

ALEKSANDRAS STULGINSKIS UNIVERSITY
BUSINESS AND RURAL DEVELOPMENT MANAGEMENT INSTITUTE

**MANAGEMENT OF MODERN
SOCIO-ECONOMIC SYSTEMS**

Volume 1

Collective monograph
edited by J. Žukovskis, K. Shaposhnykov

Kaunas, Lithuania
2017

UDC 338.24
M 24

*Recommended for publication
by the Academic Council of Aleksandras Stulginskis University
(29.12.2017)*

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Management of modern socio-economic systems. – Collective monograph. – Vol. 1. Lithuania: Izdevniecība "Baltija Publishing", 2017. – 296 p.

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2. TERRITORY MANAGEMENT: CLUSTERS, BRANCHES, REGIONS

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MANAGING THE REQUIREMENTS OF STAKEHOLDERS OF PROJECTS AND URBAN DEVELOPMENT PROGRAMS

Summary

A specific feature of urban development projects and programs is a large number of stakeholders involved in their implementation. In this context, managing requirements of stakeholders is one of the key factors of success or failure of projects and programs. Researches in the sphere of project management state that these processes are not sufficiently formalized. In view of the fact that serving the needs of stakeholders is one of the quality indicators of a project, the purpose of this study is to develop mechanisms of stakeholder management that take into account changes and make it possible to monitor meeting the requirements of stakeholders during runtime while implementing urban projects and programs. The approach, which is based on the integration of the hierarchical structure of requirements and the hierarchical structure of the project, is suggested; this approach enables supplementing available methods of classifying project stakeholders with the indicator of resource intensity of requirements that can be determined in monetary form. The method is suggested that enables monitoring the dynamics of meeting the requirements of project stakeholders in the course of time according to the amount of actually spent resources. The functional model of the suggested method is

presented. The tools for implementing the method of monitoring the requirements of urban projects and programs in MS Project environment are developed.

Introduction

Urban development projects and programs, in particular, projects for developing enterprises that ensure the viability of a modern city, are characterized by a significant number of stakeholders. Therefore, in order to ensure the quality of such projects, it is necessary to provide methodological and instrumental support for identifying stakeholder groups and mechanisms in order to monitor the requirements of project stakeholders under resource constraints.

Analysis and management of project requirements are researched in three main areas:

- Within the business analysis. Thus, BABOK (A Guide to the Business Analysis Body of Knowledge, [1]) has two separate branches of knowledge that describe the tasks of requirements management: Requirements Life Cycle Management and Requirements Analysis and Design Definition.

- within traditional project management. One of the most commonly used project management standards is A Guide to the Project Management Body of Knowledge (PMBOK® Guide), this is a standard issued by PMI. In 2013, a new area of knowledge appeared in the fifth edition of this standard [2]. This area deals with project stakeholders' management where the issues of requirement analysis are considered. Since 2014, as a result of publishing the Business Analysis for Practitioners: A Practice Guide [3], PMI has standardized the term “business analysis” as a critical competence of project management, and since the same time has considered “requirements management” as a component of the business analysis. In 2016, PMI issued a separate requirements management standard – Requirements Management: A Practice Guide [4], which is considered as an element that links [2] and [3].

- in the sphere of information technologies. At present, most studies on requirement analysis (Requirements Engineering) are related to the development of software and information systems. Requirements' Engineering describes the processes for determining, documenting, and fulfilling requirements and is an integral part of system and computer engineering. Currently, in addition to niche methods of analysing and managing requirements [5], there is a standard that connects flexible methodologies of software development and business analysis methods, that is, Agile Extension to the BABOK Guide [6].

It should be noted that although standards [1-4, 6] are developed on the basis of “best practices”, they only contain recommendations as for using certain methods of working with requirements, without a detailed description of methods and instructions for their adaptation to one or another branch. Regarding their practical implementation, the majority of corresponding studies prevail in the sphere of information technology. At the same time, in the field of traditional project management, researchers mostly focus on the management of project stakeholders but not on their requirements, the researchers emphasize such unresolved tasks as:

lack of listed factors for determining the quality of stakeholders management; need for further development of stakeholder management standards; lack of practical management approaches; lack of analysis of connection between the actions aimed at managing stakeholders and the success of a project [7]. The necessity of developing mechanisms for multi-dimensional analysis of stakeholders is grounded as well.

Available works describe the algorithm of analysis, but do not contain the mathematical basis for performing it [8]; an attention is paid to the development of software for stakeholder analysis. Available developments are based on the use of available methods of stakeholder analysis and, therefore, take over their shortcomings, in particular, the use of a small number of factors for analysis, the use of expert assessment without its verification [9]. Ukrainian scholars dealing with the classification of stakeholders pay attention mainly to economic aspects rather than to managerial ones [10].

Consequently, there is an objective need to develop and formalize methods of requirement management and control in projects outside the IT industry, in particular, for urban development projects and programs that are managed using traditional or combined methodologies.

Part 1. Developing the method for monitoring requirements of stakeholders of urban projects and programs

The implementation of any project comes amid fulfilling the requirements of its stakeholders. At the same time, a certain requirement of a stakeholder can be assigned to the project work, which ensures meeting this requirement. Fig. 1 shows the results of the integration of the Requirement Breakdown Structure (RBS) and the classical hierarchical structure of the project work (Work Breakdown Structure, WBS). The matrix of control points for meeting stakeholders' requirements assigns a certain requirement to the work that should be done to implement it. This approach enables monitoring the implementation of stakeholders' requirements with a given degree of detailing, which, in turn, is determined by the level of detailing of WBS and RBS [11-13].

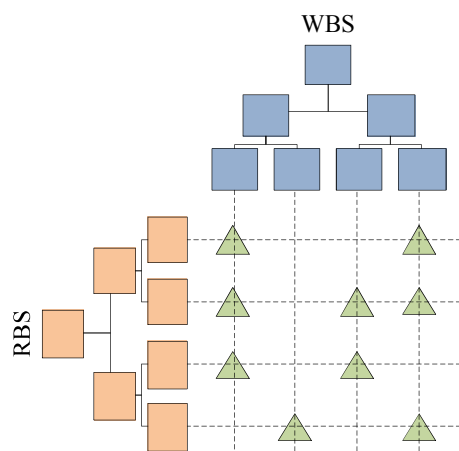


Fig. 1. The matrix of control points for meeting stakeholders' requirements

In view of the fact that while planning a project certain resources are assigned to the project works, and using the matrix of control points for meeting stakeholders' requirements, the works can be grouped according to the requirements or according to individual stakeholders. That means that this is a procedure for developing WBS according to specific principles. This procedure can be performed, for example, with WBS Schedule PRO software [14]. The example of the results of grouping works according to project stakeholders is presented in Fig. 2, where R_i is a vector of resources that corresponds to work W_i , while S_{tj} is a stakeholder whose requirements are met due to the results of this work. It is certain that at the stage of developing the matrix of control points for meeting stakeholders' requirements, it is necessary to take into account the fact that one work can contribute to meeting several requirements of various stakeholders.

The sum of resources according to each WBS branch provides the total amount of resources that are required for meeting the requirements of each stakeholder. A similar indicator can be calculated according to individual requirements of project stakeholders.

Thus, the suggested approach enables supplementing the available methods of stakeholders' classification with another indicator – the indicator of the resource intensity of its requirements, which can be determined in monetary form.

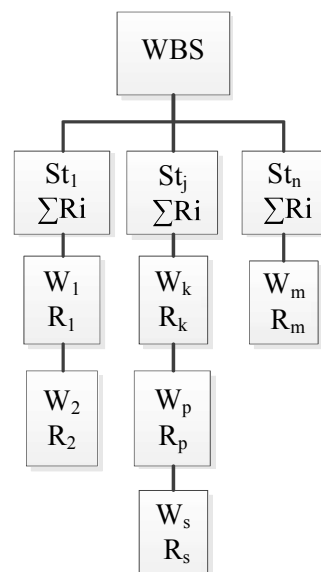


Fig. 2. The hierarchical structure of project works developed according to stakeholders' requirements

Assigning certain requirements of stakeholders to individual project work enables keeping track of their execution in the course of time according to the amount of actually spent resources similarly with the earned value method [2, 15].

Earned Volume Management (EVM) is a methodology that combines content, timetable and resource assessments in order to measure the progress of the project and the achievement of efficiency. EVM is used to monitor three key indicators for

each work package: planned volume (PV) is the authorized budget allocated to the planned work; earned volume (EV) is the amount of work done, which is expressed in terms of the authorized budget; actual cost (AC) is actual costs paid to do work for a specific period of time. Let us determine indicators for analysing the earned value of stakeholders' requirements that is the method of monitoring requirements (Table 1).

Table 1

Key indicators of the method of monitoring requirements

Indicator	Characteristics	Formula
PR	Planned amount of requirements that should be fulfilled at a certain moment of time.	planned indicator
ER	The actual amount of requirements fulfilled at a certain moment of time.	according to the results of monitoring
AC	The actual amount of resources in monetary terms spent on the project at a certain point of time.	according to the results of monitoring
SR	Schedule deviations in terms of meeting the requirements of project stakeholders. A positive value is favourable, negative one is unfavourable. Zero deviation indicates that planned indicators have been fulfilled.	$ER - PR$
CR	Cost deviations in terms of meeting the requirements of project stakeholders. The positive one is favourable, negative one is unfavourable. Zero deviation indicates that planned indicators have been fulfilled.	$ER - AC$
SPIR	Schedule index in terms of meeting the requirements of project stakeholders. The value that is greater than 1 is favourable, the value that is less than 1 is unfavourable. The value, which is equal to 1, indicates that planned indicators have been fulfilled.	ER / PR
CPIR	Cost deviations in terms of meeting the requirements of project stakeholders. The value that is greater than 1 is favourable, the value that is less than 1 is unfavourable. Value, which is equal to 1, indicates that planned indicators have been fulfilled.	ER / AC

The suggested method is graphically interpreted in Fig. 3: for a conditional project, curves PR, ER, and AC are constructed; schedule rejections (SR) and cost rejections (CR) are shown in terms of meeting the requirements of stakeholders. When the project is implemented at the moment of time T, there is a progression in meeting the requirements and savings relative to the planned indicators of the project budget.

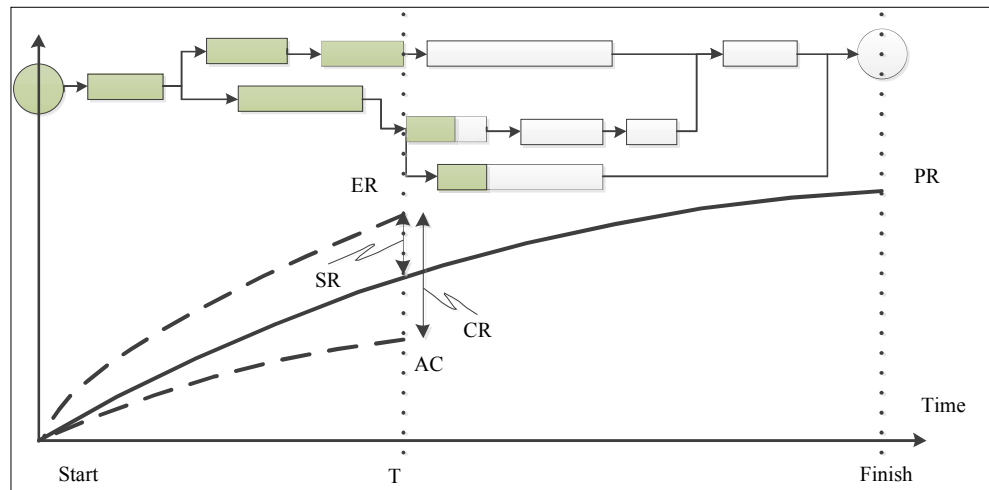


Fig. 3. Analysis of the earned volume of stakeholders' requirements

The interpretation of key indicators of the suggested method is given in Table 2, and the relationship between them is shown in Fig. 4.

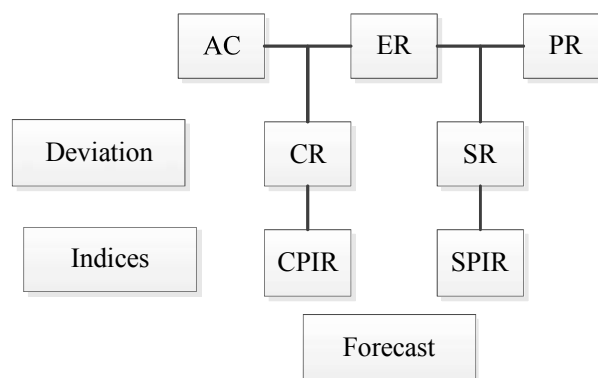


Fig. 4. The diagram of interconnections of indicators of the suggested method

It should be noted that the suggested indicators are the basis not only for monitoring but also for forecasting the project implementation.

For practical use of the suggested method, the process of its implementation should be described. Within this work, this process is described by the methodology of functional modelling and graphical description of the processes of IDEF0, which is designed to formalize and describe business processes. Fig. 5 shows the context level of the suggested model.

Table 2

Interpretation of key indicators of the method of monitoring requirements

Indicators of project implementation		Requirement		
		SR>0; SPIR>1	SR=0; SPIR=1	SR<0; SPIR<1
Cost	CR>0; CPIR>1	plan forestalling, budget saving	scheduled fulfilling the requirements, budget saving	falling behind the requirements, budget savings
	CR=0; CPIR=1	plan forestalling, budget fulfilling	scheduled fulfilling the requirements, budget fulfilling	falling behind the requirements, budget fulfilling
	CR<0; CPIR<1	plan forestalling, overbudgeting	scheduled fulfilling the requirements, overbudgeting	falling behind the requirements, overbudgeting

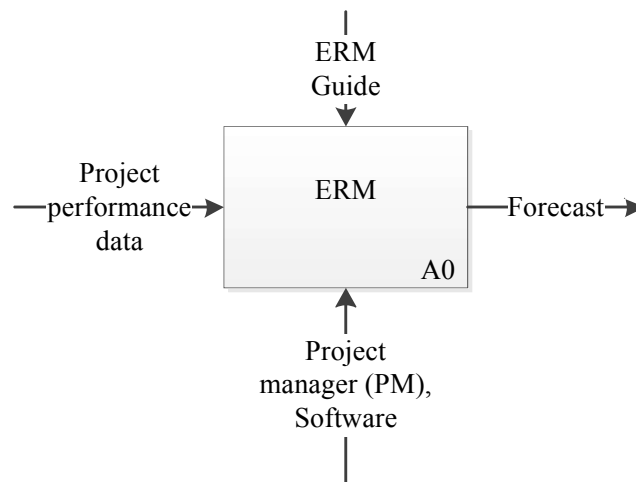


Fig. 5. The context model of the suggested ERM method

Fig. 6 shows the decomposition of the process for using the method of monitoring project requirements. The arrows of the model show the inputs, outputs, mechanisms, and controls for the respective processes.

Similar to the method described above, the relationship between the project characteristics and the hierarchical structure of the project work can be further determined. From then on, it is suggested to use the comparison of the project hierarchical structure (WBS) with the following hierarchical structures:

- R(equirements) BS is the hierarchical structure of project requirements;
- R(isks) BS is the hierarchical structure of project risks;
- R(esource) BS is the hierarchical structure of project resources;
- R(esponsibility) BS is the organizational structure of the project.

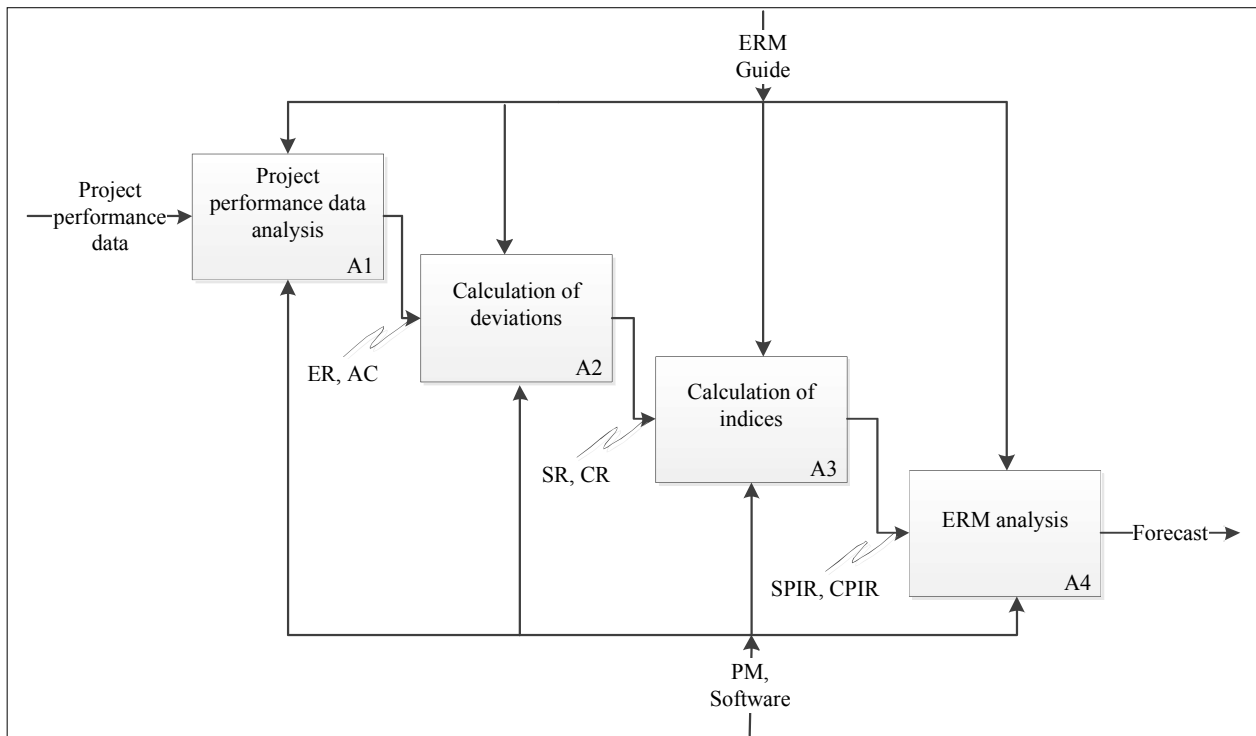


Fig. 6. Decomposition of the model for using the method of project monitoring (ERM)

Graphically, the relationships among the above sets are shown in Fig. 7.

Assigning certain characteristics of the project to its individual work enables monitoring their implementation during runtime. This can be done using software tools of project management tools, e.g. MS Project.

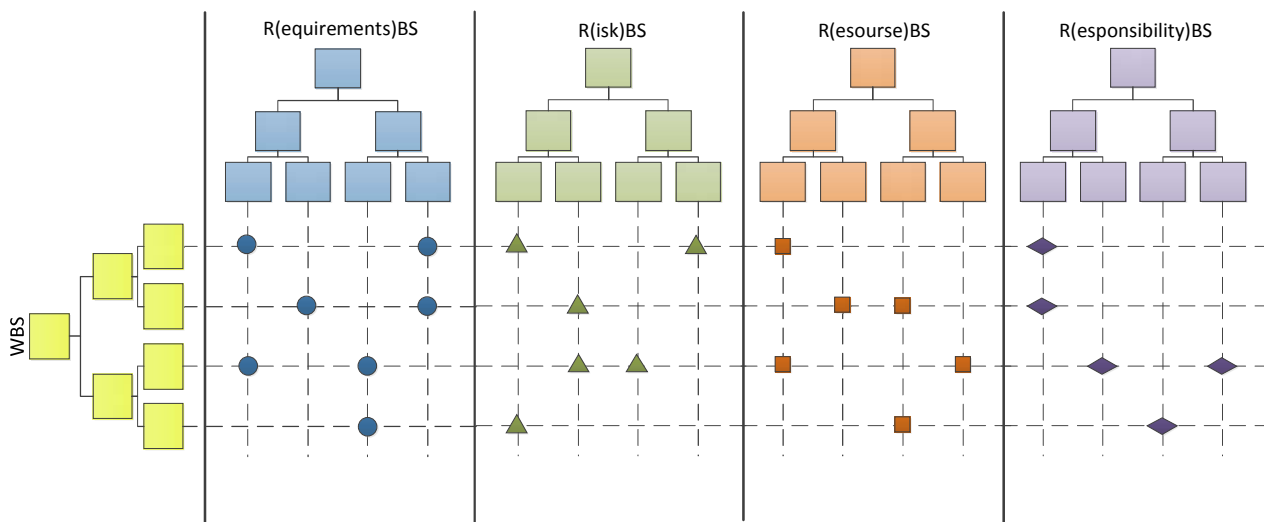


Fig. 7. Interconnections of WBS sets, R(requirements)BS, R(isks)BS, R(esponsibility)BS

Fig. 8 shows information on the project works and Gant diagram of a conditional project. Columns for R(equirements)BS, R(isks)BS, R(esponsibility)BS, R(esourse)BS were included to the standard data entry form for tasks of the project.



Fig. 8. Representation of interconnections of WBS sets, R(equirements)BS, R(isks)BS and R(esponsibility)BS in MS Project

From then on, a block that connects project stakeholders (a set of Stakeholders) and their requirements can be added to the structural scheme in Fig. 7 (Fig. 9).

This enables establishing connections among individual project characteristics through WBS. As a result, a cube is obtained, its sides being: risks, work, resources, requirements, stakeholders and people responsible for the project (risks, resources, requirements, responsibilities, works, stakeholders – 4R & WS). The flat pattern of this cube is shown in Fig. 10.

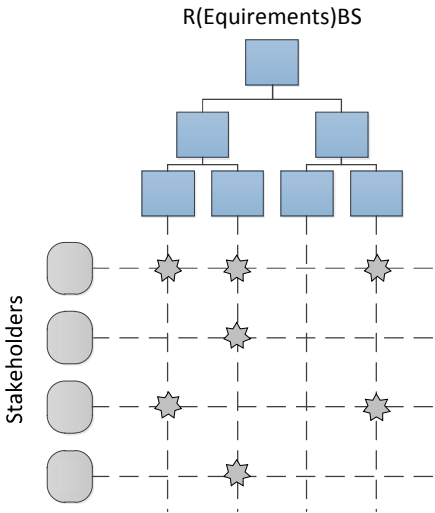


Fig. 9. Interconnection of Stakeholders sets and R(equirements)BS

Thus, each project characteristic included in 4R & WS list can be represented by means of five other ones. Consequently, each characteristic of 4R & WS can be

classified according to five directions (both separately for each direction and according to their various combinations).

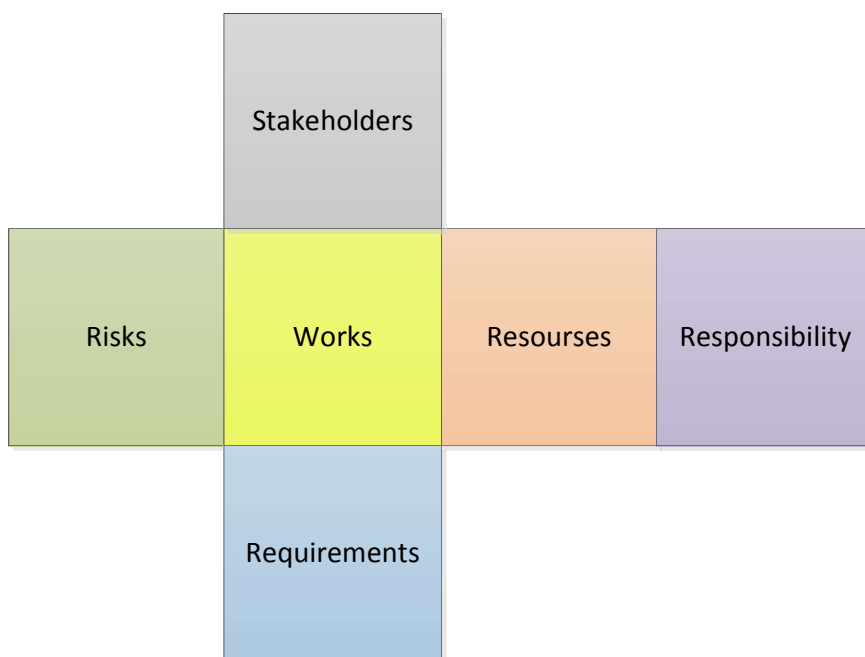


Fig. 10. The flat pattern of 4R&WS cube

In particular, project stakeholders are characterized by a list of works, which are connected with a stakeholder; stakeholder requirements related to works; risks (list and financial assessment) related to works; resources (list and financial assessment) related to works; list of responsible people.

Part 2. A software implementation of the suggested method

From then on, some indicators of the method will be considered, and the way the method can be implemented in the environment of MS Project will be demonstrated:

1. PR is the planned amount of requirements that should be fulfilled at a certain moment of time (planned indicator). If planned properly, this indicator should be equal in money to the basic cost of the planned work for the period of time under consideration. The transformation format of PR indicator in MS Project is presented in Fig. 11.

2. ER is the actual volume of requirements that was fulfilled at a certain moment of time. This indicator is determined according to the results of monitoring; therefore, it has no calculation formulas (Fig. 12).

3. AC is the actual amount of money spent on the project at a certain moment of time. This value is also determined by the results of monitoring, but MS Project environment has an indicator that characterizes it, that is the actual cost of the work done (Fig. 13).

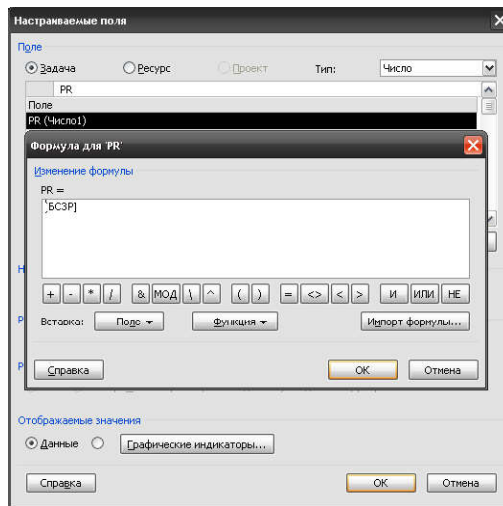


Fig. 11. Formalization of PR indicator in MS Project

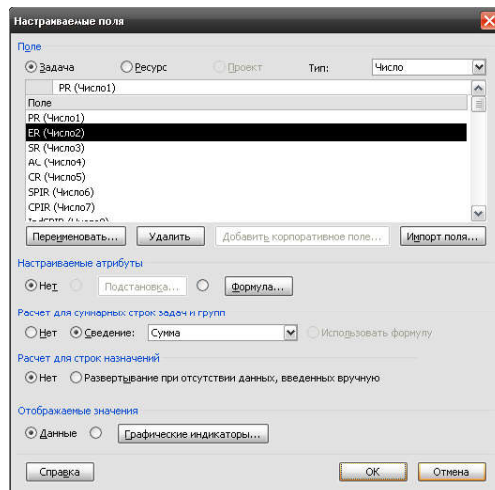


Fig. 12. Formalization of ER indicator in MS Project

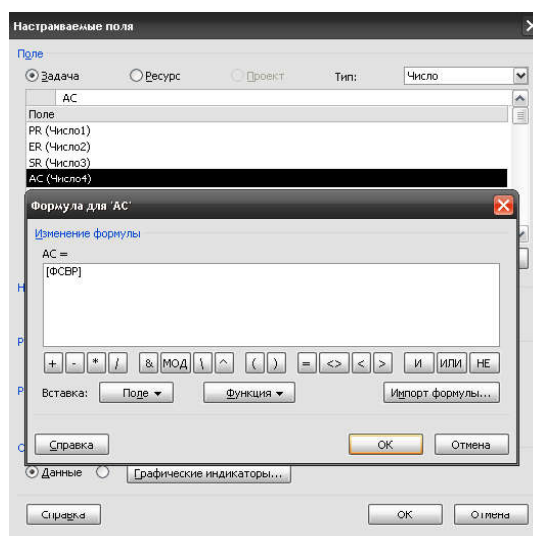


Fig. 13. Formalization of AC indicator in MS Project

4. SR is schedule deviation in terms of meeting the requirements of project stakeholders ($SR = ER - PR$). A positive value is favourable, negative one is unfavourable. Zero deviation indicates that planned indicators have been fulfilled (Fig. 14).

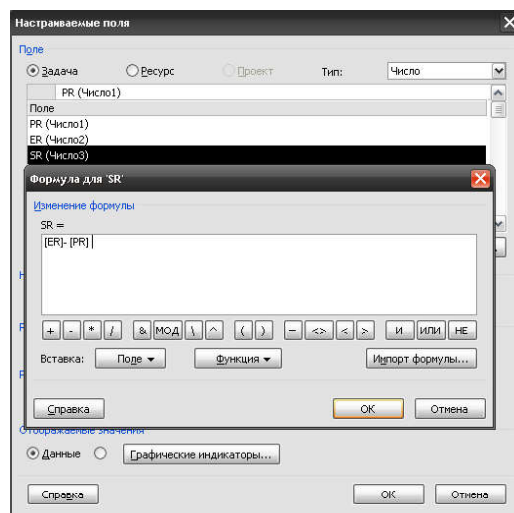


Fig. 14. Formalization of SR indicator in MS Project

5. CR is value rejections in terms of meeting the requirements of project stakeholders ($CR = ER - AC$). A positive value is favourable, negative one is unfavourable. Zero deviation indicates that planned indicators have been fulfilled (Fig. 15).

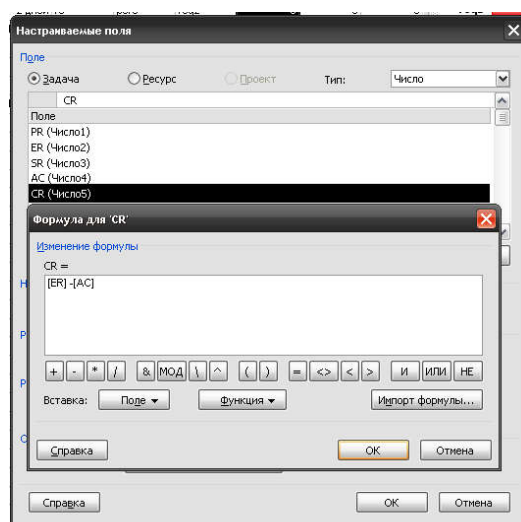


Fig. 15. Formalization of CR indicator in MS Project

6. SPIR is schedule index in terms of meeting the requirements of project stakeholders ($SPIR = ER / PR$). The value of the indicator that is greater than 1 is favourable, the value that is less than 1 is unfavourable. The value, which is equal to 1, indicates that planned indicators have been fulfilled (Fig. 16).

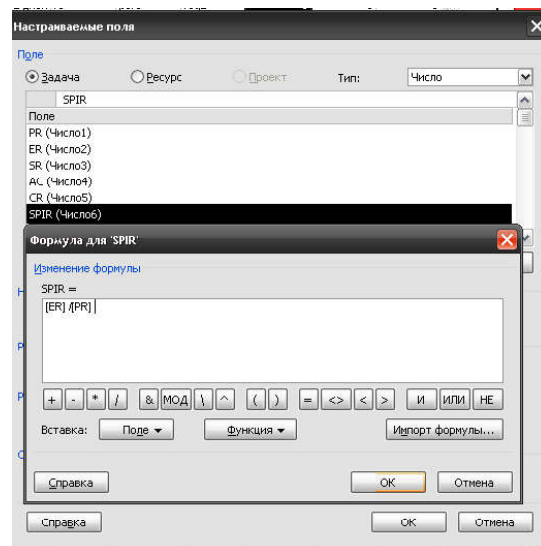


Fig. 16. Formalization of SPIR indicator in MS Project

7. CPIR is cost deviation index in terms of meeting the requirements of project stakeholders ($CPIR = ER / AC$). The value that is greater than 1 is favourable, the value that is less than 1 is unfavourable. The value which is equal to 1 indicates that planned indicators have been fulfilled (Fig. 17).

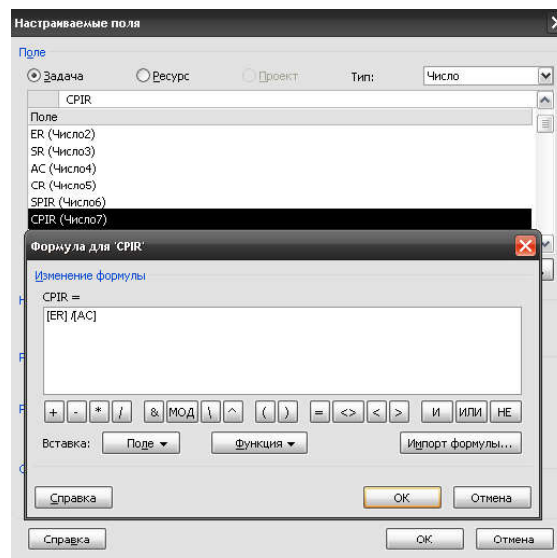


Fig. 17. Formalization of CPIR indicator in MS Project

For the project summary tasks, absolute PR, ER, and AC indicators are calculated as the sum of the indicators according to works of the corresponding level (Fig. 18).

SR, CR, SPIR, and CPIR indicators according to summary tasks are calculated using the same formulas that are used for elementary tasks (Fig. 19).

MS Project contains several tables that can be used to represent project data in different areas. In most cases, the tables already include all the necessary columns,

but any customized table can be changed or a new table contains necessary data can be created.

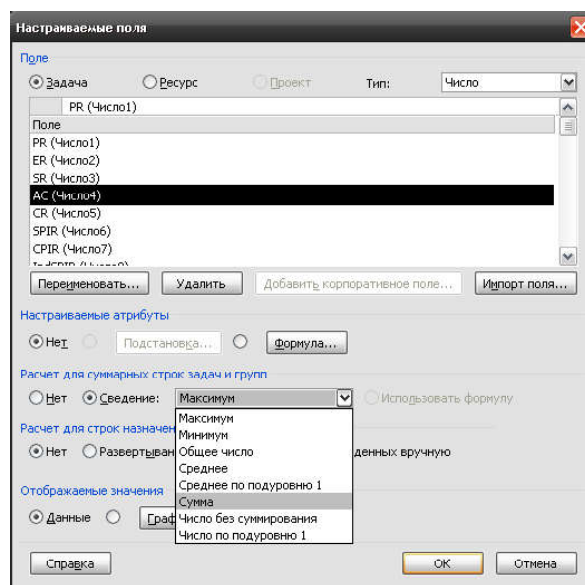


Fig. 18. Formalization of PR, ER, and AC summary indicators

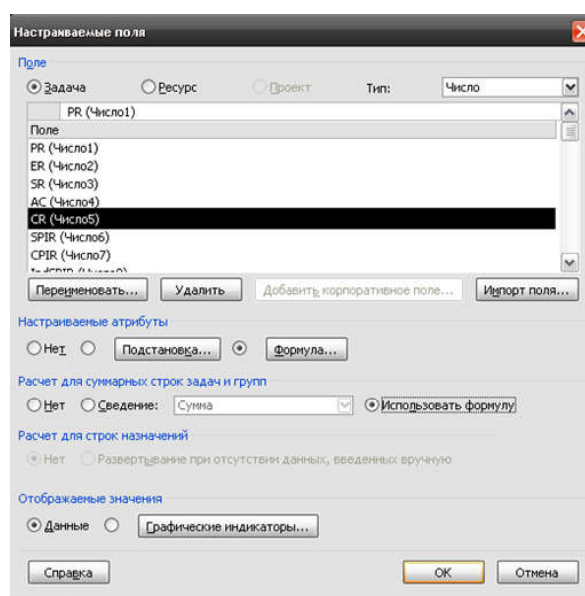


Fig. 19. Formalization SR, CR, SPIR, and CPIR summary indicators

Table “Requirements” was created, which is presented in Fig. 20.

The lines of the table contain the names of the project works, the columns contain:

- the planned volume of requirements (PR),
- the actual amount of requirements (ER),
- the actual amount of resources in monetary terms spent on the project at a certain moment of time (AC),

- schedule deviation in terms of meeting the requirements of project stakeholders (SR),
 - cost deviation in terms of meeting the requirements of project stakeholders (CR),
 - schedule deviation index in terms of meeting the requirements of project stakeholders (SPIR),
 - cost deviation in terms of meeting the requirements of stakeholders (CPIR).
- Indicators for visual control of normative limits are designed for the last two indices.

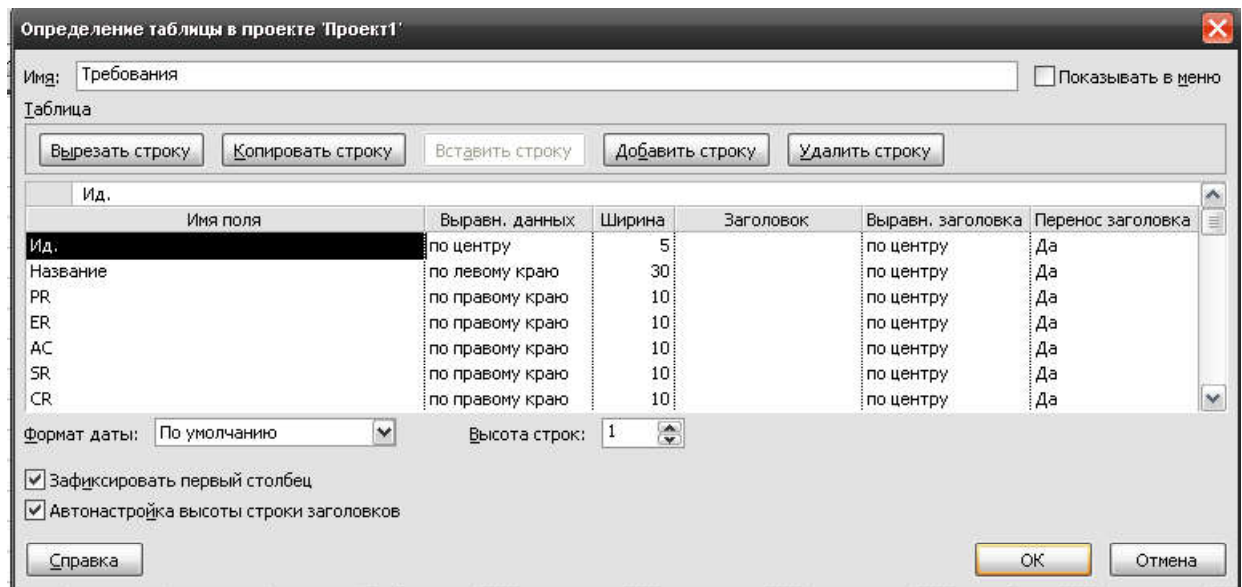


Fig. 20. Columns and lines of “Requirements” table

Fig. 21 shows a conditional project whose model was built in MS Project environment. The results of calculation according to the method of monitoring requirements in the project (the resulting table “Requirements”) are shown in Fig. 22.

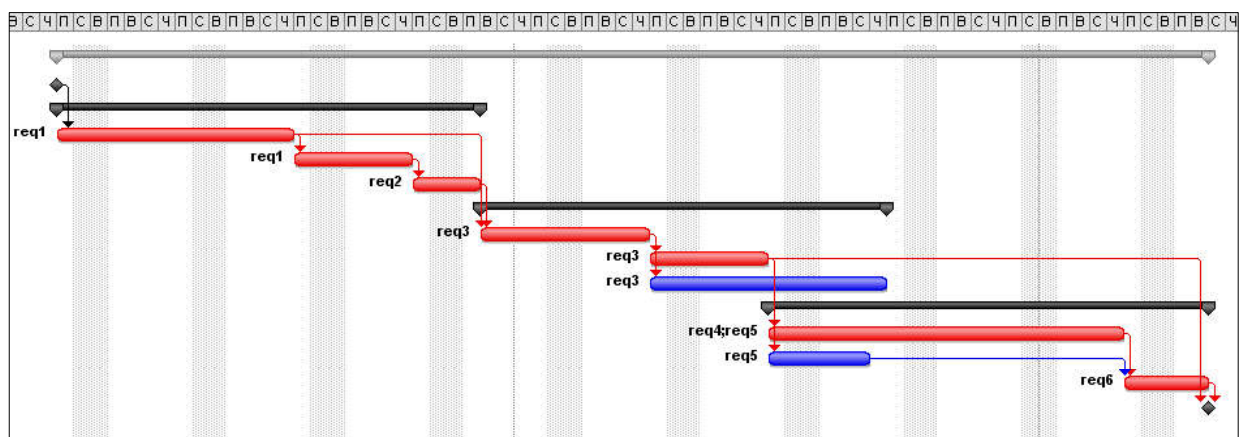


Fig. 21. Gantt diagram of the conditional project

	Название	PR	ER	AC	SR	CR	SPIR	IndSPIR	CPIR	IndCPIR
0	Project	13020	12350	5800	-670	6550	0,95		2,13	
1	Start	0	0	0	0	0	1		1	
2	Work 1	1580	1400	600	-180	800	0,89		2,33	
3	Work 1.1	700	500	500	-200	0	0,71		1	
4	Work 1.2	300	300	300	0	0	1		1	
5	Work 1.3	580	600	600	20	0	1,03		1	
6	Work 2	8150	7800	5800	-350	2000	0,96		1,34	
7	Work 2.1	1200	1000	950	-200	50	0,83		1,05	
8	Work 2.2	5750	5800	5800	50	0	1,01		1	
9	Work 2.3	1200	1000	900	-200	100	0,83		1,11	
10	Work 3	1940	1800	1200	-140	600	0,93		1,5	
11	Work 3.1	300	300	300	0	0	1		1	
12	Work 3.2	890	1000	1200	110	-200	1,12		0,83	
13	Work 3.3	750	500	500	-250	0	0,67		1	
14	Finish	1350	1350	1300	0	50	1		1,04	

Fig. 22. Table “Requirements” for a conditional project in MS Project

Thus, tools have been developed to use the method of monitoring requirements for projects that are planned and implemented using MS Project software.

Conclusions

Managing requirements is today one of the key processes for achieving successful results in projects and programs. Recently, the researches in the sphere of project management – Project Management Institute [16, 17] have indicated that problems dealing with requirements appear as the second/third most important factor that causes project failures. Respondents who focus on this particular reason of the project failure permanently come to 37-38%. In addition, according to [15], only 49% of respondents sort out resources for implementing requirement management in the project, while 47% are not able to formalize processes for objective validation of requirements. Therefore, requirements for the management of projects and programs should be methodologically supported.

This study resulted in developing the approach, which is based on the integration of the hierarchical structure of requirements and the hierarchical structure of project works, and enables supplementing the available methods of classifying project stakeholders according to the indicator of the resource intensity of requirements, which can be determined in monetary terms.

It should be noted that the suggested method of monitoring requirements enables keeping track of the implementation of requirements of project stakeholders in the course of time in accordance with the volume of actually spent resources like the method of earned volume.

The development of the suggested method, which enables monitoring the project implementation during runtime according to the factors of 4R & WS model, is also presented; these factors are classified in five areas (both separately in each area and according to their different combinations). In particular, such a classification of project stakeholders will give information about the resource and risk load of

specific stakeholder requirements, which enables planning strategies for the interaction with project stakeholders more thoroughly, as well as managing stakeholders' requirements.

In future, it is necessary to create mechanisms for the development of input data for using the approach so that to take into account different types of requirements of project stakeholders: mutually exclusive (two or more requirements that cannot be fulfilled simultaneously in the project); supporting (when fulfilling one requirement contributes to meeting the other one); independent (when the fulfilment of one requirement does not affect the fulfilment of the other one); obligatory (requirements that should be fulfilled, for example, in accordance with the current legislation), as well as the fact that the ratio "requirements-work" can be written as $m \times n$.

Tools for implementing the method of monitoring requirements in the project in MS Project environment are developed, which increases the efficiency of monitoring the requirements of project stakeholders.

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PROSPECTS FOR DEVELOPMENT OF TOURISM IN UKRAINE IN THE CONDITIONS OF FORMING TOURISM CLUSTERS

Summary

The research is devoted to the observation of conditions for the development of tourism in Ukraine, problems of the Ukrainian tourism industry. Development of tourism clusters is proposed as a modern tool for tourism development. The model of tourism cluster is given and conditions for the formation of tourism clusters are defined. The cluster approach to the functioning of subjects of regional tourism services markets is substantiated, it is emphasized that it is necessary to take into

Izdevniecība "Baltija Publishing"
Valdeķu iela 62 - 156, Rīga, LV-1058

Iespiests tipogrāfijā SIA "Izdevniecība "Baltija Publishing"
Parakstīts iespiešanai: 2017. gada 29. decembris
Tirāža 300 eks.