DEVELOPMENT OF A SCHEDULE OF THE PROJECT ON THE PROPERTY BOARD OF VALUES OF STAKEHOLDERS

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ABSTRACT

The article describes development of a mathematical model for describing the values and artefacts of the project stakeholders. The target functions of the project success based on the values and artefacts of the project are proposed. The approach to form a set of tasks of the project, and connections between them due to the use of project artefacts is proposed.

KEYWORDS: project schedule, project artefacts, artefacts resources, artefacts products

1. Introduction

The continual growth of the number of new technologies and materials leads to an increase in the number of products and services offered on the market. Coupled with the integration processes that take place between countries of the world, this leads to a constant increase in competition. The most widespread strategy of competition is the development of goods and services that are targeted at suiting the values of clients. Individual approach to each client gives companies a great competitive advantage. To ensure an individual approach of providing services, companies have to implement project management and focus on the values of stakeholders. This process results in the introduction of flexible methods and tools of project management in many companies. To introduce flexible project management methods, development of an approach to project planning which considers the values of the project stakeholders is required.

The concept of values is quite actively used in different methodologies of project management. Various descriptions of values and approaches thereof can be found in various international standards for project management [1-3].

The first scholars who began to use the concept of value in their works are well-known Ukrainian scholars such as Bushev S.D., Rach V.A., Teslia Y.M., Medvedieva O.M. and others [5-12]. Foreign scholars also actively examine the influence of values on the stakeholders' decision-making processes [13-16].

The purpose of the article is to formulate approaches to project schedule developing in accordance with the goals of the project stakeholders.

2. Article

2.1. Mathematical representation of stakeholders' values

The complexity of working with the values of stakeholders is that they are described by qualitative parameters, the values of which are determined subjectively. Stakeholders' attitude to value may be changed as a result of the influence of external factors. As an example, advertisement changes the attitude of stakeholders by providing information that changes their attitude to the advertised product or service. Most advertising projects focus on the priorities and degree of satisfaction of stakeholder values. A set of project stakeholders is mathematically described as follows

$$Z = \{Z_1, \dots, Z_k, \dots, Z_g\}, \tag{1}$$

where: Z_k – k stakeholder,
g – number of project stakeholders.

The complexity of project analysis through values consists in subjectivity in assessing the importance and impact of various kinds of information on the stakeholders. For example, such value as "Private space" can be evaluated differently by stakeholders with different cultural and moral principles. Mathematically, multiplication of the values of the interested party is represented as follows:

$$C = \{C_1, \dots, C_i, \dots, C_l\}, \tag{2}$$

where: C_i – i value of the stakeholder,
l – number of stakeholder values.

This research suggests that the attitude of the stakeholder to the value shall be described with the use of two parameters, i.e. priority and level of value provision.

$$C_i = \langle p_i^c, v_i^c \rangle, \tag{3}$$

where: p_i^c – priority of i value, $p = \overline{0,1}$, $\sum_i^l p_i^c = 1$,
v_i^c – level of provision of i value, $v = \overline{0,1}$.

The value priority defines the stakeholder attitude to the value. Priority is a relative number and its value depends on the priority of other values. The project management team when collecting information about the project stakeholders can specify the absolute value of the priority. In the subsequent analysis, a relative priority indicator is calculated, reflecting the importance of the value in the value system of the stakeholder.

By receiving project products, a stakeholder may change priorities of a value, but the stakeholder always has the basic value of priorities when starts working with the project team. The basic priorities are defined by an expert method which is implemented when a target project plan is formed. The set of basic priorities is described with an array P[l, m], the form of which is represented in Table 1.

Table 1. Basic priorities of stakeholders

		C_1	…	C_i	…	C_l
Z_1		p_{11}^b		p_{1i}^b		p_{1l}^b
	…					
Z_k		p_{k1}^b		p_{ki}^b		p_{kl}^b
	…					
Z_g		p_{g1}^b		p_{gi}^b		p_{gl}^b

The provision level is a parameter that determines the level of stakeholder values satisfaction. The parameter takes values from one to zero. The parameter takes a zero value if the value is completely unsatisfied. The parameter takes a unit value when stakeholder values are completely satisfied.

By the use of the concept of value, it is possible to formulate the goal of stakeholder participation in the project, as maximizing the satisfaction of stakeholder values. Using the mathematical representation of the values (2) and (3), we represent the target function of maximising the stakeholder values as follows:

$$\sum_i^l p_i^c * v_i^c \to 1, \tag{4}$$

By applying the formulae (1), (2) and (3) target function of stakeholder values maximisation shall be described in the following way:

$$\sum_k^g \sum_i^l p_i^c * v_i^c \to 1, \tag{5}$$

The products, which are created during the project implementation, are the physical instantiation of values. Products developed during the implementation of some project activities are used as resources for other project activities. Within the framework of this research, both the tangible and intangible project products and project resources are considered.

Good customer attitude to the company's products is an example of an intangible product and company resource. The intangible result is developed during implementation of marketing projects and further used in other projects of the company.

2.2. Mathematic representation of project artefacts

For the purpose of this research, all project products and resources are combined under the concept of "artefacts".

Definition 2.2. The artefact is understood as tangible and intangible elements of the world, which are valuable for stakeholders and may be used as the resources to perform a project [16].

The project artefacts are divided into the following components:

• Tangible component of the artefact is an artefact component containing its material implementation. Examples of a tangible artefact component are: premises, equipment, material resources. Material resources are mostly physical and may be transferred to the possession of another stakeholder.

• Information component of the artefact is an artefact component that carries the information description of the artefact. The information component of the artefact influences the outcome of the stakeholder decision-making process. Examples of intangible artefacts are: property rights, information on the changes in the dollar exchange rate, description of potential project investors, etc.

In this study, we will consider the information component of the artefact as far as it influences the decision-making process of stakeholders. Many artefacts are mathematically described in the following way:

$$A = \{A_1, \ldots, A_n\}, \tag{6}$$

where: A_n − n project artefact,
n − number of project artefacts.

Control of artefacts to a degree affects the satisfaction of the stakeholder values. The level of stakeholder satisfaction with the artefacts is described using an array V [g, l, n]. The form of the array is presented in Table 2.

Table 2. Array of dependence of values and artefacts

		A_1			A_n	
Z_1	C_{11}	v_{111}^c	p_{111}^a	...	v_{11n}^c	p_{11n}^a
	...	...	...	...	...	...
	C_{1l}	v_{1l1}^c	p_{1l1}^a	...	v_{1ln}^c	p_{1ln}^a
...	...	...		...	...	...
Z_g	C_{g1}	v_{g11}^c	p_{gl1}^a	...	v_{g1n}^c	p_{q1n}^a
	...	...	...	...	...	...
	C_{gl}	v_{gl1}^c	v_{g11}^c	...	v_{gln}^c	p_{gln}^a

By buying artefacts or participating in projects to obtain them, stakeholders raise the level of values satisfaction. Different artefacts, which may satisfy their values may be offered in the market. In order to make a right choice the stakeholder ranges a set of artefacts depending on their priority.

The artefact priority is defined as follows:

$$p_j^p = \sum_k^g \sum_i^l p_i^a * V[k, i, j], \tag{7}$$

where: p_j^p – priority of j artefact.

In order to satisfy the needs of stakeholders, a project team shall offer the artefacts, which would be able to satisfy stakeholder values of the highest priority [17].

2.3. Mathematic representation of a project

Let us consider any process of interaction between different stakeholders as an exchange process. Exchange can be executed by any artefacts owned by stakeholders. Depending on the peculiarities and time of the exchange of artefacts, the exchange may be divided into:

• **Simple exchange.** Simple exchange of artefacts takes place during purchase and sale of goods. At the time of the exchange, stakeholders determine the value of the artefacts offered for exchange and decide on the exchange of artefacts. During this exchange, stakeholders should clearly define the requirements for the targeted artefacts.

• **Complex exchange**. A complex exchange of artefacts is the purchase of services. The stakeholder, who orders the services, cannot completely evaluate the resulting product at the time of ordering the service. The stakeholder, who provides the services, requires a guarantee of payment for the services rendered.

In order to receive artefacts, which are more valuable, the stakeholder providing the services should offer the artefacts, which best suit the priority values of the customer. Therefore, the complexity and uniqueness of the process of service rendering increases for each stakeholder. High complexity and uniqueness of technological processes of organisation is provided by the use of project management methodology.

The development of new technologies and the emergence of new materials has led to the appearance of a large number of different technologies for the formation of the necessary set of artefacts. The combination of various technological processes with the use of new materials provides an opportunity to create a set of technological ways of creating the project artefacts.

The project is mathematically described in the following way:

$$F(A^p, A^r, t), \tag{8}$$

where: A^p – set of project artefacts products,
A^r – set of project artefacts resources,
t – time of project implementation.

By using the abovementioned definitions, the project is described as a set of processes of transforming artefacts resources into artefacts products.

Artefacts products are artefacts received by the stakeholders as a result of performance of the project. A set of artefacts products are mathematically described as follows:

$$A_h^p = \{A_1^p, \dots, A_b^p\}, \tag{9}$$

where: b – number of artefacts products of h project.

Artefacts resources are artefacts, which are contributed by the stakeholders in order to participate in the project.

A set of artefacts resources are mathematically described in the following manner:

$$A_h^r = \{A_1^r, \dots, A_q^r\}, \tag{10}$$

where: q – number of artefacts resources used in h project.

Overall success of the project is presented in the formula (5) as increasing the level of value satisfaction of all the project stakeholders. This level is calculated, using the description of artefact sets (9) i (10), as a ratio of level of impact on the stakeholder values of artefacts products and artefacts resources. The project is considered successful if this value is greater than unity. This formula is mathematically described as follows:

$$\sum_k^g \sum_i^l \frac{(p_{ki}^b + \sum_w^b p_{kib}^a) * \sum_w^b v_{kib}^a}{(p_{ki}^b + \sum_w^q p_{kib}^a) * \sum_w^q v_{kib}^a} > 1, \tag{11}$$

In addition to the overall project success, project success with regard to each stakeholder should be calculated. The condition (9) may be fulfilled as regards the project, but it may not be fulfilled relating to separate stakeholders. It might result in the loss of interest by the stakeholder in the project and, subsequently, to the loss of all the artefacts of this stakeholder.

A more detailed project analysis requires partition of a project into separate tasks in order to analyse the possibility of changing artefacts and choosing new ways to perform the project. A first step of decomposing is the selection of tasks concerning the creation of separate artefacts products. Therein the primary focus should be on the production of the artefact's projects of the highest priority. The next step concerns the decomposition of tasks, which use the priority artefacts resources for their implementation. The set of project tasks is mathematically described in the following way:

$$F(A^p, A^r, t) = \{F_1(A_1^p, A_1^r, t_1), \dots, F_t(A_h^p, A_h^r, t_h)\}, \tag{12}$$

where: $F_h(A_h^p, A_h^r)$ – h project task,
h – number of project tasks,
A_h^p – number of artefacts products of h project task,
A_h^r – number of artefacts resources of h project task,
t_h -- time of tasks performance.

The result of the process of decomposing tasks is the creation of a set of tasks of transforming the artefacts resources into artefacts products. The analysis of this set gives the opportunity to choose such a way of implementation that would allow to create artefacts that maximise the values of stakeholders (Figure 1).
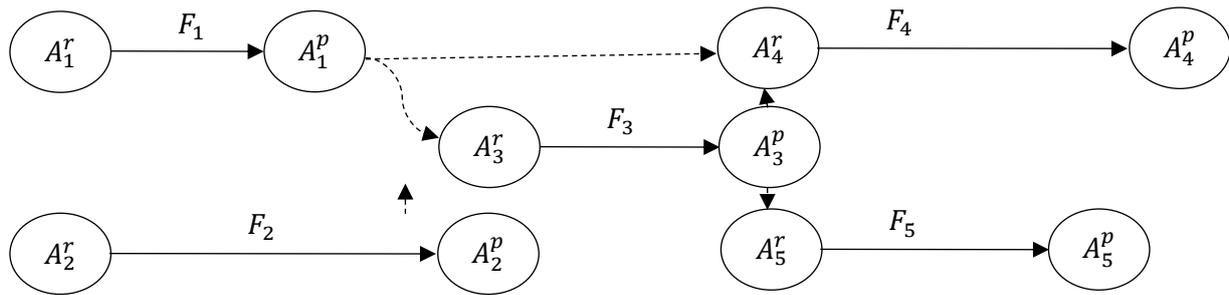
Figure 1. Possible ways of performance of the project.

For instance, when taking a decision on the purchase of an apartment under construction, a customer develops a set of values, such as comfort, convenience, status, leisure. In such a case, the customer is a stakeholder in the development project as a final consumer. There may be many offers in the housing market and all of them are aimed at satisfying different values of the final consumer. In addition, the final consumer has to contribute his artefacts (money, time, attention, etc.) in order to take decision on participation in the project.

It should also be considered that during the project implementation, the priorities and the impact of artefacts on the values of stakeholders may change. Therefore, it is necessary to monitor them constantly and, in the event of their changes, to adapt the technology of the project implementation and change the project schedule accordingly.

3. Conclusions

1. Analysing the stakeholder values, the project team has the opportunity not only to clearly define the vision of the final product, but also to determine the attitude of stakeholders to the project. By increasing the level of stakeholder satisfaction, the project team guarantees their access to the required resources. From henceforth, it is planned to develop a method for determining and evaluating the values of project resources from stakeholders on the basis of a homeostatic approach.

2. Choosing project artefacts by the level of influence on the stakeholder values, the project team generates a set of project outcomes which maximise the satisfaction of the stakeholder values.

3. Formulating a list of project tasks by analysing the level of influence of artefacts products and artefacts results.

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