TECHNOLOGY, CREATIVITY, IMPLEMENTATION

AGILE-METHODOLOGY IN SHIPBUILDING PROJECT MANAGEMENT IN CONDITIONS OF CLUSTER INTEGRATION

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Summary

The aim of the article is to study the features of the development of cluster systems for the construction of transport vessels and develop on this basis recommendations for the use of agile methodology in the mechanisms of effective management in cluster integrations. The characteristic features of a project-oriented operating system with a matrix organizational structure have been determined. The principles of the agile methodology have been adapted to the management mechanisms of the shipbuilding cluster system. The examples of the use of agile approaches that complement and strengthen the existing matrix management structure in the shipbuilding cluster system are given. The agile approaches are implemented through: maintaining stable links in the supply chain at all stages of the life cycle of the cluster; focusing the cluster system as a whole on customer needs; creation of cross-functional teams for support and development of human resources; creation of a logistics center in accordance with the agile methodology, which is implemented through short feedback cycles and regular adaptation of supply processes; lean production – from design to production at all stages. It is proposed to develop a corporate information system in business processes and supply chains of the shipbuilding cluster. Information flows connect cluster members, functions, supply chain management tasks, as well as different levels of management decision-making. Team cooperation between representatives of project organizations and the project management office of shipbuilding enterprises will ensure the development of the information system as a whole, as well as the integrity and consistency of individual elements. This confirms that the agile methodology provides flexibility in management and operational adaptation to changes in order to achieve the main goal – the competitiveness of cluster integration and its elements.

Keywords: transport vessels, flexible technologies, cognitive modeling, iterative-incremental approach, predictive mechanisms, project-oriented production, cross-functional teams.

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1. Introduction

The current state of economic development is characterized by the emergence and development of new relationships, the basis of which is the cooperation of manufacturers, suppliers, users in order to integrate business process management throughout the product life cycle. The influence of non-production factors on the economic system is increasing: supply, sales, service, etc. This requires the search for new approaches to management mechanisms, which are based on the development of inter-industrial relations, the integration of communication channels between suppliers, users, manufacturers.

The leading countries in the shipbuilding market have accumulated positive experience in creating strategic alliances in the form of *economic cluster systems*. Using the synergy of clusters, shipbuilding enterprises ensure their competitiveness through effective cooperation in the use of knowledge, financial resources, technologies, means of production. The peculiarity of cluster integrations is the participation of business structures, public administration bodies, scientific and educational institutions. At the same time, a significant factor is the real possibility of activating small and medium businesses, implementing socially important regional and national programs *(Fateev N.V., 2014; 106).*

The special features of shipbuilding cluster systems management are described in *(Kozyr, B. Yu., 2016; 91), (Fateev N.V., 2014; 106).* In work *(Zaporozhets I.M., 2018; 183)*, the scheme of decomposition of production processes as a basis of formation of network model of the project in the vessel construction is offered and substantiated. These studies are mainly aimed at the development of planning models for shipbuilding projects. Problems of project implementation management in the context of cluster integration, metrics for assessing their effectiveness in the literature are insufficiently disclosed.

Modern mechanisms of project management using flexible technologies are described in detail in the works *(Stelman, E., 2017), (Kon Mayk, 2018).* They are based on the specifics of software development project management. In 2018, the Project Management Institute (New York) published a manual "Agile: a practical guide" *(Agile: A Practical Guide, 2018),* which reveals ways of transition in project management from predictive mechanisms to flexible technologies based on iterative-incremental models.

Shipbuilding is a production system with a high degree of uncertainty. This factor is the reason why shipbuilding projects are characterized by high rates of change, complexity and high level of risk. When using traditional predictive approaches to management, these features lead to problems that are difficult to solve using traditional management mechanisms. In the early 2000s, the Agile approaches presented in the Agile Manifesto of Software Development were created *(Stelman, E., 2017), (Kon Mayk, 2018)*. The basis of the agile methodology is flexible models and mechanisms implemented in the format of iterative refinement to achieve the best end results of projects. Although these principles have emerged in the field of software development, since then they have been successfully used in many other areas *(Agile: A Practical Guide, 2018).*

The adaptation of the values and principles of the agile methodology to the management mechanisms of shipbuilding cluster integration will enable the members of the cluster and the cluster as a whole to obtain significant competitive advantages, which determines the relevance of the content of the scientific article.

The aim of the research. Introduction of the agile methodology principles into the portfolio management system of transport vessel construction and repair projects in the conditions of cluster integration.

2. Statement of the main research material

The modern shipbuilding cluster is a social and technical system with a high degree of integration *(Zaporozhets I.M., 2018; 183).* The material flow acts as an integrator, as well as the information and financial flows associated with it. According to the object-functional feature, the shipbuilding cluster can be represented as a macrologistic system, which includes shipbuilding enterprises, project, research organizations and shipbuilding educational institutions. Despite the fact that the elements of cluster integration are of different quality, their compatibility is ensured by the unity of goal to which its functioning is subordinated – the construction of competitive vessels that meet the requirements of shipowners. The main factors of competitiveness are the duration of the vessel construction, cost and quality (a complex indicator, including the volume of operating costs, maintainability, etc.)

The characteristic features of the shipbuilding industry are the project-oriented nature of production and the matrix management structure *(Fateev N.V., 2014; 106).* In terms of cluster integration, this generates a number of systemic contradictions on the way of implementing the chosen strategy when distributing resources between cluster members, individual projects and programs. Management decisions at different levels have to be made in conditions of abrupt changes in the situation, which are not always foreseen in conditions of incomplete and inaccurate information. Therefore, the problem of managing its sustainable functioning and development is of paramount importance for cluster integration. To solve this problem, it is necessary to develop mechanisms of logistic analysis as a decision-making tool in the management of sustainable development of the cluster. The basis of these mechanisms is an integrated concept of streaming of all business processes, which will ensure the validity of the choice of effective options for end-to-end management of material, information and financial flows at all levels. Cognitive modeling is an effective tool for the analysis and management of such production systems. In combination with the methods of system dynamics, cognitive analysis will make it possible to resolve the contradictions inherent in shipbuilding cluster integration.

For the practical implementation of a set of tasks for the development of the shipbuilding cluster management system, it is advisable to use some provisions of the agile methodology. In accordance with the recommendations set out in *(Stelman, E., 2017)*, it is necessary to form a number of cross-functional teams, including specialists from various enterprises and organizations of the cluster, suppliers, customers, consulting firms and others. Creative cooperation as a part of cross-functional teams will provide operative adaptation of a cluster to changes of factors of external and internal environment.

Here are examples of the use of agile approaches that complement and strengthen the matrix management structure existing in the shipbuilding cluster system.

1. Maintaining stable links in the supply chain at all stages of the cluster life cycle *(Fateev N.V., 2014; 106).* This is a complex task, which includes analysis and evaluation of motivational mechanisms of cluster participants, analysis of common challenges and opportunities, collection of proposals for the development of cluster integration. The technology and organization of solving these problems with agile tools does not replace the functions of strategic management, but complements them, involves specialists from various departments and stakeholders in the preparation and implementation of management decisions.

2. Focusing the cluster system as a whole on the needs of customers (shipowners, leasing companies, etc.). At the same time, effective benchmarking, collection and analysis of information are used on the state of the global and regional shipbuilding markets, active use of feedback in the processes of reengineering of cluster business processes. The cross-functional

teams using agile technologies will provide rapid response and adaptation of the cluster system through the preparation and implementation of informed management decisions. This approach will allow cluster members to focus on the values they create in the overall supply chain. These tools are used in teams working on Scrum, a popular way of organizing production processes in agile *(Kon Mayk, 2018).*

3. An important factor in ensuring the competitiveness of the shipbuilding cluster is the quality level of labor resources. The basis of labor quality management mechanisms is a thorough analysis of the global and national labor market, as well as the market of educational services. Shipbuilding requires a fairly large list of workers, engineers and managers. The cross-functional team for the support and development of human resources should provide facilitated interaction of educational institutions of different levels, research centers, technology parks.

4. The strategic direction in the development of the shipbuilding industry is the development of 6D-design technology – 3D modeling combined with the management of the design, construction and operation of vessels in a single information space. To solve problems of this level of complexity, the agile methodology offers an iterative-incremental approach. Its essence is revealed in the agile manifesto *(Agile: A Practical Guide, 2018)* and is aimed at containing the growth of the complexity of the problem. This is achieved by planning and executing work at short fixed intervals, that is, in short cycles.

The system of planning and accounting units is used in shipbuilding and ship repair. The upper level of decomposition consists of shop-stages, work packages performed by a certain production unit. The middle level of decomposition consists of technological sets that are being formed in the process of production planning on the principles of structural and technological unity of work and are the basic elements of calendar-network models of shipbuilding processes. The result of the completion of work on the technological set is the final product of the production unit. This is an incremental result that is required to complete the work of an adjacent production unit. Thus, the use of technological sets in the management mechanisms of shipbuilding is effectively combined with iterative and incremental approaches to agile methodology.

The corporate information system plays a key role in coordinating business processes in the supply chains of the shipbuilding cluster. Information flows connect cluster members, different supply chain management functions and tasks, and different levels of decision-making.

The corporate information system of the cluster can be functionally divided into two parts.

1. The information model of the vessel is formed at all stages of design and technological preparation of production. These works are performed in project organizations and technological services of shipbuilding enterprises.

2. The cluster management information system is a set of hardware, software and information tools that provides decision support at all levels in the elements of the cluster supply chain.

To provide controlled access to the corporate information model database, it is proposed to form a cross-functional team in accordance with the agile methodology. Creative cooperation in the team of representatives of project organizations and the project management office of shipbuilding enterprises will ensure the development of the information system as a whole, as well as the integrity and consistency of individual elements.

5. In work *(Kozyr, B. Yu., 2016; 91)*, the expediency of the organization in the structure of the cluster of shipbuilding and ship repair of the logistics center is offered and substantiated.

Its main functions are cluster modeling and material management. The planning and implementation of processes for the supply of materials and components in warehouses and production sites are an essential factor in the stability of the cluster in a dynamic environment. To build effective delivery mechanisms, it is advisable to use agile recommendations based on a balance of authority and responsibility of performers.

The network model of shipbuilding processes in the cluster system makes it possible to form the list of projects of material and technical resources necessary for the implementation of a portfolio of all nomenclature of technological sets. In accordance with the agile methodology, the logistics center implements short feedback cycles, regular adaptation of supply processes.

6. An important element of the agile methodology is *lean production* – an approach to managing the organization, aimed at improving the quality of production processes by reducing losses *(Stelman, E., 2017), (Agile: A Practical Guide, 2018).* This approach applies to all aspects of the activity – from design to production at all stages. Coordination with the customer at different stages of design will allow obtaining such characteristics of the vessel that will ensure its efficiency during the period of operation. For example, the factors of maintainability of individual elements and the vessel as a whole are formed at different stages of design, and this is an important component of maintenance costs.

3. Conclusions

These examples confirm that the use of Agile principles and values will give flexibility to the matrix management structure inherent in the cluster system of shipbuilding and ship repair. The transition to flexible methodologies in management will ensure rapid adaptation to changes in internal and external factors, which will achieve the main goal – the competitiveness of shipbuilding cluster systems.

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