

smooth rolls are defined.

3. Analysis of experimental data shows that the rolling of the workpieces in conditions close to isothermal reduces the pressure of the metal on the rolls in two or more times. This is a confirmation of the plasticity of the metal during its deformation under isothermal conditions.

4. It is established that in the range of heating temperatures of rolling dies 250 - 350 ° C expansion and pressure of metal on rolls at rolling of preparations of aluminum alloys practically does not change. This is due to the lack of hardening of the metal under these conditions of deformation.

5. Rolling of aluminum alloy blanks, in conditions close to isothermal, is recommended to be carried out in dies heated to temperatures of 250 - 350 ° C, at which the values of the expansion values are constant, and the metal pressure on the rolls is minimal.

### References

1. Scriabin S., Polokhov V., Scriabin K. Application of the process of rolling and preparatory streams in the manufacture of hot-deformed stamped forgings from aluminum alloys with an elongated axis and closed sections. Technological systems. 2003. № 4. P. 32–37.

2. Scriabin S. Manufacturing of forgings from aluminum alloys by hot working. K.: KBII, 2004. 346 s.

3. Scriabin S., Muzychuk V., Shvets L. Investigation of the plasticity of aluminum alloys in the process of rolling workpieces in conditions close to isothermal. Bulletin of Vinnytsia Polytechnic Institute. 2007. № 5. P. 102-107.

4. Skryabin S., Polokhov V., Baraboy N., Skryabin K. Stamping of forgings made of aluminum alloys with an elongated axis, a thin sheet, closed sections and a deep cavity. Tekhnologicheskie sistemy. 2006. № 1. P. 30–35.

5. Skryabin S., Baraboy N. Investigation of the plasticity of titanium alloy VT3-1 during deformation in calibers of various systems. Tekhnologicheskie sistemy. 2006. № 2. P. 45–49.

6. Scriabin S. Investigation of thermomechanical parameters of billet rolling under isothermal conditions. Bulletin of the National Technical University of Ukraine "Kiev Polytechnic Institute". Mechanical engineering. 1998. № 33. P. 311 - 317.

7. Ogorodnikov V., Muzychuk V., Nakhaychuk O. Mechanics of cold forming processes with the same type of deformation mechanism schemes: monograph. Vinnytsia: UNIVERSUM-Vinnytsia, 2007. 179 p.

8. Skryabin S., Muzychuk V., Shvets L. Investigation of broadening during rolling of billets made of aluminum alloys according to the circle-oval-rhombus system, in conditions close to isothermal. Bulletin of the Donbass State Machinery and Equipment Academy. 2007. № 1 (7). P. 164-169.

9. Muzychuk V., Nakhaychuk O., Sivak R. Plasticity of aluminum alloys during isothermal rolling of workpieces. Vibrations in engineering and technology. 2012. № 2 (66). P. 82-86.

10. Muzychuk V., Tokarchuk O. Research of development of deformation of contact stresses at rolling. Engineering, energy, transport of agro-industrial complex. № 1 (108), 2020. P. 103-110.

## METHOD FOR DETERMINING THE INTEGRATED VALUE OF A CONSTRUCTION PROJECT

**Nakhimi M.**

*Postgraduate student of the Department of Robotics and Specialized Computer Systems  
Cherkasy State Technological University,  
Cherkasy, Ukraine*

**Savina O.**

*Candidate of Technical Sciences,  
Associate Professor of the Department of Technological and Civil Security  
Admiral Makarov National University of Shipbuilding,  
Mykolaiv, Ukraine*

**Haidaienko O.**

*Candidate of Engineering Sciences,  
Associate Professor of the Information management system and technologies Department  
Admiral Makarov National University of Shipbuilding,  
Mykolaiv, Ukraine*

**Bielova O.**

*Candidate of Economic Sciences,  
Associate Professor of the Marketing and behavioral economics Department  
"KROK" University,  
Kyiv, Ukraine*

### Abstract

This work is devoted to the peculiarities of using an integrated approach in the management of construction projects. It was shown that the integrated approach is used as a combination of the value approach with the management of the content of construction projects into a single integrated process. The processes of operation of these two control methods are considered and a simplified diagram of possible interaction is built. A simpler way of constructing a diagram for integration of value content management of construction projects was presented as a

factor in establishing a clear connection to achieve project goals, in this case, time, value (costs) and content (resources).

**Keywords:** project content management, project management, construction project management, WBS, construction projects.

### Introduction.

According to a study [1], only 2% of construction projects are completed on time, within budget and with the achievement of the customer's goals. In Ukraine, the current regulatory and estimate base and documentation solve the issues of determining the predicted cost of construction, without properly integrating all the components into a common system of data and knowledge about the project for interrelated project information. In addition, construction project managers must synthesize the value preferences of a variety of stakeholders. In this regard, successful management of construction projects requires an integrated approach, which is based on aligning the interests of stakeholders and team members, as well as combining their preferences. As noted by the author [1], the use of an integrated approach allows to solve potential problems at an early stage, before the start of construction, in order to eliminate possible losses and risks. Therefore, the synthesis of value approaches [12] with the definition of integrated value of construction project and project approach, along with practical methods for determining the scope of project can increase the efficiency of project management in construction.

**Brief overview of related publications.** Studies of value-oriented approach in management were conducted by S.D. Bushuev, N.S. Bushueva, F.A. Yaroshenko, H. Tanaka, I.A. Babayev, D.L. Volkov, Yu. Tesla, V.V. Molokanov, V.B. Rogozin, M.I. Rich, R. Kaplan, T. Copeland, D. Maktaggart, A.G. Mendrul, D. Norton, B. Newman, P. Pellemans, M. Rokich, T.V. Romanov, I.V. Trifonov, J. Shet and others. The basis for the detailed development of value-oriented management is described in the Japanese Project Management Standard, A Guidebook of Project and Program Management for Enterprise Innovation (P2M). [12].

An important role in management development of project scope is played by the works of Ukrainian scientists: T.K. Grechko, O.V. Ponomarenko, S.D. Bushuev, N.S. Bushueva, and foreign scientists: Alison Dykstra, Paul Netscher, P. Andreas, F. Lawrence Bennett, Dennis P. Miller, Hans Ottosson and others.

The role of value-oriented content management of construction projects is described in [2], and typical hierarchical structures of work in construction projects in [3].

The question of the need for the introduction and development of integrated project management is being actively studied by foreign scientists, in particular: Peter Fewings, Christian Henjewe, Edward Dansker, M. Betts, P.S. Brandon, Lincoln H. Forbes, Syed M. Ahmed, Jocelline Matiku and others. In Ukraine, research on the issue of integrated project management is carried out by Yu.M. Plotnik, A.V. Bugrov, A.A. Bugrova, R.V. Trach, G.M. Ryzhakova, V.M. Molokanova and others.

Muller and Turner believe that in order to measure the success of a project, it is necessary to focus on factors such as satisfaction of the end user and owner with the result of the project, as well as other interested parties whose values need to be identified [4]. According to the study [5], the optimization of project management is possible by integrating the value management methodology with the PRIMAVERA software product based on the concepts of method-tool integration. The study [6] demonstrates the improvement of the management activities of construction companies through the integration of matrix management methods for portfolios of typical projects with project management methods. An improved approach to managing the content of construction projects, which integrates the value components of the requirements and needs of stakeholders, which are the basis for building a work decomposition structure, is considered by the authors in [11].

The analysis of literary sources demonstrates the lack of research into the management of construction projects based on the integration of value-oriented and project approaches.

**The purpose of the study** is to develop a method for determining the integrated value of a construction project, which allows taking into account the value preferences of stakeholders and makes it possible to synthesize these values into its content, as well as find the integrated value of the project and evaluate it.

**Presentation of the main material.** Managing the content of projects, including construction, in project activities requires taking into account the value orientations of all stakeholders, constant monitoring and control over the content of the project in order to prevent, prevent a possible decrease in the obtained values in the process of creating and implementing the product of a construction project. The essence of the integrated approach to construction project management is to combine the processes of the value-based approach with the management of the content of the construction project. At the same time, the value-oriented component is based on the consideration of the project from the point of view of creating new project values that it will bring to key stakeholders, and project content management acts as the basis for the development of the work breakdown structure (WBS) of the construction project, taking into account the value component. WBS is a way of describing the tasks of a project by decomposing it in terms of hierarchically interrelated deliverables of work packages, the execution of which is necessary for the implementation of the project. [11] analyzes whether the development of a project value structure can lead to more robust WBS in construction projects. In this case, the decomposition should be focused on the required results [7].

In the context of WBS development, there are at least two main problems: the level of detail and decomposition criteria [8]. However, there is no universal rule for determining the required level of detail. However,

project managers are well aware that decomposing a project requires breaking down all work and components into the most fundamental elements to the level at which they represent products, services, or results that are of value to the stakeholders of those projects.

The value approach is based on the following principles [9-11]:

1. constant identification of the value of the project, means of its measurement and assessment, monitoring and control. In an organization, this principle forms value chains (vertical and horizontal);
2. focusing goals before finding solutions that optimize product and project value for key stakeholders;
3. focusing on functions that maximize innovative and practical results within the project service model.

The value of a construction project is determined by the benefits that the project product provides when fulfilling the requirements contained in the project mission. There are two prerequisites to ensure that project value is created. The first is the project manager's practical ability to execute a project as planned; and second, finding a way to harmonize the value of the project for all stakeholders through the properties of the project product. The first condition is mandatory, while the second is a sufficient condition for creating value for the project [10].

The method of value-based management in relation to project stakeholders consists of the following stages:

1. Determine the range of stakeholders and key parameters of the project.
2. Identify value indicators of stakeholders within the framework of the project objectives.
3. Identify conflicts of interest of stakeholders.
4. Assess the risks associated with identified conflicts of interest of stakeholders.
5. Find and apply effective methods of dealing with risks, reducing them to an acceptable level.
6. Develop a project WBS based on stakeholder values.
7. Determine the integral value of the project.
8. Monitor the achievement of project values in the process of its implementation.

Scope management acts as a set of processes that provide a precise definition and displays the scope of the project [11]. Scope management techniques allow project managers to allocate the amount of work required to complete a project.

However, for content to be effective, it must be based on a robust WBS structure based on project values. A properly constructed WBS hierarchically and accurately reflects all tasks and work packages of the project in accordance with the values, which simplifies their management, allows to achieve project completion on time, within budget and with the required quality (Figure 1). Processes for managing construction projects through the prism of stakeholder values are aimed at achieving project goals.

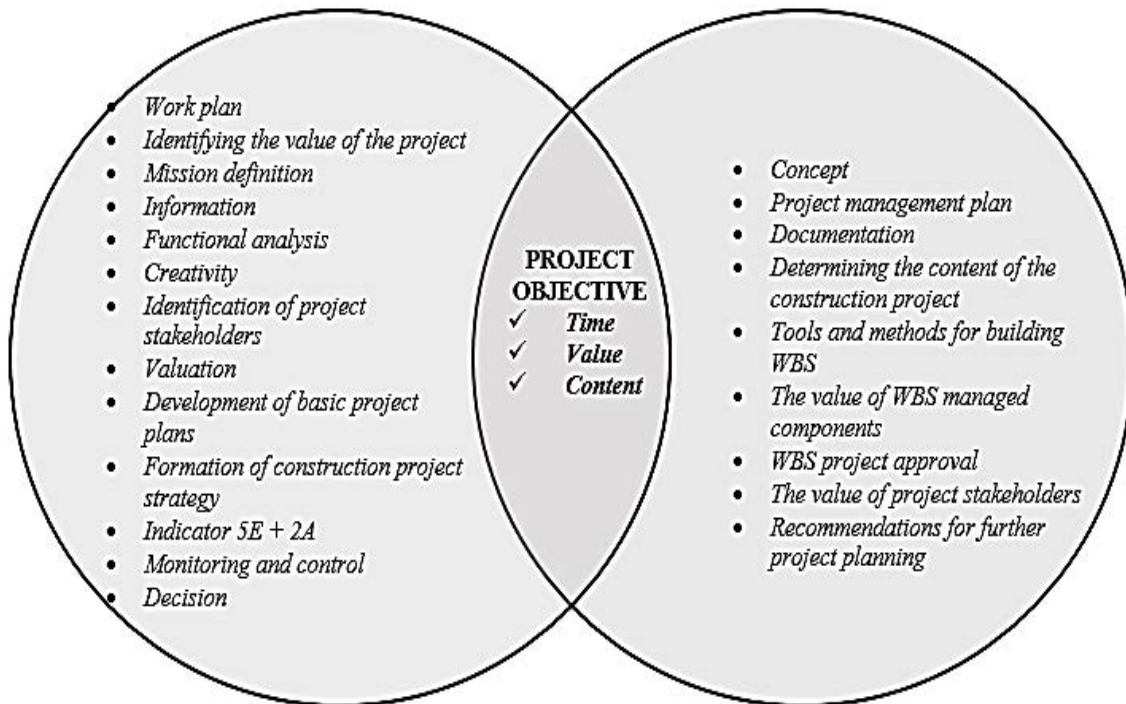


Fig. 1.

*Integration of value-based approach and content management processes to achieve goals of construction project*

To integrate the value approach and content management processes, a simplified diagram of possible interactions was drawn up (Fig. 2.).

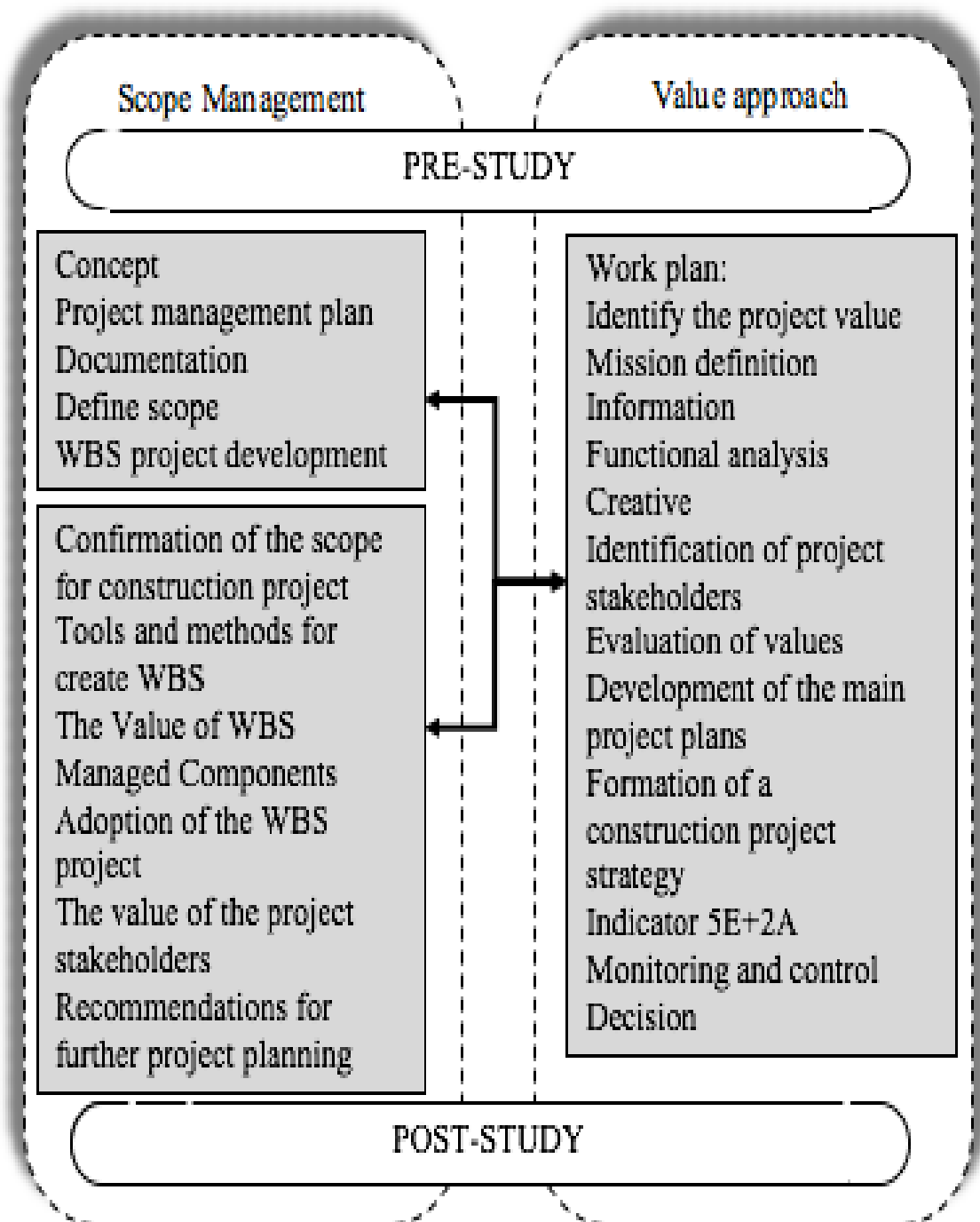


Fig. 2. Processes for integrating value approach and content management

Integration of values and project scope management processes includes the following steps:

1. Pre-study of both value and content components.
2. Drawing up a concept and a construction project management plan based on a value approach, documentation, definition of content taking into account values and development of project WBS.

At this stage, there is: identification of project value; mission definition; transfer of information; functional analysis; insurance; identification of project stakeholders; value assessment; development of basic project plans; formation of a construction project strategy; calculating the value of a construction project behind the 5E + 2A indicator, monitoring and controlling

it, confirming the content of a construction project, using tools and methods for constructing a WBS with value-driven components, accepting a WBS project, forming recommendations for further project implementation.

3. After the study (post-study), the results are analyzed and a decision is made on the implementation of the construction project.

Let's take a closer look at the integration of the value approach and project content management processes.

The initial stage of development of any project is the definition of a construction concept.

*Concept* – a set of views on a construction project, related and interrelated processes. At this stage, specialists together with the customer formulate requirements for further project and assess the potential of the project.

A *Project Management Plan* (PM Plan) is a formal, approved document that defines how a project is executed, controlled. It can be a short or detailed document that can include baseline data, support plans and other planning documents.

*Documentation.* Project management typically requires documentation to not only track the progress of a project but also serve as a historical reference for future projects.

To identify the value of a construction project, it is necessary:

*Defining a mission* is a very responsible and significant task. In order to avoid miscalculations in defining the mission, it is necessary to conduct a number of special studies, in particular, an analysis of the market situation, industry and the competitive position of the enterprise.

*Transferring information* about the mission of the project.

*Functional analysis* is a method that is responsible for meeting the client's needs for a project. It focuses the team's attention on the core functions required to meet this need (value) and why it exists. The team studies data and brainstorms to reduce costs while maximizing the value function.

*Creativity* is the ability for non-standard, witty, bold problem solving, creating a new product using non-specialized resources or tools. Solving the problem in a non-standard way, an original idea that solves the customer's problem.

Creative is a non-standard thinking person who can see the problem from different angles while finding a comprehensive solution to a specific problem.

Creativity in project management is the creativity of project team members who are focused on the future success of the project, are able to adapt to new conditions and are ready to cooperate, as well as are interested in innovations and have strategic thinking.

#### *Identification of project stakeholders*

The initial step in successful management is the Stakeholder Identification process, the purpose of which is to identify the people, teams or organizations that are under influence or influencing the project; in documenting information concerning their participation and affecting their interests.

The input data of this process are the charter or passport of the project and the organizational structure of the project and organization - the project of the organizer. The output of the process results is a register of stakeholders.

The methods of obtaining information for the formation of the register are: polls, questionnaires, brainstorming of the project team.

Stakeholders can be actively involved in the project, they can be inside or outside the project, they can be at different levels of authority.

In the stakeholder analysis, it is necessary to identify all stakeholders that can influence the project, as

well as potential difficulties that can interrupt it or reduce its success; evaluate the means, rules and principles of communication throughout the project and plan actions to reduce the negative impact of stakeholders on the project.

A key factor in the success of management is understanding the real expectations of stakeholders, who quite often, for one reason or another, hide their true interests.

#### *Value assessment*

Many assessments obtained as a result of the value management process will be subjective, but an important characteristic of value management is the fact that decisions represent the unanimous opinion of all participants in the process. Analytical techniques used in value management allow the client's briefing document to be used throughout the project life cycle as a clear basis for all judgments about the implications of various issues.

Project value planning is assessed based on criteria such as comparing the profit from the project with the established planned costs. Typical methods and indicators used for this assessment are: CBA (Benefit Cost Analysis), CF (Cash Flow), NPV (Net Present Value Calculation) and IRR (Internal Rate of Return Calculation).

*Development of basic project plans* – it is a process that covers several stages of the life cycle of a construction project at a specific time. It starts with the participation of the project manager in the concept development process, the selection of strategic goals, including contract proposals, up to the conclusion of contracts and ends only at the end of the project.

#### *Formation of a construction project strategy*

Creating value requires meeting and aligning user needs and owner strategies, coupled with innovative thinking. The project strategy is the central process in the development of directions of action, in order to obtain the unique results of the project defined by the mission and the system of goals.

The preparation of project strategies can be roughly divided into three procedures: strategic analysis; development and selection of a strategy; strategy implementation.

When determining the strategy for a construction project, one should take into account such aspects as: the geographical location in which the project will operate; selection of a market position and marketing concept to achieve it; functional purpose and scope of the project; main parameters that contribute to success, strengthening of positions in the market, level of management. The interests and attitudes of top management play a very important role in choosing a development strategy for a construction company.

The obligations of the construction company for preliminary strategies create a certain inertia in the development. It is impossible to completely abandon all previous commitments due to the transition to new strategies.

Therefore, when choosing new strategies, it is necessary to take into account the fact that for some time the obligations of previous years will be in force,

which, accordingly, will restrain or adjust the possibilities of implementing new strategies. In this regard, in order to avoid a strong negative impact of old commitments, it is necessary to fully take them into account when choosing new strategies and include their implementation in the process of implementing new strategies.

*Indicator 5E + 2A.* There are many mathematical theories for assessing the value of a project. However, according to P2M [12], the most appropriate and effective method for assessing value is the method five "E" and two "A" (5E + 2A). This method is increasingly used in corporations and is supported by them when implementing project management.

5E (efficiency, effectiveness, earned value, ethics, ecology): the efficiency of resource use in projects is determined by the ratio of benefits received from the project to the amount of resources used; effectiveness - refers to the level of satisfaction of stakeholders before and after the project, and also describes the area of benefits based on defined performance criteria; earned value - a universal indicator of measuring the progress of projects, in which the concept of the project is related to its schedule and costs (resources) compliance with ethical standards is the reaction of the program community to the general acceptability and social orientation of the program idea, to compliance within its framework of social and corporate rules and meeting the ethical expectations of stakeholders; ecology - a criterion to support the continued growth of an organization or the continuous progress of a program, with due regard to environmental protection.

2A (accountability, acceptability): accountability - determined by the level of management responsibility for the results of the project / program, including the intermediate results obtained by stakeholders, as well as transparency, visibility and openness (publicity) when informing the public about the status of the project / program at the current moment; acceptability - determined by a number of conditions that the stakeholders have accepted in terms of the cost indicators of projects, expressed in the amount of capital invested, guarantees of return on investment and approved plans for the distribution of the program's cash flow over time [12].

*Monitoring and control* – a stage that focuses on documenting changes, tracking deviations, and making changes to the content of the project. Monitoring is based on management theory, theory of cycles, crises and other concepts, which allows it to be an effective control tool in the process of project management, to observe and evaluate changes in project indicators in terms of compliance with their planned values, to assess the influence of various factors on ongoing changes and final results, make operational and strategic decisions on the project based on the results obtained.

Monitoring allows to solve the following tasks in the process of project management:

- organize the receipt of timely and reliable information on the implementation of project task and the project as a whole;

- identify factors and risks that can affect the implementation of the project, and assess the degree of their influence;

- make forecasts, make management decisions on the project, develop recommendations for overcoming negative situations and maintaining positive trends.

*Project documentation* is a set of documents describing the project and regulating the activities within the project.

*Scope determination* is the process of developing a detailed description of a major project component into smaller, more manageable components based on values of the project stakeholders and value of the product.

The scope of the project describes the results to be obtained and the work that needs to be done to obtain these results. The process of defining the content is aimed at achieving goals: improving the accuracy of estimates of cost, duration of work and required resources, the formation of a baseline as the basis for the correct execution and project management. Ensuring clear allocation of responsibility.

*Development of project WBS.* WBS – it is a hierarchical structure built with the aim of logically distributing all work on the project and is presented in a graphical form. WBS development consists of several levels, each of which is formed by a project team. WBS provides the project manager and team with the necessary task infrastructure, which will be used in the future to ensure the planning of project tasks at the most detailed and accurate level.

*Confirmation of construction project's content* – it is a process of formalized acceptance of the content and values of project's stakeholders. It is carried out through an inspection, which, depending on the specifics of the project, can be an audit, an analysis of the values of the project, an overview of the construction project itself, etc. The result of the content confirmation process is the documentation according to which the customer has accepted the main results for the scope of the project.

#### *WBS Building Tools and Techniques*

Today, to build WBS, not only analytical and graphical methods of building are used (Mind Manager, Excel, MS Project, Visio or any online analogue), but also some progressive information technologies (RationalPlan, MatchWare MindView, WBS Schedule Pro and others).

Among the methods, the main ones can be distinguished: guidelines, analog approach, top-down approach, bottom-up approach, Mind-mapping technique. To implement the content planning process, product analysis is used with methods such as system engineering, value engineering, value analysis, functional analysis, and the deployment of quality functions, allows to designate the parameters of project product, analysis of income or expenses, which is carried out in a specific sequence, namely: an assessment of material and intangible costs and profits is carried out for various possible options for the implementation of the project and using various financial indicators (return on investment, reimbursement period to assess the relative benefits of certain alternatives, etc.). In addition, the method of identifying alternatives is used, which is implemented

to develop various options for approaches to the project, brainstorming and "lateral" thinking.

*The value of managed WBS components* – using and adding components of stakeholder values when building a project' WBS, thereby managing these values as a result. The process of dividing the values of project stakeholders into smaller components (constituting the values of each stakeholder) that are easier to manage.

A value-driven adaptation of the WBS would allow project sponsors and clients to define which work packages were required and place the added value figure in additional packages. This would mean that when the side event was worth more (in terms of the amount of drag and drop costs and resource costs) than its sponsor value, that fact would become apparent due to its "negative value added". A decision can then be made to either abandon the unnecessary work or change the planned way of doing it to make it cost-effective (achievable).

*Project's WBS acceptance*

At this stage, it is necessary to understand whether this result is actually achievable. The project manager needs to sit down with the project team members and view the current schedule. Where to give the team member an opportunity to think about whether the result is achievable. Then they need to think about how long it will take them to achieve the result. At the same

time, the project team discusses the approach and budget for the work.

*The value of project's stakeholders*

The value of a construction project is determined by the benefits that the project product provides when fulfilling the requirements contained in the project mission. Creating value requires fulfilling and aligning user needs and owner strategies, coupled with innovative thinking. Focus on identifying stakeholder's value to create project value shows the importance of aligning strategies with customer needs to maximize value creation.

*Recommendations for further planning value of the project*

At this stage, a discussion is held between the project manager and project team regarding new technologies and methods, innovations that allow to obtain or increase project values.

Based on the processes of integrating the value approach and content management, we will formulate the main stages of the method for determining the integrated value of a construction project (Fig. 3).

In process management, the coordination of works should become more efficient, since work flows from department to department with fewer errors and client requirements are met immediately and on time.



*Fig 3. Stages of the method for determining the integrated value of a construction project*

The advantages of a process-based approach to integrating value-based management of construction project content are: a focus on each process that contributes to satisfaction of project results; avoiding partial responsibility in the appointment of process managers; process management allows to create a better basis for controlling resources and time of work; taking into account the dynamic nature of the development of organizations; significant reduction in management costs; high adaptive ability of the approach; reducing the level of bureaucracy in management systems; increasing staff understanding of their responsibilities; focus on quality of activity and continuous improvement, etc. Thus, in modern management conditions, there are a number of reasons explaining the need to use a process-oriented model for managing construction projects.

**Conclusions.** Consequently, by combining value and content management into one integrated process,

construction project management objectives can be more effectively achieved. In addition, an integrated approach helps to establish a clear connection between project values for each stakeholder, transforming them through WBS into an integrated value of a construction project, which makes it possible to develop and achieve consensus between key project stakeholders and leads to an improvement in the implementation of such projects.

#### References

1. Create a Lean, Construction Building Machine with Integrated Project Management: <https://www.smart-sheet.com/integrated-project-delivery>
2. Nakhimi, Mokhammad Yasin. (2019). The role of using value-oriented management in the scope of construction projects. Management of Development of



Complex Systems, 38, pp. 6-12, dx.doi.org/10.6084/m9.figshare.9783296

3. Nakhimi MM The role of using the structure of decomposition of works in the management of the content of construction projects // Collection of scientific works "Bulletin of Cherkasy State Technological University. Series: Technical Sciences", №4, 2017, pp. 42-46.

4. Muller, R., Turner, R. (2010), "Leadership competency profiles of successful project managers", International Journal of Project Management, Vol. 28, No. 5, pp. 437- 448.

5. Surya Theja Reddy, A. Application of Value Engineering in Building Construction [Text] / A. Surya Theja Reddy, S. Polisetty // International Journal of Latest Trends in Engineering and Technology. – 2016. – Vol. 8, Issue 1. – pp. 239–244. doi: 10.21172/1.81.032

6. Teslya, Yu. M. Integration of management methods for individual projects with the method of matrix management of portfolios of standard projects / Yu. M. Teslya, N. Yu. Yegorchenkova, TV Latysheva // Management of complex systems development: collection of articles. Science. пр. - Київ: КНУБА, 2016. - 25p. - pp. 66–72.

7. Buchtik, L. Secrets to Mastering the WBS in Real World Projects, 2nd ed.; Project Management Institute: Newtown Square, PA, USA, 2013; ISBN 978-1628250336.

8. Globerson, S.; Vardi, S.; Cohen, I. Identifying the Criteria Used for Establishing Work Package Size for Project WBS. J. Mod. Proj. Manag. 2016, No.4, pp. 64–69.

9. The Value of Project Management. Project Management Institute, 2010.

10. Nakhimi Mokhammad Yasin Mokhammad Khusain. Conceptual model of value-oriented content management of construction projects / Abstracts of the XV International Conference "Project Management in the Development of Society" Topic: Project Management in the transition to a behavioral economy // responsible for the issue of S.D. Bushuyev K.: KNUBA 2018. - 256 p., P. 147-148.

11. Danchenko O.B. Value-oriented management of construction project content / O.B. Danchenko, M.M. Nakhimi, O.Yu. Savina // Bulletin of NTU "KhPI". Series: Strategic management, portfolio management, programs and projects. – Kharkiv: NTU "KhPI" publishing house, 2020. – No.2. – pp. 23-31. DOI: 10.20998/2413-3000.2020.2.4.

12. P2M. Guidelines for the management of innovative projects and programs of organizations / Ed. Yaroshenko F.A. - K.: New Druk, 2010. - 160 p.