

The necessity of digitalization of project management processes is shown, in particular, for the creation and use of the information standard of project management (ISPM). A model of using the information standard of project management to determine the planned parameters of projects has been developed. The principles and tasks of digitalization are formulated, the solution of which will allow to create such a standard. The analysis of existing theoretical and practical developments in this field is carried out. It is shown that the issue of creating an information standard of project management is still open. It is established that traditional software or databases are not suitable to meet the formulated requirements. This is due to the fact that they do not provide the necessary level of system and documentary support in the process of forming the information standard of project management. Therefore, it is proposed to use the information management system of enterprises and projects PrimaDoc to create such a standard. The concept of construction and use of the information standard of project management on the basis of the information management system PrimaDoc is offered. The structure of information technology for the formation of ISPM project-oriented company has been developed. The approach and tools for adjusting the environment of the PrimaDoc information management system to the technology of forming the ISPM of a project-oriented company are proposed.

Experimental research has been conducted, which showed a 65 % reduction in labor costs in the formation of ISPM. Practical approbation of ISPM information technology formation of project-oriented company on the basis of PrimaDoc system is executed. PJSC Tutkovsky (Ukraine) created an information standard of project management, which included more than 10,000 documents. The results of experiments and practical testing indicate the effectiveness of the developed concept and information technology of formation and use of information standard of project management

Keywords: information standard of project management, PrimaDoc information management system, project planning

DEVELOPMENT OF THE CONCEPT OF CONSTRUCTION OF THE PROJECT MANAGEMENT INFORMATION STANDARD ON THE BASIS OF THE PRIMADOC INFORMATION MANAGEMENT SYSTEM

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1. Introduction

Nowadays, the requirements for the quality and efficiency of project management have increased significantly. This

requires not only improving the professionalism of project managers, but also providing them with all the information they need to manage. And information that relates not only to the current project, but also information on how similar proj-

ects have been implemented in the past. Whether performers and managers worked effectively, what risky events occurred, and what this led to, and how reliable resource providers are. All this information forms some information standard of the company's project management and allows to "learn" from the mistakes of predecessors, rather than their own [1]. Therefore, the digitalization of project management, for more complete and effective use of all information available in projects comes to the fore in the modern period of economic development.

Much is being done and has been done in this regard. Information technologies for project and enterprise management have been developed and are being developed, ERP systems are being implemented, and various software tools are being used.

But there are two problems along the way. First, in most cases, all these tools are focused on solving the problems of current projects, rather than on the intellectual analysis of previous information for more effective management of current projects. Second, project-oriented companies typically use a variety of non-informational tools in their project management processes. The software tools used in the projects are created by different developers, they do not have a single digital environment. They need to create information technologies for database integration. Such software products do not create a single project management system, do not cover all processes of project-oriented companies, and additional settings require significant investment. Moreover, such tools do not form a single information environment that would minimize the diversity of systems, and which could be used to build an information standard of project management of a project-oriented company [1]. Which would include information on planning, budgeting, monitoring, procurement, administration, risk management, portfolio management, collateral management, etc. of previous projects.

Therefore, it is necessary to carry out the digital transformation of project management to create an information standard that will be the foundation for solving the functional problems of project management, programs, and portfolio. And this requires the creation of some integrated technology for the formation of ISPM in the process of solving current problems of project management. And as previous experience has shown, such technology can be based on the use of an information management system of enterprises and projects – PrimaDoc [2].

Therefore, there is an urgent scientific problem, which is to develop a concept of digitalization of projects and programs, which would create a relevant information standard of project management, to increase the efficiency of their implementation.

2. References analysis and problem statement

Global trends in the development of many areas of human activity are aimed at digitalization. Examples of digitalization are virtual offices, e-currencies, online payments, digital services and more. The digital transformation of modern business requires changes in project management processes. Currently, these changes are the successful application of cloud technologies, so project activities are moving to complete independence from the geographical or technological location of project participants. The issue of digitalization of project management is considered in many works [3–8]. [3] states that companies that do not have an existing digital transformation program

have a year or less to adopt it. A study [4] shows that 33 % of companies develop their plans for digital transformation, but will not be implemented within the next 12 months. 92 % of businesses believe that intelligent automation (combined use of artificial intelligence and automation) will be more widely used within their company over the next 12 months [5]. The benefits of digital transformation efforts include increasing market share (41 %), increasing customer interest in digital channels (37 %), more positive employee morale (37 %), greater activity on the Internet and mobile devices (32 %), income (30 %) [6]. An example of modern research is the work [7]. It explores the management of digital projects from a holistic perspective: from consulting to post-production. The author tried to solve problems related to digital projects. Namely, tools related to DevOps, project planning, collaboration, Agile project management, test management and project planning, in-depth coverage of the Agile implementation model with its indicators, best practices and application scenarios, special and in-depth coverage to achieve high quality digital projects through a quality system with a detailed case study, the latest trends and innovations in the digital space and their impact on digital project management, etc. Or, in the study [8] the aim is to define the concept of digitalization of project management, as well as to assess how project management works. can be further developed and supported by digital project management solutions. This study is qualitative in nature and is an empirical inductive study, supported by a review of the literature. The study interviewed Nokia Supply Chain (SCE) project management experts. The empirical example consists of an analysis of the current state and specification of project management requirements in Nokia MN/BM/SCE, as well as a comprehensive feasibility study of three state-of-the-art digital project management solutions available in the markets: JIRA, HP. PPM and MS POL. The analysis showed that the development of information technology contributes to more effective management of project teams. [9] highlights ready-made software products that ensure the life cycle of projects. The disadvantage is the sparseness of the presented technologies by functions, the lack of conceptualization of a single information space for project and program management. The issue of integration of technologies from the standpoint of digitalization of the enterprise is covered in [10]. The paper presents the prospects of rapid response, better availability of data in e-government, but the paper does not present the combination of e-government of one shop with others, with the administration, no regulations for such management. And the issue of integration of project management with enterprise management is not considered. Electronic management of business operations of the enterprise was continued in the work [11]. The study presents a model that consists of components that can be used to determine the interaction between different projects and programs. This allows to develop more effective digital transformation strategies. But the paper does not present the structure of the database of interactions, does not take into account the uniqueness of each individual enterprise, which has its own internal standards of digitalization. Conceptualization of digitalization of projects and programs is considered in [12]. The results of the study are aimed at integrating system, process and design approaches into a single digital space. The presented work is aimed at digitalization of free economic zones, but does not take into account the needs of production project-oriented enterprises. The issue of planning new projects in the single information space taking into account the existing information (which is stored in the single information space) on completed projects remained open.

This issue is partially presented in [13]. The article presents a digital assistance system for planning the production program in the early stages of the project based on material flow modeling. Product data is generated using the previous one similarity assessment orders. But the presented model does not take into account operational activities, the issues of a single information space go beyond this study.

The concept of information standard is currently used for construction projects in the context of building information modeling (BIM). In [14], the shortcomings of existing research on the implementation of BIM are highlighted. The continuation of this study is the work [15]. The paper proposes an information standard structure for BIM to define a systematic standard and a method for the effective development of various recommendations for the standard. The solution to the problem of implementing electronic project management by project-oriented enterprises is presented in [16]. But the paper explores the management of projects that can be clearly defined in the planning and control of implementation: projects for the creation and provision of information resources. The article [17] describes a study of the scale and nature of project documentation and flows of project information in the construction industry. The study compared different types of project information with documents. Based on this analysis, a computer system was developed to support project information management. The system allows construction managers to enter information for various project events, cross-references to different sets of information and use the information to monitor and control various aspects of the construction project.

The most well-known and popular tool for working with project documentation is the Microsoft SharePoint family of products [18]. But these products do not have the tools to adjust the information environment to the formation of the information standard of project activities, with the identification of experts and the preservation of the entire history of evaluations and changes in individually defined project parameters.

Based on the results of the analysis, it is concluded that currently no scientific works have been identified in which the issue of formation and application of the information standard of project management of project-oriented companies with specialized software is considered. On the other hand, there are works on information management systems of enterprises and projects [2]. But in these works the possibility of their application to creation of the information standard of project activity is not considered.

Given the above, it is possible to conclude that the scientific and practical importance of creating a single digital space (based on the information management system of enterprises and projects). And in this space, information will become nothing more than an information standard for project-oriented enterprises.

3. The aim and objectives of the study

The aim of the study is to develop a concept for creating and using an information standard of project management in project-oriented companies based on the information management system PrimaDoc. This will allow project-oriented companies to create information standards for project activities directly in the processes of electronic document management and information management of the company.

To achieve this aim it is necessary to solve the following objectives:

- to formulate the principles and identify the tasks of digitalization, the solution of which will create an ISPM project-oriented company;
- to develop a model of using ISPM to determine the planned parameters of new projects;
- to develop the structure of information technology for the formation of ISPM project-oriented company;
- to offer an approach and tools for setting up the PrimaDoc information management system to the information technology of ISPM formation of a project-oriented company.

4. Materials and methods of research

The object of research is the processes of creating and using the information standard of project activities of project-oriented enterprises. The subject of research is the processes of identification and storage of information that is formed during the implementation of projects and can be used to improve the management of future projects.

The concept of information standard was introduced and disclosed in [1]. The information standard is not an ISO project management standard (which regulates processes). This is a new concept, synonymous with the “standardized archive of previous projects of the company.” In traditional technologies, such a standard is created by a variety of project management tools. In this case, additional work is required for the systematic use of such a “distributed” standard. To eliminate this shortcoming, a new concept is proposed – to use the PrimaDoc system as the core of the information standard of project management. Through this system, all other tools will provide information for project management, and PrimaDoc will perform an additional function – to create this standard as a single information system in a project-oriented company. Therefore, the concept of building and using the information standard of project activities does not develop new methods and means of accumulating information about the progress of the project, and uses the existing information management system of enterprises and projects PrimaDoc. But for effective use it is necessary to adjust it to those tasks of digitalization, the implementation of which will create a standard designed to improve the accuracy of planning future projects. This is justified by the fact that the issues of creating information standards of project activities are not implemented by existing project management tools [19, 20]. The assumption of the work is that the project-oriented companies that will use the proposed concept will implement projects that will contain a significant amount of work and resources that have already been performed and used in previous projects.

Based on this, the hypothesis of the study is that the creation of ISPM based on the PrimaDoc system will increase the accuracy of planning, which in turn will increase the efficiency of management of new projects.

The provisions of the system approach were used to integrate digitalization tasks, models of ISPM use, information presentation structures and technology setup of the PrimaDoc system into the concept of ISPM creation. The principles of the project approach were used to highlight the information component of project processes, which will fully increase the accuracy of planning and efficiency of future project management. Expert assessment methods and probability theory were used to develop a model for the use of ISPM, which formed the basis for forecasting the parame-

ters of future projects. Development of ISPM structures was performed using the PostgreSQL database.

Experimental research was conducted in the conditions of the operating production enterprise which worked in the field of instrument making. This allowed to check in practice the adequacy of the proposed concept and model, and the compliance of the PrimaDoc system settings with the technology of information resource formation in projects for the production of complex geophysical instruments.

5. Results of research of creation and use processes of the information standard of project management

5.1. Principles and tasks of digitalization, focused on creating the information standard of project management

The purpose of digital transformation of project-oriented companies is to increase the efficiency and quality of activities through better use of information resources of the company. This allows to more fully meet the information needs of project teams by storing the necessary information in digital form in the information standard of project activities. Let's set a number of definitions that relate to the process of digital transformation of project-oriented companies.

Definition 1. The information space of project-oriented companies is all the information used by the company in the process of its activities. Some elements of the information space are digitized and transferred to the digital space. Which is part of the information space of the Free Economic Zone.

Definition 2. Information Standard of Project Management (ISPM) of a project-oriented company – information that is digitized in the process of project implementation, and which can be used to improve the efficiency of functional tasks of future project management.

At the heart of any concept should be the principles that determine the vision of its scope, mechanisms and tools for its implementation, the place in the subject area. Principles of digitalization that will ensure the creation of an information standard of project activities are given in Table 1.

Following the formulated principles (Table 1), it is possible to correctly determine the tasks of project management and the information resource that needs to be included in the ISPM.

Such tasks include tasks of analysis, planning, monitoring, risk management and procurement, and others, which create an information resource for effective project management. Therefore, the information standard of project management must reflect all the information on how and what happened in the project.

Based on this presentation of the problem of digitalization of project-oriented companies in the process of forming ISPM, it is necessary to solve four problems:

1. Determine what part of the company's information space should be reflected in the information standard.
2. Develop the structure of ISPM.
3. Develop the technology of its formation.
4. Develop the model of its use.

Based on this vision of the place and role of ISPM in project management, it is possible to identify its main components and tasks of digitalization, which will fill these components with information on projects implemented in the company:

1. Information about project analysis. The expert assessment of the project, presented in the technical, financial, economic analysis, SWOT analysis and feasibility analysis, is valuable.

2. Project documentation. Documentation describing the product of the project and its configuration. This may be the backlog of the product (IT projects), design and estimate documentation (development and construction), design and technological documentation (projects in the field of industrial production), etc. An important element of the information standard in this part is the physical scope of work on the formation of the project product and the number of resources required.

3. Project plan. Approved plan and changes made to it in the progress of its implementation. Important dynamics of changes in the plan, the work of performers, delays and their causes, the quality of the plan and the quality of estimation by various experts of the parameters of the plan (what parameters the experts set, and what it really was).

4. Project budget and changes to it that occur during the project implementation. Important information for future projects – planned and actual costs of work and material resources. Assignment of overhead costs. Dynamics of overhead costs.

5. Planned and actual terms of procurement of material resources. Important information about delays in procurement and the causes of failures – inaction of contractors, or poor performance of the company's logistics.

6. Risk management plan, risk events that occurred, deviations of the actual parameters of risk management from the planned and which experts made mistakes.

Table 1
Principles of digitalization, which ensure the creation of an information standard of project activities

No.	Name	Description
1	The principle of effectiveness	The result of the digital transformation of project-oriented companies is the creation of ISPM and technology for its use in the project management process. Having the information standard of project management it is possible to calculate parameters of the plan taking into account the information accumulated in the standard.
2	The principle of entry	The information standard is part of the information space of a project-oriented company
3	Conformity principle	Digital transformation aims to create a digital space, which means creating an information standard of project-oriented activities
4	The principle of the reflection completeness of project management processes	The information standard of project management should reflect everything that happens in the projects and that can be used with subsequent projects. This diverse product, which is created and used by participants in the objects, is contained in different databases of different software

To enter the above information in the ISPM project-oriented company must solve the following problems:

1. Identify the sources of information that form the components of the information standard.
2. Develop formal scenarios for processing and entering information in the ISPM.
3. Develop the technology of using scenarios for entering information into the ISPM in the process of working on the project. Moreover, the use of scripts should not create inconvenience and require additional time.
4. Develop a database structure for storing ISPM information.
5. Develop a model for determining the planned parameters of new projects using information standard data.

Unlike the traditional database in the information standard, all information corresponds to a logical scheme: expert estimation→projected parameters of the completed project→actual parameters of the completed project→degree of trust in the expert & expert estimation of the new project→projected parameters of the new project.

Therefore, the structure of the database is based on a logical connection: based on the information “A”, the state “B” of the project is planned, although in fact the state of the project has become “C”, which requires supplementing the database tables with fields (Table 2).

Table 2

Additional properties of the information standard of project management and their example

Project DB property			ISPM property		
Expert	Project characteristic	Predicted (calculated) value	Output information	Planned value	Actual value
ID1201	Project duration	X	Implementation of 13 previous projects	1.2·X	At the end of the project
.....					
ID1207	Performer budget	Y	Implementation of 7 previous projects	1.5·Y	At the end of the project

Formation of ISPM in the context of the given tasks will allow:

1. Create ISPM in the form of a data archive, structured to assess the parameters of new projects.
2. Estimate a new project through the expert assessments of previous projects preserved in the information standard.
3. Calculate the parameters of work, procurement, risks based on the experience of previous projects.
4. Build trust in experts by deviating from their assessments of the fact of project implementation.

In order to build the technology of filling ISPM, it is necessary to determine what information from previous projects is most needed to determine the planned parameters.

5.2. Model for determining the planned characteristics of new projects using the information standard of project management

Determination of the planned characteristics of new projects on the characteristics of completed projects should be performed on the basis of the following calculations.

1. Calculation of task duration. It is determined:

1.1. Based on indicators set by experts (information on the current project). In addition, the deviation of the actual duration from the planned one, which was set by the same experts, is taken into account:

$$\tau_m^* = \frac{\sum_{m=1}^M \tau_m^m \cdot \frac{\sum_{i=1}^{n-1} \sum_{j=1}^{k_i} \tau_{ji}^m}{\tau_{ji}^*}}{M}, \tag{1}$$

where τ_m^* – expected duration of task Z_{rn} in project Π_n , obtained on the basis of expert estimations and ISPM data; τ_m^m – estimation of duration of task Z_{rn} in project Π_n by expert E_m ;

τ_{ji}^m – estimation of duration of task Z_{ji} in project Π_i by expert E_m ;

k_i – number of tasks in project Π_i ;

τ_{ji}^* – actual duration of task Z_{ji} in project Π_i ;

M – number of experts.

1.2. Based on the task duration with the same name in previous projects. It is specified through the use of work capacity of task and capacity of resources:

$$\tau_m^* = \frac{\sum_{i=1}^{n-1} \left[\frac{F_m \cdot W_{ri}^* \cdot \tau_{ri}^*}{F_{ri}^* \cdot W_m} \right]}{n-1}, \tag{2}$$

where τ_m^* – expected duration of task Z_{rn} in project Π_n , obtained taking into account the capacity of work and resources; F_{rn} – work capacity of task Z_{rn} in project Π_n ; F_{ri}^* – actual work capacity of task Z_{ri} in project Π_i ; W_{rn} – work resources capacity to task Z_{rn} in project Π_n ; W_{ri}^* – actual work resources capacity to task Z_{ri} in project Π_i .

For each task, the planned task duration is selected from two values: τ_m^* and τ_m^m . The rule for selection: if the number of projects in which Z_{rn} task was performed is significant (in practice, more than 5), the selected value is τ_m^* , otherwise selected the value τ_m^m . But here it is necessary to consider the conditions of tasks performing. If the conditions of the current project differ from the previous ones (for example, other seasons, other performers), it is better to choose the value τ_m^m .

2. The need for resources.

2.1. For work resources to determine the work capacity of project tasks. Based on indicators set by experts. The deviation of the actual work capacity of task from the planned one set by the same experts is also taken into account:

$$\overline{W_{rkn}} = \frac{\sum_{m=1}^M \overline{w_{rkn}^m} \cdot \frac{\sum_{i=1}^{n-1} \overline{w_{ji}^*}}{\overline{w_{ji}^m}}}{M}, \tag{3}$$

where $\overline{w_{rkn}}$ – expected capacity of resource T_r in task Z_{kn} of project Π_n , obtained on the basis of expert estimations and data from ISPM; w_{rkn}^m – estimation by expert E_m capacity of resource T_r in task Z_{kn} of project Π_n ; W_{ji}^m – estimation of capacity of resource T_j in project Π_i by expert E_m ; W_{ji}^* – actual capacity of resource T_j in project Π_i .

Estimation of the required capacity of resources T_j in project Π_i by expert E_m is calculated on the tasks of this project

$$W_{ji}^m = \sum_{Z_{ki} \in \Pi_i} w_{jki}^m,$$

where w_{jki}^m – estimation by expert E_m capacity of resources T_j in task Z_{ki} of project Π_i .

2.2. For any resources. Based on the list of resources in the tasks with the same name of previous projects. It is specified through work capacities of tasks:

$$\overline{w_{rkn}^*} = \frac{\sum_{i=1}^{n-1} \sum_{j=1}^{z_j} z_j = z_m \cdot \overline{w_{rji}} \cdot \frac{F_m}{F_{ji}^*}}{n-1}, \tag{4}$$

where $\overline{w_{rkn}^*}$ – expected capacity of resource T_r in task Z_{kn} of project Π_n , obtained from ISPM by analogy with previous projects; F_{ji}^* – actual work capacity of task Z_{ji} in project Π_i ; F_{rn} – planned work capacity of task Z_{rn} of project Π_n ; w_{rji} – capacity of resource T_r in task Z_{ji} of project Π_i .

For each work resource the planned work capacity for task is selected from two values: w_{rkn} and w_{rkn}^* . The rule for selection is: if the number of tasks in which the resource T_r is used is more than 20, then the value w_{rkn}^* is selected, otherwise w_{rkn} is selected. For material and cost resources, the value w_{rkn} is selected.

3. Procurement of material resources. It is determined:

3.1. Based on indicators set by experts (information on the current project). Deviations from the actual deadlines set by the same experts are also taken into account:

$$\overline{\Delta}_m = \frac{\sum_{m=1}^M \Delta_m^m \cdot \frac{\sum_{i=1}^{n-1} \Delta_{ri}^*}{n-1}}{M}, \tag{5}$$

where $\overline{\Delta}_m$ – expected procurement duration of material resource T_r in project Π_n , obtained on the basis of expert estimations and data from ISPM; Δ_m^m – estimation of procurement duration of material resource T_r in project Π_n by expert E_m ; Δ_{ri}^m – estimation of procurement duration of material resource T_r in project Π_i by expert E_m ; Δ_{ri}^* – actual procurement duration of material resource T_r in project Π_i .

3.2. On the basis of information on procurement from the same suppliers previously:

$$\overline{\Delta}_m^* = \frac{\sum_{i=1}^{n-1} [\Delta_{ri}^*]}{n-1}, \tag{6}$$

where $\overline{\Delta}_m^*$ – procurement duration of material resource T_r in project Π_n , obtained from ISPM data.

From two values $\overline{\Delta}_m$ and $\overline{\Delta}_m^*$ is recommended to select a larger value.

4. Risk assessment.

4.1. Based on an assessment established by experts. But the assessment of risks in previous projects by these experts and the fact of their occurrence and impact on the project are taken into account.

Risk probability:

$$p_m = \sum_{m=1}^M p_m^m \cdot \frac{\frac{\sum_{i=1}^{n-1} p_{ri}^m - L_r^\square}{n-1}}{\sum_{s=1}^M \frac{1}{\sum_{i=1}^{n-1} p_{ri}^s - L_r^\square}}, \tag{7}$$

provided:

$$\sum_{i=1}^{n-1} p_{ri}^m - L_r^\square \neq 0,$$

$$\sum_{i=1}^{n-1} p_{ri}^s - L_r^\square \neq 0,$$

where p_{rn} – expected probability of risk R_r in project Π_n , obtained on the basis of expert estimations and data from ISPM; p_m^m – estimation of the probability of risk R_r in project Π_n by expert E_m ; p_{ri}^m – estimation of the probability of risk R_r in project Π_i by expert E_m ; L_r^\square – number of events that led to risk R_r in previous projects; p_{ri}^s – estimation of the probability of risk R_r in project Π_i by expert E_s ; M – number of experts.

Information on risks in previous projects is taken from the information standard of project activities. Moreover, it determines how many projects L_r had the risk R_r .

Risk losses estimation:

$$D_m = \sum_{m=1}^M D_m^m \cdot \frac{1}{\frac{\sum_{i=1}^{n-1} (D_{ri}^m - D_{ri}^*)}{\sum_{s=1}^M \frac{1}{\sum_{i=1}^{n-1} (D_{ri}^s - D_{ri}^*)}}}, \tag{8}$$

provided:

$$\sum_{i=1}^{n-1} (D_{ri}^m - D_{ri}^*) \neq 0, \sum_{i=1}^{n-1} (D_{ri}^s - D_{ri}^*) \neq 0,$$

where D_{rn} – expected losses from risk R_r in project Π_n , obtained on the basis of expert estimations and data from ISPM; D_m^m – estimation of losses from risk R_r in project Π_n by expert E_m ; D_{ri}^m – estimation of losses from risk R_r in project Π_i by expert E_m ; D_{ri}^* – actual losses from risk R_r in project Π_i ; D_{ri}^s – estimation of losses from risk R_r in project Π_i by expert E_s .

The calculated risk probabilities and expected losses from the occurrence of risk events should be used by the risk management team of the new project Π_n .

Knowing what ISPM data is needed to plan the next projects, it is possible to proceed to the development of the structure of information technology for the formation and use of the information standard of project management of a project-oriented company.

5.3. Structure of information technology of formation and use of information standard of project management of project-oriented company

To build an ISPM, it is necessary to determine exactly what documents and what data are needed to get the maximum effect from such a standard.

Traditionally, all databases are divided into factual and documentary. The information standard of project management contains mainly factual data. Therefore, let's divide the information that will be entered into the ISPM into two categories:

1. Documents that are processed entirely (in particular, pdf format). For example, contracts, documents, incoming correspondence.

2. Documents or data that may be partially processed. For example, a project schedule plan created in MS Project. In this case, the information standard of project management can be formed automatically.

A data model is proposed, which allows to present ISPM in a form convenient for further use. Schematically, the information standard of project management should include the following elements:

1. Information standard of project management:
 - 1.1. Archive of primary documents: project product documentation.
 - 1.2. Project budget in terms of cost items, contractors, planned and actual terms of use of financial resources.
 - 1.3. Project plan (deadlines).
 - 1.4. Incoming documents: all documents received through the office to the project administration.
 - 1.5. Data that reflect the information space of the company and are used in projects: staffing, departments, managers, contacts, etc.
 - 1.6. Project analysis documents.
 - 1.7. Information on stakeholders (primarily data on performers and suppliers of material resources).
 - 1.8. Tasks for performers and the actual timing of their implementation.
 - 1.9. Procurement plan and actual terms of procurement.

1. 10. Risks, whether risky events occurred and their consequences.

1. 11. Orders, Directives, Contracts.

1. 12. Financial and accounting documents: incoming documents of accounting (invoices, payments, spreadsheets, registers, reports, requirements, contracts, etc.).

Based on this, the ways of forming ISPM are:

1. Processing of primary documents with the help of special tools that ensure the entry of their details in the information environment through the user interface (elements 1. 1, 1. 7, 1. 11).

2. Display of information products generated by project management tools – results of project analysis, schedule plan, tasks for performers, procurement plan, project budget, risks in the information standard of project management (elements 1. 3, 1. 6, 1. 8–1. 10).

3. Display of the progress of the project, the implementation of tasks, the use of funds, the progress of procurement of material resources, risk management, etc. (elements 1. 3, 1. 6, 1. 8–1. 10).

4. Reflection in ISPM of minutes of meetings, orders, directives, decisions and results of their execution (element 1. 11).

5. Formation of the information standard of project management by means of the decision of the functional problems which are realized in management processes of the project-oriented enterprises. The source information is not only provided for further use by the user, but also loaded into the ISPM (elements 1. 2, 1. 5, 1. 12).

6. Reflecting on ISPM information used in various processes and communications. For example, the process of forming and monitoring the execution of orders, or communication top management & management. In this case, the information of these interactions becomes part of the ISPM (element 1. 4).

Processes of formation of the information standard of project management should provide storage and display not only of the current information, but also all history of changes and additions. Record the results of information interaction with users. In essence, the means of processing primary information should form an “information pipeline”, which transforms the information resource into an information product for storage and use in the infor-

mation standard of project management. This function can be performed by electronic document management, if they are supplemented by some specific models that provide the formation of ISPM in the format shown in the Table 2.

Thus, it is necessary to create some technology for processing documents, their elements, their processing functions, and data obtained in the process of working on the project. Schematically, this technology is shown in Fig. 1.

And as follows from Fig. 1, in the technology of formation of ISPM using the information environment of the project-oriented enterprise can be divided into four components:

1. Formation of ISPM in the process of realization of electronic document management (for display of traditional documents).

2. Entering the results of the project activity of the project team in the ISPM – analysis.

3. Display project plans.

4. Entry indicators of plan implementation.

The use of the information standard is performed in the planning module in accordance with the proposed model.

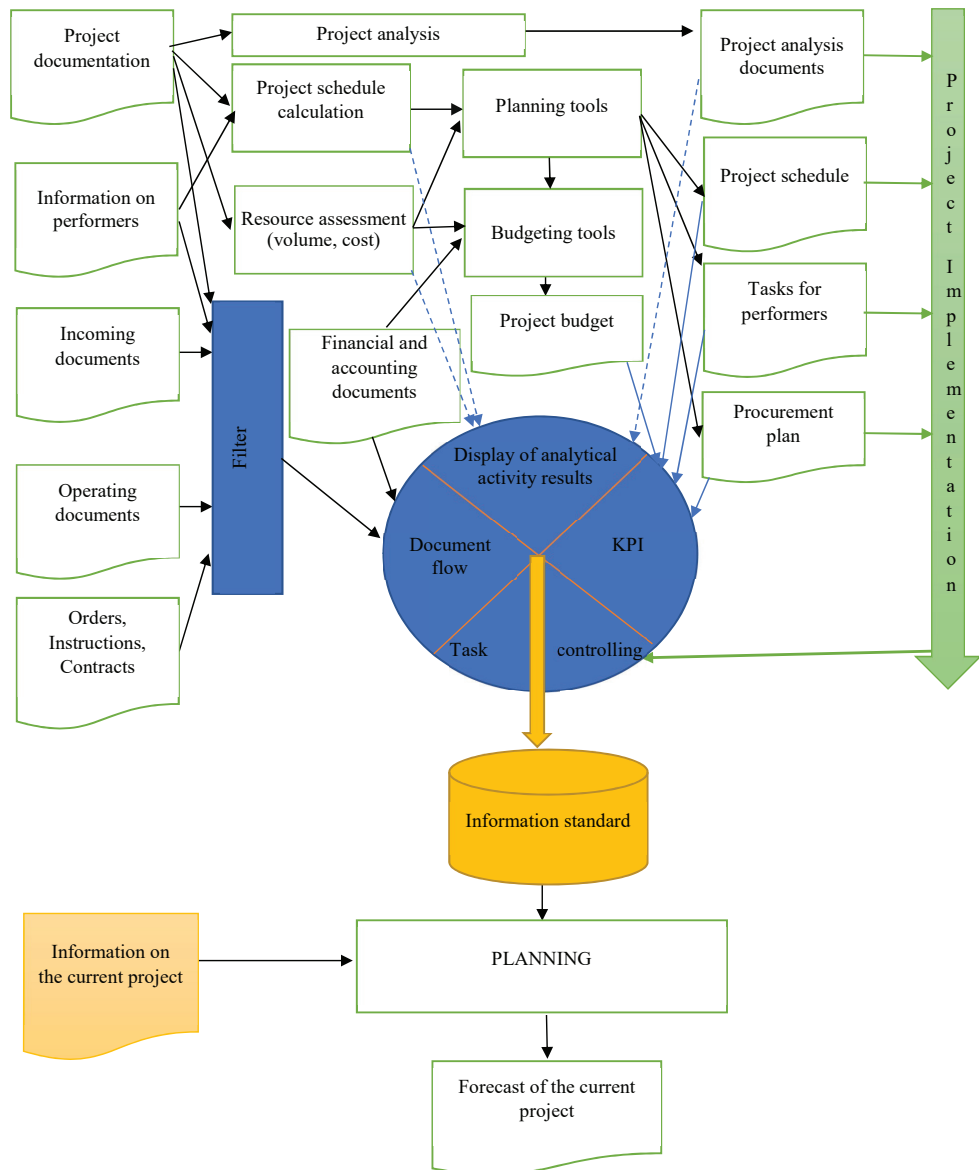


Fig. 1. The structure of the technology of formation of the information standard of project management

To implement these components, it is necessary to build some integrated technology for filtering the data required for ISPM, its presentation in a convenient form for further use and entry in the information standard of project management. All these functions are performed by the information management system of enterprises and projects PrimaDoc [2]. Consider the concept of its use to create an information standard.

5. 4. Approach and tools for setting up the PrimaDoc information management system for the formation of the information standard of project management

There are many different options for using ready-made tool systems to create an information standard of project activities. For example, creating an interface with a database of such systems. But in this case, the digitalization processes themselves, which are entrusted to such a system, do not change, and, accordingly, project management tasks are not separated from the single information technology implemented by such systems.

One could use the Microsoft SharePoint Foundation application is a family of Microsoft SharePoint products [18]. But in these software products there are no tools to configure the information environment to form the information standard of project activities. Therefore, within the concept of building and using the information standard of project management, a new approach is proposed. Which is to configure the existing PrimaDoc information management system to form the information standard of project management. Let's consider the functions implemented by the PrimaDoc system and which can be used to build an information standard of project management [2].

5. 4. 1. Functions of the PrimaDoc system

PrimaDoc enterprise and project information management system is developed on the LINUX platform, PostgreSQL database [2]. Interaction with customers is carried out through the WEB-interface. Initially, it was conceived as an electronic document management system. But in the process of its creation there was a need not only to streamline and automate the flow of documents, but also to manage all information flows. In particular, it is very important to monitor the implementation of orders contained in various documents, or even arbitrary correspondence. Therefore, this system covers more functions than the usual electronic document management system. In essence, it is a system of information management of enterprises and projects. The system is designed to create an electronic archive of documents, the organization of corporate document flow (workflow) and automation of business processes in enterprises, institutions and organizations of any kind. The system allows to solve a large number of tasks, the implementation of which is entrusted to the relevant modules. Different combinations of such modules are organized into products. The system can be easily configured to form an information standard of project management, taking into account the specifics of each individual enterprise.

The system implements a number of functions that allow the creation of the ISPM. In particular:

1. Ensuring the submission, storage, administration and control of incoming, internal and outgoing documents (close paragraphs 1. 4–1. 5, 1. 11–1. 12).

2. Logging of all actions with the system. The protocol contains information about who did what and when from

ISPM. In the process of creating an information standard of project management, this allows to identify experts who provide information.

3. Automatically divide documents into categories: not executed, executed, closed, created, scripts, canceled.

4. Using scripts to manage the flow of documents. Scripts allow to return, refine, redirect, etc. documents. Through the scenarios, the technology of entering information into the ISPM from various sources, including from project management software, is implemented.

5. Creating internal groups of recipients. Convenient when solving different classes of project management tasks.

6. Monitors the implementation of tasks. Deviations in the implementation of project plans are automatically recorded, which allows the ISPM to have information on how accurate the experts involved in project management were.

7. Performs processing of both paper and electronic correspondence. This allows to upload to the information standard as scanned documents and various files that are the product of project management software.

8. Controls the passage of all documents. Controls who, when and what did with the document (even if the user just opened it for viewing and did nothing with it). This is useful for collecting statistics on the use of information standard elements.

9. Creates and maintains an archive of documents. The information standard of project management is placed in the archive.

10. Implements various modes of work with documents – review, redirection, execution, cancellation, return, upload to the archive (ISPM), etc.

11. Allows to create and maintain the structure of documents in the ISPM.

12. Ensures the use of ISPM.

As can be seen from Fig. 1 technology of formation of the information standard of project management contains four components: display of results of analytical activity, electronic document management, display of planned indicators and control of execution of plans (tasks) on the project. All these components are implemented by the above functions of the PrimaDoc system. The basis of the information standard of project management is the structure of project presentation and information technology of ISPM formation in the PrimaDoc system.

5. 4. 2. Structure of the information standard of project management in the PrimaDoc system

In order to systematically use the information standard of project activities, it must be organized in terms of projects, experts and components proposed in section 4. The description of the functions of the PrimaDoc system shows that the identification of the expert is carried out in the systems automatically through the protocols of work with the system. Projects are identified by linking each document to the project (Fig. 2).

In order to disseminate project information on the components of the information standard in the PrimaDoc system, the structure of the information standard of project activities of project-oriented companies was created (Table 3).

Assignment of documents, as well as information products of project management software to the elements of the information standard, is performed in the process of project activities of the company using the technology of formation of the information standard of project management. Consider it.

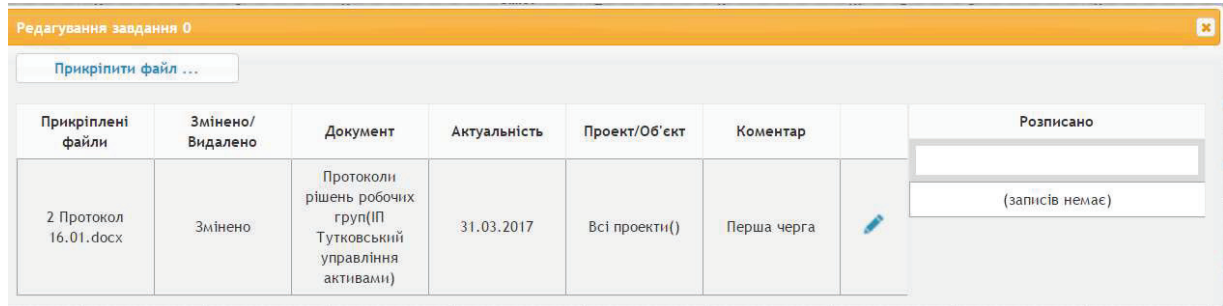


Fig. 2. Project identification window in the PrimaDoc system

Table 3

The structure of the information standard of project activities

Component	WBS Code	Name	Department
1	2	3	4
ED	1	Enterprise documents	MDC
ED	1.01	Incoming resolutions, orders, directives of the owners of the company	MDC
ED	1.02	Data on project stakeholders	MDC
ED	1.03	Enterprise requisites	MDC
ED	1.04	Policy decisions on the project	MDC
ED	1.05	E-mails, messages	MDC
ED	1.06	Requests for information	MDC
ED	1.07	Emails, letters to PMO	MDC
ED	1.08	Company correspondence	MDC
ED	1.09	PMO correspondence	MDC
ED	1.10	Logistics	MDC
ED	1.11	Orders	MDC
ED	1.12	Minutes of the meeting	MDC
ED	1.13	Miscellaneous	MDC
ED	1.14	Directives	MDC
ED	1.15	Internal memos	MDC
ED	1.16	Penalties, Encouragement	MDC
ED	1.17	Faxes	MDC
ED	1.18	Financial and accounting documents	MDC
ED	1.19	Legal documents	MDC
ED	2	Project documents. Logistics center	PMO
ED	2.1	Project budget	PMO
ED	2.1.1	Budget performance	PMO
ED	2.1.2	Overhead costs	PMO
ED	2.1.3	Direct costs	PMO
PA	2.2	Project analysis documents	PMO
PA	2.2.1	SWOT analysis	PMO
PA	2.2.2	Feasibility analysis	PMO
PA	2.2.3	Risk analysis	PMO
PA	2.2.4	Technical analysis	PMO
PA	2.2.5	Financial analysis	PMO
ED	2.3	Primary project documents	PMO
ED	2.3.1	Architectural planning specifications	PMO
ED	2.3.2	Design tasks	PMO
ED	2.3.3	Approval and project expertise (documentation)	PMO
ED	2.3.4	Design and estimate documentation	PMO
ED	2.3.4.1	Cost estimates	PMO
ED	2.3.4.2	Drawings	PMO
ED	2.3.5	Specifications	PMO
PP	2.4	Project schedule	PMO
PP	2.4.1	Baselines	PMO
PI	2.4.1.1	Plan execution	PMO
PP	2.4.2	Tasks for performers	PMO

Continuation of Table 3

1	2	3	4
PI	2.4.2.1	Execution of tasks by performers	PMO
PP	2.5	Procurement management	PMO
PP	2.5.1	Procurement plan	PMO
PI	2.5.2	Procurement actuals	PMO
PP	2.6	Risk management	PMO
PP	2.6.1	Risk management plan	PMO
PI	2.6.2	Actual risks and their impact on the project	PMO

Note: Components: ED – electronic document management; PA – project analysis; PP – project planning; PI – project implementation. Departments: MDC – management departments of the company; PMO – project management office

5. 4. 3. Technology of information standard of project management formation in PrimaDoc system and its implementation

The information, which is a product of the project activity of the project-oriented company, should enter the ISPM with minimal work costs and at the same time with the completion of its processing. For this purpose, in the project management system, in the processes of information processing are built-in information technology filling ISPM. In total two models of information technology realization of ISPM filling are provided. This is a model of filling ISPM in the process of electronic document management. And the ISPM content model is based on the import of information from project management software. Let’s first consider the model of filling the ISPM in the process of electronic document management.

The basis of the model of filling the ISPM in the process of electronic document management is the use in scripts of document processing commands to automatically transfer the required information to the ISPM, which is placed in the data archive.

Definition 3. Document processing scenario – a description of the trajectory of the document by performers with the definition of the order, duration and result of processing. Implemented through PrimaDoc system templates.

Some templates of the PrimaDoc system are shown in Fig. 3. In the upper window, specify the name of the template, the type of document for which it is used for summary. In the lower window for each template is set:

1. No. of stage (if it is the same for different reviewers – then the document gets to them at the same time, if different – in the order specified No. of stage).
2. Performer – position, role or name of the reviewer.
3. Task – a description of the task for the reviewer.
4. What needs to be done – a formal presentation of the result of document processing.
5. Days –how many working days are allotted for the task.

For documents (scanned, PDF) or any files that need to be stored in the ISPM in the templates must indicate the line (Fig. 3):

1. No. of stage – the next after approval (signing). For external documents – 1.
2. Performer – ISPM.
3. The task is to save.
4. What to do – save.
5. Days – 0 (automatic entry in ISPU immediately after approval).

The technology of processing or creating a document using templates is implemented according to the following scheme:

1. When working with the document, the author must choose a template of the PrimaDoc system, which corresponds to the element of ISPM (Table 3). Thus, the address-ee will be established automatically – ISPM.

2. Attach a scanned document or other file (s).
3. Fill in the template and indicate the project (Fig. 2).
4. Indicate (if necessary) the date on which the document must be kept.
5. Execute.
6. Monitor the passage of the document in the PrimaDoc system.

The content of ISPM based on the import of information from project management software is considered below. There are two technologies of information import:

1. If the databases of project management tools and PrimaDoc systems are in the same database (in this case PostgreSQL), the import can be done by a simple SQL-query with the transfer of information from the tables of such software in the table PrimaDoc.

2. Otherwise, the most convenient and common way to import information from various project management software (Project Expert, MS Project, Primavera, etc.) in PrimaDoc are MS Excel spreadsheets.

The PrimaDoc system has created a module for automatic import of information from other means through MS Excel spreadsheets. To do this, information from project management software is written to the MS Excel spreadsheet, which is loaded through the appropriate settings in PrimaDoc. The structure of tables for importing information from project management tools is shown in Tables 4–6.

Experimental research on the use of the PrimaDoc system for information management of enterprises and projects have been conducted previously and their results are presented in [2]. This research allowed the practical use of the system for the implementation of electronic document management technologies, task control, archiving management and creation of electronic archives, administration. And these results serve as a practical basis for the implementation of the concept of using the PrimaDoc system to create an information standard of project management in project-oriented companies.

Table 4

Document table structure (Dok)

Id	Content	Document type	Source	Date	Performer	Status	N Document	Author
755	Project charter	1	2123	14.11.2020 19:51:26	177	1	6	12

Table 5

The structure of the table of attached documents (Dok_1)

ID	ID_Dok	Date	Author	Encrypted file name	Encrypted file path
1212	755	23.11.2020 17:25:24	12	5ogoc3duie-4e4q10uu008080002	hjpgkfk4ck1t9400u0u0g04020080804000300u00u0uuu843

Шаблони				
Добавити				
Назва шаблону	Тип документу	Зміст документу		Хто затверджує погодження
Проект договору	Проект договору	Для затвердження відносин		
Проект наказу	Проект наказу (ПВС)	Для виконання		
Протокольні рішення	Протокольні рішення	Для виконання		
Завдання	Завдання	Для виконання		
Проект наказу	Проект наказу (основна діяльн	Для виконання		
Проект наказу	Проект наказу (ДС)	Для виконання		
Креслення	Проектна документація	Для запуску в виробництво та внесення в інф		
Кошториси	Проектна документація	Для запуску в виробництво та внесення в інф		
SWOT-аналіз	Проектний аналіз	Для внесення в інформаційний стандарт		
План проекту	Планування проекту	Для внесення в інформаційний стандарт		
Звіт по виконанню проект	Виконання проекту	Для опрацювання		

№ етапу	Виконавець	Добавити	Завдання	Що треба зробити	Днів
1	Керівник проекту(Офіс управління проєк	Процц затвердити документ		Підписати	1
2	ІСПУ(Архів)	Зберести		Зберегти	0
2	Директор ОУП(Офіс управління проєкт	Процц ознайомитись		Ознайомитись	1
2	Керівник компанії(Девелопер)	Процц ознайомитись		Ознайомитись	1

Fig. 3. Templates for processing documents in the PrimaDoc system

Table 6
The structure of the table of approval, signing and storage of documents (Dok_2)

ID	ID_Dok	Reviewer	Note	Receipt data	Author	Review date	Resolu- tion	What to do	What is done	Accep- tance date
703	755	14	Not specified	29.10.2020 21:18:15	1	30.10.2020 11:18:00	-	12	12	30.10.2020 21:18:15
704	755	8	Not specified	30.10.2020 21:18:15	1	30.10.2020 21:18:15	-	11	11	30.10.2020 21:18:15

the time spent was as follows: formation of the structure of ISPM and templates for entering information into ISPM – about 10 work hours; introduction of commands for entering information into the ISPM for about 40 hours (0.25 hours per day).

This concept and set up for the construction and use of information standard of project management in project-oriented companies PrimaDoc system was implemented in PJSC Tutkovsky (Ukraine). The system was used for digitalization of design and technological documentation for projects to create geophysical instruments. The documentation included descriptions of devices and manufacturing technologies. In addition, information was entered regarding the manufacturing process itself – the duration of individual stages and the amount of resources used. In essence, the information standard of project activities for the manufacture of geophysical instruments was formed. To do this, let's use a template for direct recording of information in ISPM (template "Archiving"), which included the command (Fig. 3):

1. No. of stage – 1.
2. Performer – ISPM.
3. The task is to save.
4. What to do – save.
5. Days – 0 (automatic entry in ISPU immediately after approval).

The technology of information processing for geophysical instruments is implemented according to the following scheme:

1. Select the "Archive" template of the PrimaDoc system.
2. Attaching the scanned document (documents were mostly in paper form).
3. Enter in the template No. and the type of document (field "Document" in Fig. 1).
4. The project is specified (Fig. 1).
5. Restrictions in terms are not specified (Fig. 1).
6. Execute.

According to experimental research, the implementation of the project lasting 6 months with the traditional approach required the archiving of relevant information for future projects about 200 work hours. When using the PrimaDoc system,

In addition, the information standard included information on all meetings (minutes of meetings) with the decisions taken and the results of the implementation of these decisions. In total, about 10,000 documents were submitted to the ISPM. About 10 minutes of the meeting were held every month. That at the first stage allowed the company to stop using paper documents and completely switch to using the PrimaDoc system to obtain the necessary information. In the second stage, ISPM was used by the company's engineering and technical staff to plan the implementation of tasks related to current projects in the "by analogy" mode. When parameters (duration and amount of resources) were selected for the same works on different devices, which corresponded to the average values of these parameters of previous projects (formulas (2), (4)).

6. Discussion of the results of creating the concept of building the information standard of project management based on PrimaDoc

A distinctive feature of the concept of creating an information standard of project management is the combination of expert information with information on the deviation of expertly determined parameters of previous projects with the actual parameters of their implementation. The peculiarity of this concept is that it forms the scientific and methodological basis for the creation of ISPM based on the tool system of information management of enterprises and projects PrimaDoc. While traditional concepts use for this purpose the limited possibilities (in the field of digitalization) of project management software tools. And this requires additional time for the constant allocation and transfer of information on projects in the part of the database that is allocated for the information standard. According to the authors, the implementation of the project lasting 6

months requires about 200 work hours to archive relevant information for future projects. Setting up the PrimaDoc system to form such a standard requires about 10 work hours. This is due to the peculiarity of the proposed concept – when all the processes of formation of ISPM are centralized and transferred to the information management system PrimaDoc. Thus, most of the functions of the formation of ISPM are performed automatically, without the involvement of a person. And this not only reduces the time for the formation of ISPM, but also improves the quality of information, as it reduces the impact of the human factor, and hence errors.

Based on the above features, the principles, approach, model, structures, scenarios and technology of construction and use of the information standard of project management based on the information management system PrimaDoc. These results reflect the features of the proposed concept and are presented: principles of ISPM formation (subsection 5.1, Table 1), approach to ISPM formation (subsection 5.4) and model of using information standard of project management to determine planned parameters of new projects – subsection 5.2, formula (1)–(8). On this basis, the technology of forming ISPM project-oriented company (subsection 5.3, Fig. 1, Table 3), which uses the settings of the information management system PrimaDoc by developing templates and scenarios for submission and processing of documents in ISPM to solve the problems identified in the concept digitalization of project activities (subsection 5.4, Fig. 2, 3, Tables 4–6).

These results achieved the goal of the research, namely to obtain the concept of building and using the information standard of project management in project-oriented companies based on the information management system PrimaDoc. This concept allows solving the scientific and practical problem of obtaining reliable information for project planning not only from the expert assessment of its parameters, but also from the history of planning and implementation of previous projects.

The limitations inherent in this research are related to the narrow scope of the concept only to the tasks of planning work, determining the amount of resources and procurement of material resources, and risks. Thus, the issues of displaying information in ISPM on the effectiveness of team work of project management groups, content management and project cost are not considered. After all, all these components are very important for project management of any company. Therefore, this is not only a limitation, but also a disadvantage of this work.

In addition, the PrimaDoc system is an open Ukrainian development that lacks an English-language interface. This narrows the scope of its application, at least until there are customers interested in creating an English-language interface. But the value of the proposed concept is that it can be used to adapt and configure other systems to form ISPM. In this case, only the tools for forming ISPM structures and information processing templates will be different. And everything else from the concept – principles, approach, structures and technology will remain unchanged.

The disadvantage of the research is that it does not take into account the conditions of previous projects. After all, their conditions may be different, which affects the deviation of the actual parameters from the planned ones.

The importance of predictable, accurate, systematic within the directive time and means of project implementation requires the search for new concepts, tools and mechanisms for project planning. And this problem is solved in this research. On the other hand, this formulation of the problem is not entirely complete in terms of the development of project

management methodology. After all, the proposed concept only allows configuring the tools of the information management system of enterprises and projects PrimaDoc to create ISPM. However, the task of creating the technology of using ISPM to increase the efficiency of management of all project components remains unsolved. Although, as follows from the results of the implementation of the developed concept, it has successfully passed practical testing.

7. Conclusions

1. A new concept is proposed – to use the PrimaDoc system as the core of the information standard of project management, through which all other tools will provide information for project management. PrimaDoc will perform an additional function – to create this standard as a single information system in a project-oriented company.

Four principles have been formulated and tasks of digitalization have been identified, which will ensure the ISPM creation: identification of ISPM information sources, development of ISPM filling scenarios, development of ISPM information entry technology, ISPM structure development, ISPM use model development.

The selection of the above principles and objectives integrates the process of creating ISPM in the processes of digitalization of project-oriented companies. This distinguishes the proposed concept from traditional approaches to the creation of project information repositories with project management tools. It is shown that the solution of the formulated tasks will allow the ISPM creation, which in turn will allow to solve the problems of planning new projects using the “digitized experience” of managing previous projects.

2. A model of using ISPM has been developed to determine the parameters of new projects: terms of works and resources, terms of material resources procurement, probabilities of occurrence and expected losses from risks. A distinctive feature of this model is the combination of expert information with information that reflects the fact of previous projects. Thus, it is possible to take into account not only the opinion of experts when planning new projects, but also the “digitized experience” of previous projects. The model includes 8 formulas for calculating indicators of future projects using ISPM information. Of course, the model does not cover all the tasks of project management, but allows “by analogy” in the future to move to the use of ISPM and to solve other problems.

3. Based on the fact that the use of the developed model requires the creation of an information base for calculating the parameters of projects, developed a structure of technology for the formation of ISPM project-oriented companies.

A data model is proposed, which allows to present ISPM in a form convenient for further use. This model includes the ISPM components needed to determine the parameters of new projects and is based on PrimaDoc tools. This feature of the ISPM presentation allowed to organically integrate the technology of ISPM formation into the traditional process of document processing, which is carried out in the process of working on the project.

4. The approach which consists not in development of special methods and tools of ISPM creation, and in adjustment of the existing system of information management system PrimaDoc on formation of the information standard of project management is offered. The structure of the information standard of project activity is developed and the environment

of the PrimaDoc system is adjusted to the technology of formation of ISPU of the project-oriented company. What is new is that this technology is based on the development and use of scenarios for the formation of ISPM. The structure of information processing templates and the templates themselves, which are used by the PrimaDoc system for the implementation of ISPM formation scenarios, are given. The structure of database tables is proposed to display template information, and a scheme of technology for processing or creating a document using templates and two technologies for importing information from project management tools is presented.

There are 12 functions of the PrimaDoc system used in the process of ISPM formation. It is shown that the PrimaDoc system implements two models of ISPM formation: the ISPM filling model in the process of electronic document circulation and the ISPM filling model based on the import of information from project management software. Based on this, two technologies of direct import of information from project management tools into the PrimaDoc system are proposed.

The use of PrimaDoc system templates and both import technologies fully ensure the possibility of forming ISPM in different conditions and modes of operation of project management systems.

The result differs from the existing ones in that instead of the technology of creating a standard by project management tools, a software and information core is used, which combines information flows of project management to create ISPM.

The value of the proposed concept is that it can be used to adapt and configure different systems for the ISPM formation. That allows to use the principles, approach, structures and technologies offered in the concept in other countries of the world, and not only in Ukraine.

According to experimental research, the implementation of a project lasting 6 months requires about 200 work hours to archive relevant information for future projects. The use of the developed concept allowed to reduce the cost of creating ISPM to 50 work hours for the project lasting 6 months.

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