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THE SUPPORT OF PROJECTS RISK MANAGEMENT IN PRODUCTION COMPANY USING METHODS OF PRODUCTION ENGINEERING

11.1 INTRODUCTION

In the case of companies whose functioning is based closely on the successful implementation of projects, it is very important to pay attention to various aspects of the tasks. The aim is to improve operational efficiency, reduce the amount of unplanned costs and, above all, to achieve the intended objectives according to plan. In such a situation, it is important, therefore, that after the completion of each project, as well as during their lifetime, to draw the appropriate conclusions.

It should concern issues such as, among others, execution management tasks, cooperation with subcontractors, as well as the quality of the work performed by the individual functional groups. Information on these issues can be useful for risk management in the future, because the consciousness of the past, certain risks or opportunities, combined with the knowledge on how to deal with such situations, can contribute to the rapid implementation of the appropriate risk response [1, 5].

In fact, it happens, however, that after the completion of the project the amount of time spent on its analysis and draw on the basis of valuable proposals is inadequate, because very quickly is started another venture.

In that case to share the knowledge gained during the implementation of the project with other employees of the company, not to mention its proper cataloging it may not be possible. So it would be useful to have a tool to support the fast archiving any available information and knowledge, and to a certain extent, enabling it to draw conclusions on the basis of available data.

An obstacle to the practical use of such a tool is the fact that each of ongoing projects it is somewhat innovative and unique, and so their comparative analysis will not always make sense. If, however, the study will be put to group of twinning projects under certain considerations, their comparison can provide useful information and lead to draw conclusions which are helpful in managing the risk of other similar projects which will be implemented by the company in the future.

This situation have place in the companies related to the automotive industry, which implement many programs, consisting of projects similar to themselves, to each customer. This means that the projects are comparable to each other, and on this basis it is possible to formulate a thesis that the identification of risks that have occurred in the past during the various stages of the projects, can contribute to more effective risk management during the current and future projects [2].

To be able to use the above-described approach in practice, it is necessary to know the methodology of analysis of data on completed projects in order to identification of risks related with them.

The aim of this paper was to develop the methodology for collecting and analyzing data on completed projects in a way that allows their subsequent analysis, in order to identify key risks of projects and provide valuable information.

11.2 METHODOLOGY OF DATA COLLECTION AND ANALYSIS

To make a valuable data analysis is necessary to determine the appropriate method of data collection. It was determined that the collection of data may take place as follows:

- 1) At the start of the project, as well as each of its phases, providing of information should take place:
 - a) what budget has been allocated for the implementation of works falling within the scope of the project (planned cost of implementation);
 - b) planned execution time;
 - c) the identified sources of uncertainty;
 - d) the identified risks;
 - e) the success factors of the project, which should be provided.
- 2) After completion of the project, as well as each of its phases, there should be collecting data on:
 - a) the amount that has been spent on the implementation (actual cost);
 - b) the duration of implementation;
 - c) the person responsible for the result of the work performed;
 - d) persons/functional group that carried out the work;
 - e) other stakeholders involved in the implementations and their impact on the project;
 - f) sources of uncertainty identified during the implementation;
 - g) sources of uncertainty, from which have resulted materialized risks;
 - h) risks identified during the implementation;
 - i) materialized risks;
 - j) the impact (financial and time) materialized risks on project/phase;
 - k) the success factors of the project, which should be provided.

In a situation where there was a gathering of the data described above, it is possible to analyze them. Based on the literature and accumulated in it solutions [1, 3, 6], and also the experience, it has been attempted to create a methodology supporting

risk management of the implementation projects in the manufacturing company of the automotive industry.

The following is a developed methodology:

- 1) To conduct a separate analysis of each of the projects/phases:
 - a) comparison of the budget of the project with costs that had to be allocated for its implementation;
 - b) comparison of the budget of the subsequent phases with costs that have to be devoted to their implementation;
 - c) comparison of the planned execution time of the project with the time that was needed to complete it;
 - d) comparison of the planned execution time of subsequent phases with the time that was needed to end them;
 - e) comparison of the list of sources of uncertainty identified before the project started with those that have been identified during the subsequent phases;
 - f) specification of the received summary list of these uncertainties, of which it has been resulted with materialized risk during project implementation;
 - g) comparison of the list of risks identified before the start of the project, as well at each of the phases, with those that have been defined during the implementation of the project;
 - h) specification of the received summary list of these risks that have materialized and save their impact on the project in terms of cost and the execution time;
 - i) comparing the list of success factors of the project, which should be provided during its implementation (as well at each of the individual phases) with a list of success factors, which are guaranteed in the implementation of tasks;
 - j) to determinate which person in the list of other stakeholders involved in the project have positive, and which have the negative impact on its implementation;
 - k) to determinate which persons were responsible for the result of work performed on the particular phases, together with details which phases ended before time, which ended on time and which were delayed;
 - l) to determine which persons were responsible for the result of work performed on the particular phases, together with details which phases exceeded the budget, which bore the assumed costs and which were carried out cheaper than it was expected;
 - m) to determine which persons/functional groups performed work within of each phases, with details which phases ended before time, which ended on time and which were delayed;
 - n) which persons/functional groups performed work within each phases, with details which phases exceeded the budget, which bore the assumed costs and which were carried out cheaper than expected.

2) Determination of implementation indicators, separately for each of the projects/phases:

a) The index of the financial viability the project implementation/phase:

$$W_F = \frac{K_R}{K_P} \cdot 100\% \quad (11.1)$$

where:

K_R – the actual cost of the phase/project;

K_P – the planned cost of the phase/project.

b) The index of the time efficiency of the project implementation/phase:

$$W_T = \frac{T_R}{T_P} \cdot 100\% \quad (11.2)$$

where:

T_R – the actual duration of the project/phase;

T_P – planned duration of the project/phase.

c) The indicator of efficiency identify sources of uncertainty of the project/phase:

$$W_{N_I} = \frac{N_{P_Z}}{N_{P_Z} + N_{P_{NZ}} + N_{R_{NZ}}} \cdot 100\% \quad (11.3)$$

where:

N_{P_Z} – the number of types of sources of uncertainty identified before the project/phase started, which have also been identified during its implementation;

$N_{P_{NZ}}$ – the number of types of sources of uncertainty identified before the project/phase started, which were not identified during its implementation;

$N_{R_{NZ}}$ – the number of types of sources of uncertainty not identified before the project/phase started, which were identified during its implementation.

d) The indicator of efficiency identify sources of uncertainty leading to the materialization of risks:

$$W_{N_M} = \frac{N_{P_{ZM}}}{N_{P_Z} + N_{P_{NZ}} + N_{R_{NZ}}} \cdot 100\% \quad (11.4)$$

where:

$N_{P_{ZM}}$ – the number of types of sources of uncertainty identified before the project/phase started, which have also been identified during its implementation and led to the materialization of risks;

N_{P_Z} – the number of types of sources of uncertainty identified before the project/phase started, which have also been identified during its implementation;

$N_{P_{NZ}}$ – the number of types of sources of uncertainty identified before the project/phase started, which were not identified during its implementation;

$N_{R_{NZ}}$ – the number of types of sources of uncertainty not identified before the

project/phase started, which were identified during its implementation.

- e) The indicator of efficiency of ensuring of the factors' success of the project/phase:

$$W_{CS} = \frac{CS_R}{CS_P} \cdot 100\% \quad (11.5)$$

where:

CS_R – the number of success' factors of the project/phase provided during its implementation;

CS_P – the number of success' factors of the project/phase, which should be provided during implementation.

- f) The indicator of financial efficiency of the person responsible for the result of the work carried out within the project/phase:

$$O_{OF} = \frac{K_P - K_R}{K_P} \cdot 100\% \quad (11.6)$$

where:

K_P – the planned cost of the project/phase;

K_R – the actual cost of the project/phase.

- g) The indicator of time efficiency of the person responsible for the result of the work carried out within the project/phase:

$$O_{OT} = \frac{T_P - T_R}{T_P} \cdot 100\% \quad (11.7)$$

where:

T_P – the planned duration of the project/phase;

T_R – the actual duration of the project/phase.

- h) The indicator of financial efficiency of the person/functional group responsible for the work carried out within the project/phase:

$$O_{WF} = \frac{K_P - K_R}{K_P} \cdot 100\% \quad (11.8)$$

where:

K_P – the planned cost of the project/phase;

K_R – the actual cost of the project/phase.

- i) The indicator of time efficiency of person/functional group responsible for the work carried out within the project/phase:

$$O_{WT} = \frac{T_P - T_R}{T_P} \cdot 100\% \quad (11.9)$$

where:

T_P – the planned duration of the project/phase;

T_R – the actual duration of the project/phase.

- j) The indicator of efficiency of risk identification of the project/phase:

$$W_{RI} = \frac{R_{PZ}}{R_{PZ} + R_{PNZ} + R_{RNZ}} \cdot 100\% \quad (11.10)$$

where:

R_{PZ} – the number of the types of risks identified before the project /phase started, which have also been identified during its implementation;

R_{PNZ} – the number of the types of risks identified before the project/phase started, which were not identified during its implementation;

R_{RNZ} – the number of types of risks not identified before the project/phase started, that were identified during its implementation.

k) The indicator of efficiency of identification of materialized risks in the project/phase:

$$W_{RM} = \frac{R_{PZM}}{R_{PZ} + R_{PNZ} + R_{RNZ}} \cdot 100\% \quad (11.11)$$

where:

R_{PZM} – the number of types of risks identified before the project/phase started, which also identified during its implementation, and which materialized;

R_{PZ} – the number of the types of risks identified before the project/phase started, which have also been identified during its implementation;

R_{PNZ} – the number of the types of risks identified before the project/phase started, which were not identified during its implementation;

R_{RNZ} – the number of types of risks not identified before the project/phase started, which were identified during its implementation.

- 3) Preparation of references library by comparing of the corresponding data from all projects, that in the future was possible further analysis of available data and direct insight into their character.
- 4) The calculation of the average value of the each of indicators of project/phases implementation based on the values determined through the implementation of point 2.
- 5) Identifying key risks of projects/phases:
 - a) calculating the probability of occurrence of each of the risks, based on the data;
 - b) assessment of the level of severity for each of the risks, keeping the demarcation on the degree of financial risk and the degree of time of the risk;
 - c) the risk categorization of particular phases – selection of appropriate limit values should be made on the basis of information, experience of the project manager and the nature of the implemented project.

11.3 CONCLUSION

In the present paper it was developed a methodology for collecting data on completed projects, in a way that allows their subsequent analysis, and also developed methodology of data analysis to identify the key risks of projects and provide valuable information. Using the developed methodology, in the further it is

planned to create a tool to support the implementation of projects in the form of a spreadsheet. While continuing work on the field tackled in this paper, it is recommended that the developed methodology for the collection and of data analysis, to implement into a computer application.

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Date of submission of the article to the Editor: 04.2017

Date of acceptance of the article by the Editor: 05.2017

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THE SUPPORT OF PROJECTS RISK MANAGEMENT IN PRODUCTION COMPANY USING METHODS OF PRODUCTION ENGINEERING

Abstract: Presented paper attempts to develop a methodology for supporting risk management in projects in production engineering. The methodology applies to manufacturing companies of the automotive industry, because it is one of the industries where the projects are comparable to each other. On this basis, it is possible to identify the risks that occurred in the past during the various stages of the projects, which can contribute to more effective risk management during the current and future projects. The developed methodology describes how to collect data on ongoing projects, as well as how to make their analysis to allow their subsequent use.

Key words: projects risk management, methodology, production engineering

WSPOMAGANIE ZARZĄDZANIE RYZYKIEM REALIZACJI PROJEKTÓW W PRZEDSIĘBIORSTWIE PRODUKCYJNYM Z WYKORZYTANIEM METOD INŻYNIERII PRODUKCJI

Streszczenie: Prezentowany artykuł podejmuje próbę opracowania metodyki wspomagającej zarządzanie ryzykiem w realizacji projektów w inżynierii produkcji. Metodyka dotyczy przedsiębiorstwa produkcyjnego branży motoryzacyjnej, ponieważ jest to jedna z branż gdzie realizowane projekty są ze sobą porównywalne. Na tej podstawie możliwe jest zidentyfikowanie ryzyk, które wystąpiły w przeszłości podczas realizacji poszczególnych etapów projektów, co może przyczynić się do efektywniejszego zarządzania ryzykiem podczas wykonywania obecnych oraz przyszłych przedsięwzięć. Opracowana metodyka opisuje w jaki sposób należy gromadzić dane dotyczące realizowanych przedsięwzięć, a także jak dokonywać ich analizy aby możliwe było ich późniejsze wykorzystanie.

Słowa kluczowe: zarządzanie ryzykiem projektów, metodyka, inżynieria produkcji