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FORMATION OF AN INFORMATION SYSTEM FOR STAKEHOLDER MANAGEMENT OF *SHIPBUILDING 4.0* TECHNOLOGY PLATFORM PROJECTS

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In order to create an effective information system for managing the digitalization processes of enterprises and organizations in the shipbuilding industry of Ukraine, their main stakeholders are identified. A methodology for qualimetric ranking of stakeholders by the level of influence on digitalization projects is proposed. In accordance with the main provisions of the theory of project stakeholder management, the information needs of project managers are identified.

Introduction

An urgent problem of further development of Ukraine's economy is the revival of its shipbuilding industry [1–4].

Today, the further development of shipbuilding in the world is associated with the introduction of elements of the *Shipbuilding 4.0* technology platform into the shipbuilding industry. The substantive part of the technological platform involves the introduction of digital technologies at all stages of the product life cycle, the end result of which is the creation of a "digital twin" [5–13]. The adopted main directions of the *Shipbuilding 4.0* technological platform include the development and implementation of digital modeling and numerical experiments, robotization of technological processes, production of new materials, use of additive technologies, the Internet of Things, etc.

Given the global trends in shipbuilding, it is clear that the revival of this industry in Ukraine requires the development and implementation of a number of relevant digitalization projects. The effectiveness of solving project tasks depends on several factors, among which one of the most important is the project management methodology adopted by the project team. Among the constituent elements of the methodology, an important place is occupied by the management processes (Fig. 1) of project stakeholders [14], which in the context of digitalization of management processes requires the creation of an appropriate information system.

Given the significant impact of the shipbuilding industry on the economy of Ukraine, the creation of an information system for managing digitalization projects, in particular by stakeholders of the *Shipbuilding 4.0* technology platform projects, is an urgent scientific and applied task of national importance.

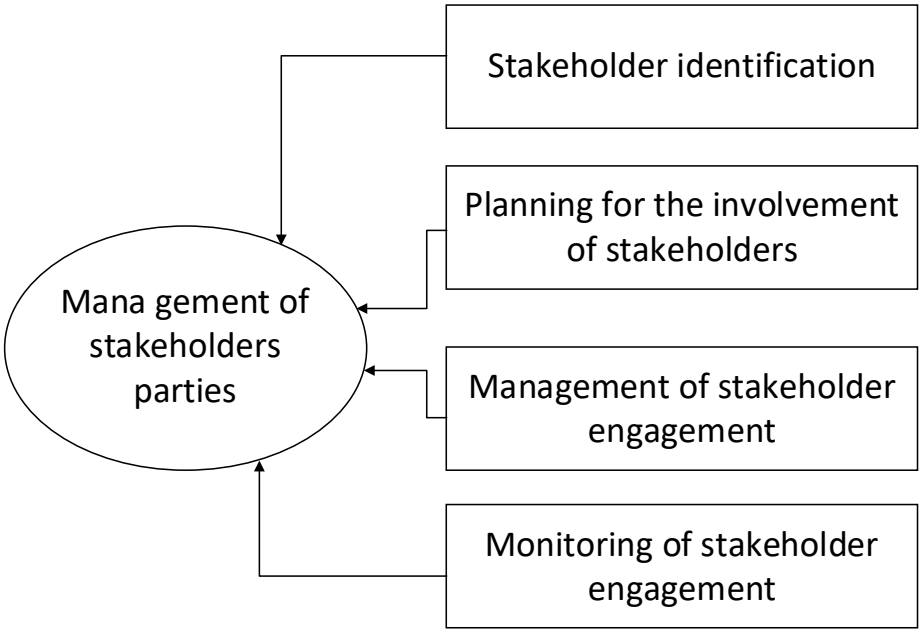

Fig. 1. Stakeholder management processes

Identification of stakeholders in *Shipbuilding 4.0* technology platform projects

According to the definition of the concept of an information system [15], in general, it should contain the following interconnected basic elements: information search and collection units, information storage unit, information processing and transmission unit (Fig. 2).

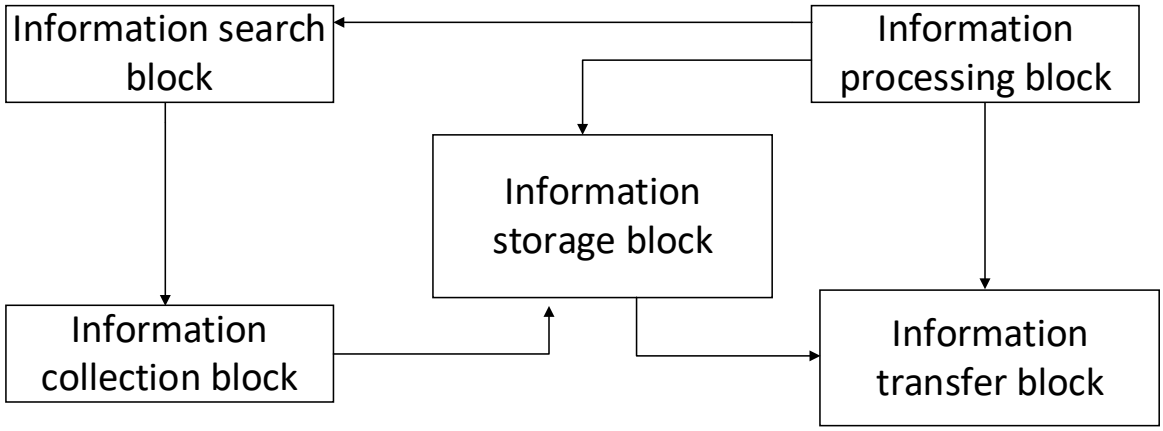

Fig. 2. Main components of the information system

The target function of using the information system for *Shipbuilding 4.0* technology platform projects is to increase the efficiency of digitalization projects by improving stakeholder management:

$$E_1 \gg E_0, \text{ if } E_1 \to \max, \quad (1)$$

where E_1 – is the efficiency of project stakeholder management using the information system;

E_0 is the efficiency of project stakeholder management without the use of the information system.

The main indicators of the effectiveness of the implemented projects are the terms and quality of work performed, project budgets, as well as the amount of value acquired by the project team: knowledge and experience in project management, improvement of the project team's position in the project management services market:

$$\frac{T_{real}}{T_Z} \le 1; \quad \frac{B_{real}}{B_Z} \le 1; \quad \frac{Q_{real}}{Q_Z} \ge 1; \quad K_1 > K_0; \quad P_1 > P_0; \quad L_1 - L_0 > 1, \qquad (2)$$

where T_{real} – project execution time;

T_Z – project implementation time specified in the terms of the contract;

B_{real} – budget of the completed and accepted project;

B_Z – the project budget determined by the terms of the contract;

Q_{real} – quality of the completed and accepted project;

Q_Z – quality defined by the terms of the contract;

K_1, P_1 – the amount of knowledge and experience gained by the project team based on the results of its implementation, respectively;

K_0, P_0 – the amount of knowledge and experience of the project team before its implementation, respectively;

L_1 – the numbered position of the project team in the market for the provision of services after the project is completed;

L_0 – the numbered position of the project team in the service market before the project is implemented.

The creation of a project stakeholder management information system is preceded by the identification of stakeholders [14], as well as the determination of their impact on project performance.

Expert research of the possible range of stakeholders in the development of the shipbuilding industry based on the development and implementation of the *Shipbuilding 4.0* technology platform (representatives of the management of more than 30 major enterprises and organizations of the shipbuilding industry of Ukraine were interviewed) made it possible to develop a generalized structural diagram of project stakeholders (Fig. 3).

The main stakeholders of the Shipbuilding 4.0 technology platform projects include shipbuilding industry enterprises and infrastructure organizations,

authorities, territorial communities, shipbuilding customers, financial and credit institutions, supervisory authorities, and public organizations.

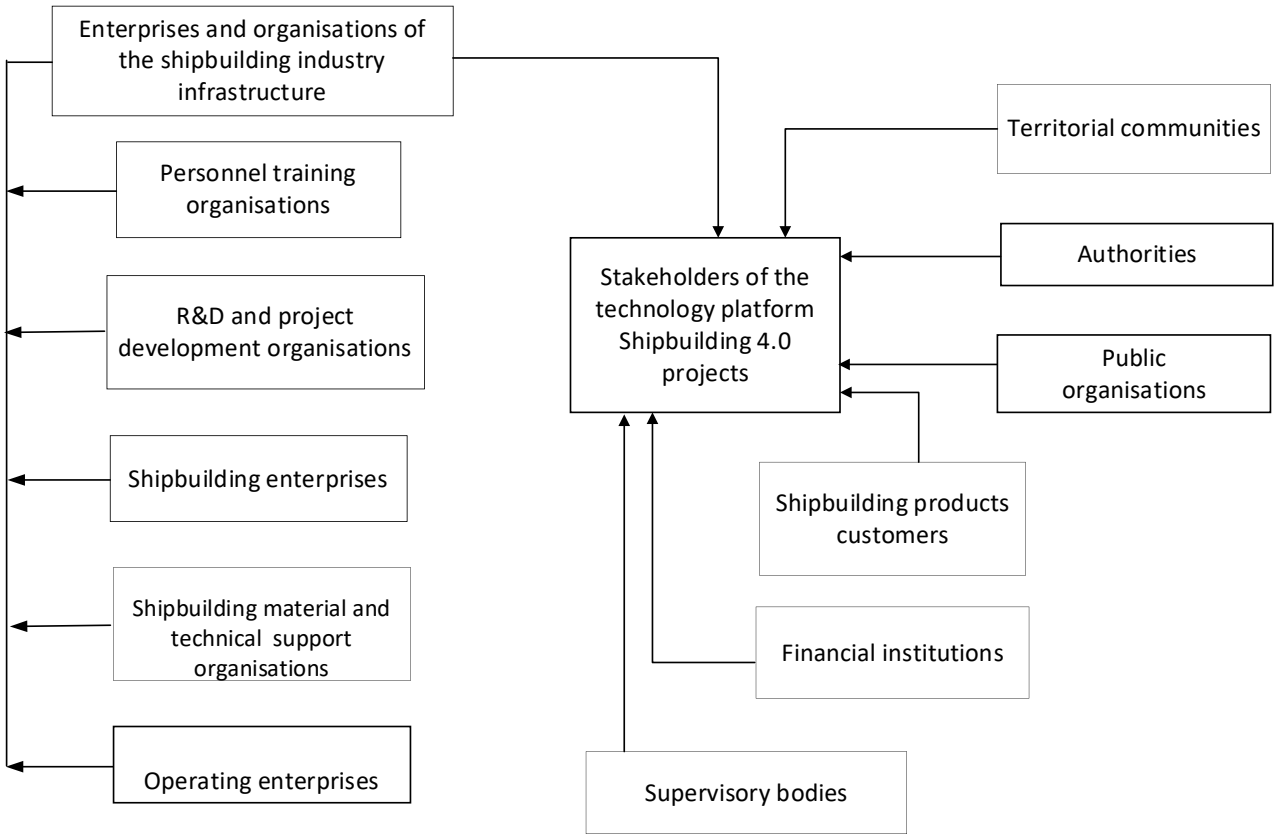

Fig. 3. Block diagram of the main stakeholders of *Shipbuilding 4.0* technology platform projects

According to the proposed structural scheme, the group of enterprises and organizations of the shipbuilding industry infrastructure includes training organizations, research and design organizations, shipbuilding enterprises, shipbuilding logistics organizations, and operating enterprises.

Determining the impact of stakeholders on *Shipbuilding 4.0* technology platform projects

Given the existing models of stakeholder management, the impact of stakeholders in *Shipbuilding 4.0* technology platform projects was determined based on an improved methodology. The methodology is based on ranking stakeholders by their impact on project performance throughout its life cycle. The following qualimetric classification of stakeholder rank is proposed: stakeholders whose impact on the project is critical – rank K; stakeholders whose impact on the project is significant – rank Z; stakeholders whose impact on the

project is insignificant but should be taken into account – rank V; stakeholders whose impact on the project may not be taken into account – rank MV. It should be noted that the ranking of project stakeholders is a dynamic characteristic that depends on the phase of the project and the circumstances that have developed during its implementation:

$$K,Z,V,MV = f\left(F,O\right), \tag{3}$$

where F is the phase of the project life cycle;

O is a set of circumstances that may arise during the formation and implementation of the project and reduce its effectiveness.

In accordance with the life cycle of creating a physical shipbuilding object and its "digital twin" (Fig. 4), as well as the main components of the *Shipbuilding 4.0* technology platform, the ranks of stakeholders are expertly determined according to their accepted classification (Table 1).

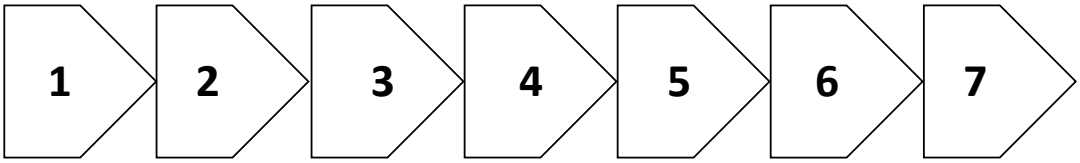

Fig. 4. Phases of the life cycle of creating a physical shipbuilding facility and its "digital twin":
1 – decision-making on the creation of a shipbuilding facility;
2 – development of technical specifications; 3 – design of facility accounting;
4 – facility design; 5 – facility creation; 6 – comprehensive testing;
7 – facility operation, decommissioning and utilization

In the event of unforeseen circumstances in the process of project formation and implementation, the rank of stakeholders is determined according to the accepted classification, but subject to their potential ability to minimize the negative impact of circumstances on project effectiveness.

In determining the stakeholders of digitalization projects, it is necessary to take into account the interests and influence of stakeholders on the "failure" of projects. Potential processes that generate a negative attitude towards *Shipbuilding 4.0* technology platform implementation projects and allow identifying relevant organizations, enterprises, and individuals include the following: economic competition in the domestic and foreign shipbuilding markets; political processes in the country and abroad; military aggression, etc.

Table 1

The rank of stakeholders determined by the level of their influence on the phases of the life cycle of shipbuilding and "digital twins"

Key stakeholders of the projects	Phases of the life cycle of creating a "digital twin" Rank of the project stakeholder						
	1	2	3	4	5	6	7
Public authorities	*K*	*MV*	*MV*	*MV*	*MV*	*V*	*V*
Territorial communities	*K*	*MV*	*MV*	*MV*	*Z*	*MV*	*K*
Shipbuilding enterprises	*K*	*K*	*K*	*K*	*K*	*K*	*V*
Public organizations	*K*	*MV*	*MV*	*MV*	*MV*	*V*	*K*
Supervisory organizations	*K*	*K*	*K*	*K*	*K*	*K*	*K*
Training organizations	*Z*	*MV*	*MV*	*MV*	*MV*	*V*	*V*
Research and development and design organizations	*Z*	*Z*	*Z*	*K*	*Z*	*K*	*Z*
Customers of shipbuilding products	*K*	*K*	*K*	*K*	*K*	*K*	*K*
Financial and credit institutions	*K*	*K*	*MV*	*MV*	*K*	*MV*	*Z*
Logistics organizations	*K*	*K*	*V*	*K*	*K*	*V*	*K*
Operational enterprises	*Z*	*V*	*V*	*V*	*Z*	*K*	*K*

Based on the expert determination of the stakeholders in the "failure" of projects and the developed ranking methodology, it is possible to form a matrix of their rank of influence.

Effective stakeholder management of *Shipbuilding 4.0* technology platform projects is ensured by the availability of relevant information about stakeholders and information about their interests [14]. The formation of a project management information system, including stakeholder management, requires the generalization of such information. At the same time, the information array required for effective management must meet the following conditions:

$$I_{real} \geq I_m, \tag{5}$$

where I_{real} – available information support for stakeholder management processes;

I_m – Necessary information support for effective stakeholder management processes.

In order to determine the information needs for stakeholder management of *Shipbuilding 4.0* technology platform projects, a matrix of the required information support for effective stakeholder management processes was developed (Table 2).

Table 2

Matrix of necessary information support for the processes of effective stakeholder management of Shipbuilding 4.0 technology platform projects

Key stakeholders of the projects	Key relevant information about stakeholders	Significant information about stakeholder interests
Public authorities	Status of the enterprise or organization according to the following criteria: state ownership; belonging to the relevant group on property grounds; availability of institutional initiative; belonging to another state; positioning in the relevant markets of resources and services; degree of influence on other industries	Governmental, technological, economic, political, corporate, and individual interests
Territorial communities		
Shipbuilding enterprises		
Public organizations		
Supervisory organizations		
Training organizations		
Research and development and design organizations		
Customers of shipbuilding products		
Financial and credit institutions		
Logistics organizations		
Operational enterprises		

Conclusions

In the course of the study, we came to specific conclusions.

1. Further development of the shipbuilding industry in Ukraine requires the formation and implementation of relevant digitalization projects based on the *Shipbuilding 4.0* technology platform.

2. The effectiveness of digitalization projects is ensured by the creation of a project management information system.

3. One of the ways to increase the efficiency of digitalization projects is to create an information system for managing project stakeholders of the *Shipbuilding 4.0* technology platform.

4. The determined rank of stakeholders by the level of their influence on the phases of the life cycle of shipbuilding facilities and "digital twins", as well as the

developed matrix of the necessary information support for the processes of effective project stakeholder management, form the elements of the information system for project stakeholder management of the *Shipbuilding 4.0* technology platform.

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