ризики впровадження рішення і розраховувати за допомогою математичних моделей можливі вигоди і збитки для підприємства. Практичною цінністю проведеного дослідження є запропоновані рекомендації щодо підвищення ефективності проектування логістичних систем.

Ключові слова: проект, проектування, логістичні системи.

ПРОЕКТИРОВАНИЕ ЛОГИСТИЧЕСКИХ СИСТЕМ КАК СОСТАВЛЯЮЩАЯ ЭФФЕКТИВНОГО ФУНКЦИОНИРОВАНИЯ ПРЕДПРИЯТИЯ

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Учитывая тот факт, что логистическая деятельность происходит в очень динамичной среде, состояние логистической системы следует постоянно контролировать, анализировать и оценивать. Исследование посвящено важному и одновременно сложному вопросу – процесса проектирования логистических систем как важной составляющей функционирования предприятия. Эта проблема не полностью изучена как в теоретическом уровне, так и в области практического применения принципов проектирования. Целью научного исследования является определение сущности, задач и особенностей процессов проектирования логистических систем. В работе использованы следующие методы исследования: описательный, сравнительный, системный. В статье рассмотрена сущность понятий «проект» и «проектирование». Определены основные задачи проектирования логистических систем и приведены возможные условия их применения. Систематизированы факторы, обусловливающие успех внедрения логистических систем. На основе проведенного исследования сформированы общие рекомендации по проектированию логистических систем на предприятиях любого типа, предложена система отраслевых логистических функций. Предложен список решений, которые принимаются в процессе проектирования логистических систем. Этапы проектирования логистических систем были определены в соответствии с задачами проектирования логистических систем. Результаты исследований показали, что при проектировании логистических систем следует учитывать возможные риски внедрения решения и рассчитывать с помощью математических моделей возможные выгоды и убытки для предприятия. Кроме того, были выделены рекомендации по повышению эффективности проектирования логистических систем.

Ключевые слова: проект, проектирование, логистические системы.