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MECHANIZMY ZARZĄDZANIA PROJEKTAMI I LOGISTYKI W OKRĘTOWNICTWIE

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Adnotacja. Celem badań jest określenie cech kształtowania systemu logistycznego projektu oraz uzasadnienie zasad zarządzania projektami w logistyce przedsiębiorstwa budownictwa okrętowego. Przedsiębiorstwa budownictwa okrętowego są zorientowane na projekt przedsiębiorstwa z macierzową strukturą organizacyjną, gdzie metody i modele zarządzania projektami i logistyki aktywnie współdziałają. Zbudowane modele zarządzania projektami w logistyce mają na celu rozwój systemu logistycznego przedsiębiorstwa i zarządzania przepływem zasobów, które zachodzą przez system na wszystkich etapach cyklu życia projektu. Zarządzanie projektami okrętowymi charakteryzuje się złożonością i dynamicznością, co wymaga racjonalnego logistycznego zarządzania zasobami projektów związanych ze stałym zarządzaniem zmianami w strukturze relacji między przedsiębiorstwami partnerami, jego powiązaniem ze środowiskiem zewnętrznym i funkcjonowaniem istniejących procesów biznesowych. Funkcjonalny i organizacyjny model systemu logistycznego przedsiębiorstwa jest w stanie zapewnić moc systemu logistycznego, rozwiązać problemy zarządzania kosztami, zaoferować niezbędny poziom usług w realizacji projektów. Zintegrowane systemy informatyczne zarządzania projektami w logistyce pozwolą przedsiębiorstwu odpowiadać czynnikom konkurencyjności.

Słowa kluczowe: struktura sieci projektu, cykl życia statku, funkcjonalny, organizacyjny, model informacyjny, IDEF, SADT, moc systemu logistycznego.

PROJECT MANAGEMENT AND LOGISTICS MECHANISMS IN SHIPBUILDING

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Abstract. The aim of the study is to determine the features of the formation of the project logistics system and substantiate the principles of project management in the logistics of a shipbuilding enterprise. Shipbuilding enterprises are project-oriented enterprises with a matrix organizational structure, where methods and models of project management and logistics actively interact. The constructed models of project management in logistics are aimed at developing the enterprise's logistics system and managing the flow of resources that pass through the system at all stages of the life cycle of the project. The functional and organizational models of the enterprise's logistics system are able to provide the logistics system capacity, solve cost management issues, and offer the required level of service in the implementation of projects. And integrated information systems for project management in logistics will allow the enterprise to comply with the factors of competitiveness.

Key words: project network structure, ship life cycle, functional, organizational, information model, IDEF, SADT, logistics system capacity.

МЕХАНІЗМИ УПРАВЛІННЯ ПРОЕКТАМИ ТА ЛОГІСТИКИ У СУДНОБУДІВНОМУ ВИРОБНИЦТВІ

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Анотація. Метою досліджень є визначення особливостей формування логістичної системи проекту й обґрунтування принципів управління проектами у логістиці суднобудівного підприємства. Суднобудівні підприємства є проектно-орієнтованими підприємствами з матричною організаційною структурою, де активно взаємодіють методи та моделі управління проектами і логістики. Побудовані моделі управління проектами в логістиці направлені на розвиток логістичної системи підприємства й управління потоком ресурсів, які походять через систему на всіх етапах життєвого циклу реалізації проекту. Управління суднобудівними проектами характеризується складністю та динамічністю, що вимагає здійснення раціонального логістичного управління ресурсами проектів, пов'язаних із постійним управлінням змінами у структурі зв'язків між підприємствами партнерами, його взаємозв'язків із зовнішнім середовищем і функціонуванням бізнес-процесів. Функціональна й організаційна модель логістичної системи підприємства здатна забезпечити потужність логістичної системи, вирішити питання управління витратами, запропонувати необхідний рівень сервісу в реалізації проектів, а інтегровані інформаційні системи управління проектами у логістиці дозволять підприємству відповідати факторам конкурентоспроможності.

Ключові слова: мережева структура проекту, життєвий цикл судна функціональна, організаційна, інформаційна модель, IDEF, SADT, потужність логістичної системи.

Introduction. The activity of modern shipbuilding enterprises is characterized an increasing complexity of the tasks facing them, due to the variety of emerging problems, the high degree of variability of the external environment and the need to search for new opportunities to increase competitiveness. Along with the main factors of competitiveness of projects of shipbuilding enterprises, such as time, cost, quality, it is necessary to add logistics.

Logistics at shipbuilding enterprises has its own features, which are typical for project-oriented enterprises, among which it is necessary to pay attention to the following: unit production, significant labor intensity, information connections, number and cost of counterparty works, supplies to the project in the total cost of the ship exceeds 50%, complex financing schemes. The logistics system is based on the planned satisfaction of the project needs and the company's portfolio. An urgent task to be solved is to substantiate and develop the mechanism for the development of logistics in project management.

Logistics in project management is due to the presence of many flow processes that require management. This is due to the fact that the implementation of the project is supported by various types of collateral. The task of logistics in project management is to create a resource flow management system based on information flows of resource movement and control of material flows, technology definition and resource allocation for project work, prediction timely supplies to the project. It should be noted that logistics should take into account all flow processes and manage the material, financial, service, information flows of the project, which is implemented in a sequence of phases, stages and life cycle activities in accordance with the construction of a chain of interaction of all participants. The logistics of the project is considered as an element of the shipbuilding enterprise system, where the following projects are implemented: projects, programs, order portfolio of the enterprise.

The enterprise order portfolio, in turn, is a strategic plan and requires the application of the concept and methods of project management in the process of designing logistics systems with constant changes in them and solving problems of process flow management in the logistics system of the enterprise. Thus, the flow processes in the logistics system are the object of *project management in logistics*, where the issue of creating a logistics system of the enterprise and its subsystems, including the objects of logistics infrastructure, constant adaptation of enterprises to the changing environment.

As a result, shipbuilding enterprises solve logistics management issues in two aspects:

- Logistics in project management is to improve the efficiency of the flow management system of enterprise projects.

- Project management in logistics is to manage the investment, financial and operational activities of the project portfolio for the shipbuilding enterprise, taking into account the environment in which the enterprise operates.

These aspects interact and complement each other. Project resources form the pool of resources of the enterprise and are an integral part of both operational activities and strategic program. The logistics of each shipbuilding enterprise project forms a value chain at the enterprise order portfolio level. This issue is relevant for modern shipbuilding enterprises that are actively developing project management technologies in logistics.

Management of material, information and financial flows of enterprises based on the design methods of modern logistics systems is an urgent issue, revealed in the works (Denysenko, 2010: 336), (Rudkovskiy, 2011: 83) and other scientists. When managing projects in logistics, methods and models of project management are used in the process of designing and forming logistics systems. In (Fateev, 2014: 106), the functional decomposition of the operating system of design and construction of transport vessels, which is based on the principles of logistics, is revealed. Modern schemes of interaction of enterprises with the logistics center are revealed in (Kozyr, 2016: 91), where the functions of the logistics integrator are defined. The peculiarities of the operating system and management structure of a project-oriented enterprise, where the mechanism of functioning of the project management office as a communication element for project management in logistics is revealed in (Fateev, 2020: 48). Building a project logistics system using a scientific and practical approach is an urgent issue for solution.

The aim of the study. To determine the features of the formation of the project logistics system and substantiate the principles of project management in the logistics of a shipbuilding enterprise.

Main part. The logistics system of the project is based on the production process. The production process at the shipbuilding enterprise is implemented in stages, its formation begins: Research work – Design – Production preparation – Production – Testing – Operation – Ship maintenance – Disposal.

The first and second stages form the main parameters of the logistics system of the project. Research work provides the necessary results for the creation of technological processes, methods of organization and production planning. This stage influences and lays down the main factors of production competitiveness and projects for the creation of new ships.

The design process consists of the stages of development for design documentation: terms of reference, technical design, working design. Shipbuilding projects relate to project-oriented (individual, one-off) production, therefore, at this stage, a project value chain is being planned. The design process begins with an agreement with the shipping company, where the technical and operational requirements for the vessel are determined and the final cost of the project is formed. The approved project is the basis for the development of design documentation and production preparation.

Preparation of shipbuilding production – the formation of a set of logistics processes that ensure the technological readiness of the enterprise for the implementation of the project. At the heart of the logistics system at the stage of preparation of the project, the process of rationing of material and labor resources is being implemented. The rationing of the consumption of materials should be understood as the establishment of the planned rate of their production consumption for the work of the project. Production rates of expenses for materials and labor resources in the project are calculated per planning and accounting unit (fig. 1). The planning and accounting unit is determined by the design characteristics of products, technological and organizational features of the production process and includes the following levels: Project (vessel) – Design and technological element – Technological set – Brigade set (POO). At this stage, technical and economic indicators are established for a package of works that are capable of ensuring the optimal amount of expenses, both material and labor, for the project as a whole.

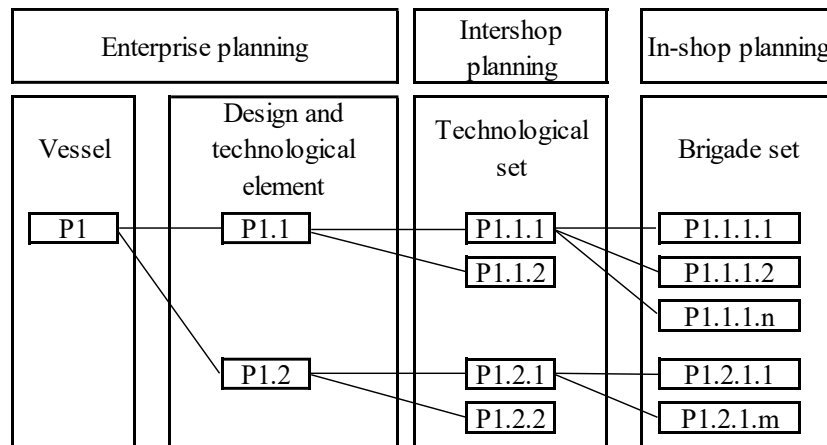


Fig. 1. System of planning and accounting units in the ship design

The production stage lasts from the first production operation to the completion of the shipbuilding project (completion of tests, delivery of the ship to the customer) (fig. 2). At this stage, the logistics of the project is determined by the uneven resource flow. At first, relatively slowly, during the formation of the ship's hull, and then, when installing the ship's equipment, the costs increase sharply. During the test period, costs increase the least actively. The production stage of the project is characterized by the duration of the production cycle, labor intensity, cost of work.

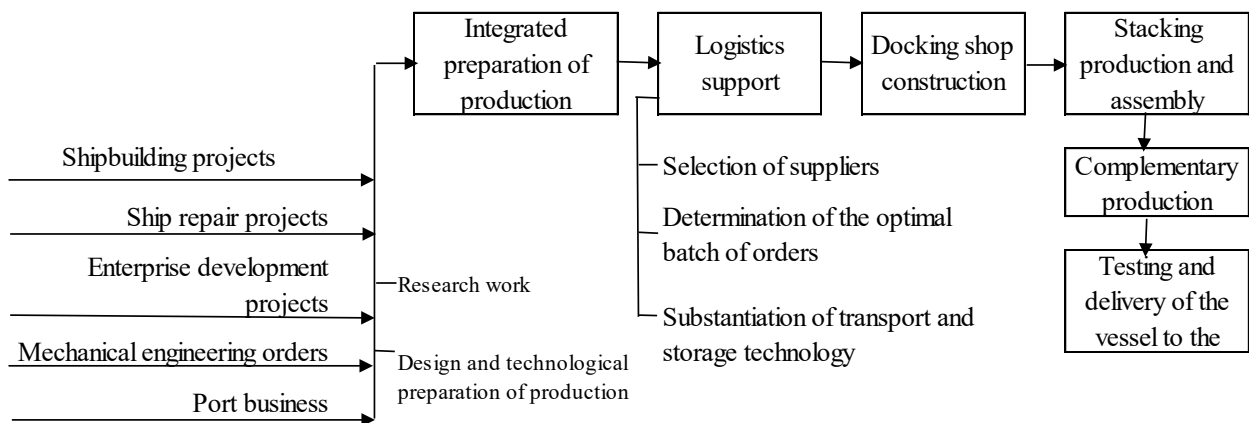


Fig. 2. Production process of project implementation

The value of the vessel is formed at all stages of the life cycle of the project, since the chain of formation of the project value consists of operations and business processes that take place between all participants, creating a logistics network structure of the project. Operations management from the receipt of the order forms the supply chain and monitors the project implementation process.

Shipbuilding enterprises support projects throughout the life cycle of the vessel (fig. 3). Therefore, enterprises in their business activities implement the following business processes: shipbuilding projects, maintenance of ships in the process of their operation, the implementation of projects for modernization and disposal of ships.

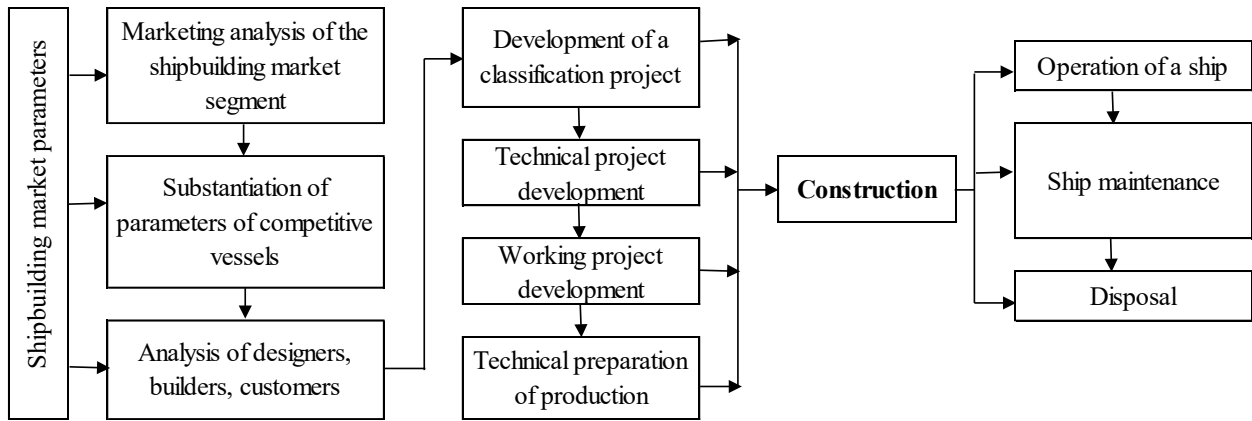


Fig. 3. Scheme of the logistics process of the shipbuilding project

Project management in logistics covers all aspects of business activity of the enterprise. The logistics system is characterized by the presence of a significant number of projects and complexity of the interaction between them. Therefore, the logistics system permeates the entire organizational structure of the enterprise and this necessitates its management by all departments to build logistics chains. The model of the logistics system of the enterprise is a set of functional, organizational and information models, where the organizational model describes the composition and structure of the enterprise, and the information model describes the flows and content of information that exist in functional and organizational models (fig. 4). It should be noted that the IDEF methods are basic, they can be supplemented by other methods of the SADT methodology, depending on the level of detail of the logistics processes. The functional model of the enterprise allows to carry out the system analysis of logistics functions and processes at the enterprise.

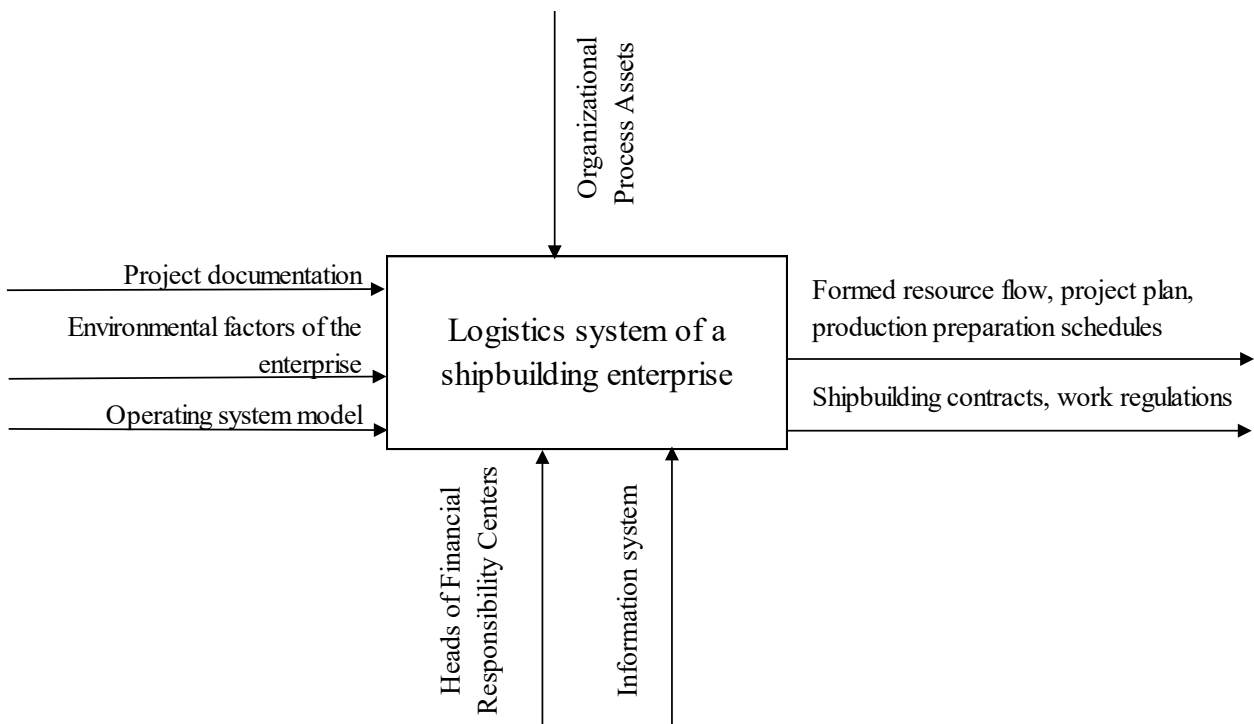


Fig. 4. Planning and design of the logistics system of the enterprise

A-0 «Logistics system of a shipbuilding enterprise»

The enterprise's order portfolio provides the *capacity of the logistics system*, which is formed subject to the rational organization of supply chains. The resource flows of each project reflect the relationship of the logistics system with the environment and determine its capacity. The capacity of the enterprise's logistics system reflects the maximum capabilities of the logistics infrastructure in the ability to meet project commitments. The capacity management of the logistics system is based on modeling methods and involves solving the following tasks:

- formation and management of the production program, which corresponds to the portfolio of orders for the calendar period;
- development of an algorithm for changes in the production program in the event of a change in the balance model of the order portfolio;
- substantiation of the movement of material, financial and information flows.

The capacity of the logistics system is provided by the workload of the production system of the enterprise on the basis of concluded contracts for the calendar period. The value chain is formed throughout the life cycle of the project. A supply chain is planned and designed for each ship construction and repair project. An integrated logistics supply chain is planned for the company's order portfolio, based on the interaction of the supplier system, the warehouse system and the information system of the enterprise. This process is implemented through the document management procedure and the logistics management information system.

The capacity of the logistics system is determined by the categories: continuous service improvement, cost management, elimination of unnecessary losses. Improving the service is achieved through the development of service capabilities. The work (Kozyr, 2016: 91) proposes the creation of an independent logistics center that provides logistics services of the 4PL class of logistics providers. The task of the logistics center is to form a single information space for the purpose of sharing information resources in the implementation of shipbuilding and ship repair projects. Cost reduction is possible through the construction of an effective organization of management resources. The authors of (Fateev, 2020: 48) defined the structure of the project management office. The key function includes control over the allocation of resources for projects, formation of a corporate pool of necessary material and technical resources. Elimination of unnecessary losses is achieved as a result of process-oriented project management (Zaporozhets, 2018: 183), through determining the cost of each process in enterprises with the required level of detail, forming a cost structure for each technological set, monitoring costs for each center of financial responsibility.

It should be noted that the information flow of resource management is constantly growing, therefore, the efficiency of managing this process increases with the use of logistics information technologies. Internal operations for planning and monitoring project resources are implemented on the basis of ERP, CRM class systems, and information flows interact with the logistics center, business processes, subcontractors and other stakeholders of shipbuilding enterprises, building an information architecture of integrated supply chains.

Conclusions. Shipbuilding enterprises are project-oriented enterprises with a matrix organizational structure, where methods and models of project management and logistics actively interact. The constructed models of project management in logistics are aimed at developing the enterprise's logistics system and managing the flow of resources that pass through the system at all stages of the life cycle of the project.

Shipbuilding project management is characterized by complexity and dynamism, which requires rational logistics management of project resources related to the constant management of changes in the structure of relations between partner enterprises, its relationship with the external environment and the functioning of existing business processes.

The functional and organizational models of the enterprise's logistics system are able to provide the logistics system capacity, solve cost management issues, and offer the required level of service in the implementation of projects. And integrated information systems for project management in logistics will allow the enterprise to comply with the factors of competitiveness.

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