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Hard lessons learned: A model that facilitates the selection of methods of IT project management

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Abstract—*The article presents the results of research conducted in an international enterprise responsible for IT project implementation. The carried out analysis of the case study with the use of surveys and data synthesis allowed the major factors causing problems connected with project management to be identified. The identified factors were aggregated and then, by using four key variables, a rhomboidal model adaptation was proposed to facilitate the choice of the best method of project management. The proposed solution may aid Project Managers choosing the most appropriate method of project management as well as measuring and monitoring risk indicators.*

I. Introduction

The development of methods and tools of project management is a challenge for people responsible for project management [1, 5]. High dynamics of changes taking place in IT projects regarding client expectations and awareness means that it becomes more and more challenging to achieve the final success of the project [4, 8].

It is therefore necessary to continue to explore solutions that, based on the experience of completed projects, facilitate taking the right decision on the choice of methods of IT project management because incorrect decisions made in the initial phase of the life cycle are much more risky for the project. The high costs associated with removing the consequences of wrong decisions transfer into a project and are often not accepted by customers [7].

II. The development of IT project management

Current reference books outline a lot of methods of project execution [2]. They concentrate on three main approaches: classic [5], agile [4] and hybrid [8].

The classic approach, as the name suggests, uses a classic method for project management (i.e. PRINCE2, PMBOK - collection of good practices). This approach places a particular emphasis on precise project planning in such a way that later, in the project execution phase, it works towards maintaining the base plan adopted earlier. Classic methods are also characterized by a high level of formalization and they use a cascade approach to product or service development. The further stages of the project come one after another, without returning to the previous stage. The advantage of this approach is higher control and predictability of the project budget. Less flexibility regarding the necessity of implementing changes and the identification of the customers' needs are disadvantages.

The agile approach uses adaptation methods for project management (i.e. SCRUM, Extreme Programming, Lean). Agile methods have a low level of formalization and they assume an incremental and iterative way of product or service development. The spiral model of development used in this approach allows for returning to the earlier stages of the projects depending on the needs. The advantage is the possibility of having a flexible approach to the project and increased interaction with the product or service users [6]. The frequent problems related to project scope control and, as a consequence, related to budget control are a disadvantage. The higher engagement of the users in relation to classic methods increases the costs of product manufacturing but minimalizes the risk of making mistakes related to wrongly defined customer requirements.

The hybrid approach combines both the above approaches to project management alternately (i.e. classic and agile). Depending on the project structure, it uses both classic methods, mainly in the layer of management processes, and agile methods, mainly in the layer of production processes [7]. Thanks to such an approach, benefiting from the advantages of both methods described above is possible. Difficulty connected with the efficient estimation of the place and scope of using particular methods, as well as the necessity for Project Managers to have higher competences may prove to be disadvantages.

III. Research Methodology

In the presented research the following testing method was adopted: (Fig. 1)

Fig. 1. Research Methodology

This work was not supported by any organization

Step 1: Book references analysis. The objective of this step was to conduct an analysis of the research problem on the basis of the available reference literature. Within the analysis, a review of the main approaches to project management (classic, agile and hybrid), taking into account both advantages and disadvantages, was performed.

Step 2: Variables identification. The objective of this step was to identify and describe the variables causing problems related to project management. It was conducted in three stages:

• Phase 1: Identification of the variables of the analysis of the accomplished IT projects.

• Phase 2: Identification of the variables of the opinions provided by participants of the IT projects.

• Phase 3: Evaluation of the characteristics of real projects for the correctness of choosing the project execution method.

In this step, a survey questionnaire was used. It allowed the acquisition of opinions from participants of the projects. The provided data was subjected to synthesis, which allowed the main factors determining the choice of the particular project management method to be distinguished. Within this research, the characteristics of variables appearing in real projects were identified on the basis of a quality analysis of the current situation present in the examined enterprise.

Step 3: Decision model development. The objective of this step was to create a decision model which, thanks to the adaptation of a rhomboidal model, would ease decision making regarding the choice of the IT project management method.

The criterion of the appropriate selection of the project management method was defined as the general satisfaction of the project stakeholders with the delivered product or service within the executed project. Among the methods of project execution, three approaches were distinguished, i.e. classic, agile and hybrid.

Step 4: Model validation. The objective of this step was to verify the correctness of the assumed diagram model construction, the usage of which would allow the correct selection of the IT project management method on the basis of the identified variables. The model was subject to validation on the basis of the projects conducted in the examined enterprise.

IV. VARIABLES IDENTIFICATION

The examined enterprise accounts for the large business sector, employing approximately two thousand people. Within the overall structure, the IT Department was created. It is responsible for the design, realization and implementation of IT projects for internal clients' needs. The company executes their projects mainly according to the classic approach, i.e. PMBOK or PRINCE2. Every time, project documentation is created before the project launch and completed regularly throughout the project duration. The decision regarding the choice of projects for realization is made by the office in charge of the project portfolio selection, in consultation with the company's management.

Forty-two employees of the company took part in the research. The participants were people involved in the execution of IT projects. The participant structure of the survey is presented in Table 1.

TABLE I.
PARTICIPANT STRUCTURE

Respondent's role in a project	Percentage [%]
Designers	7
Developers	27
Management	18
Implementation Specialists	35
Remaining participants	13

The respondents of the research are people present in all stages of the project life-cycle, which means designing, creating and implementing. A substantial number of people (18%) were represented by management of the project, which means decision-makers, responsible for the possibility of making changes in the scope of the selection of the project realization methods.

The results of the survey research were presented in the form of percentages. In the case of multiple choice questions, the percentage estimates the ratio of people who indicated a particular answer from all of the research respondents.

The first question referred to the evaluation of the effectiveness of the project execution. It required the respondents to list the main problems encountered during the project execution. The obtained results are presented in Fig. 2.

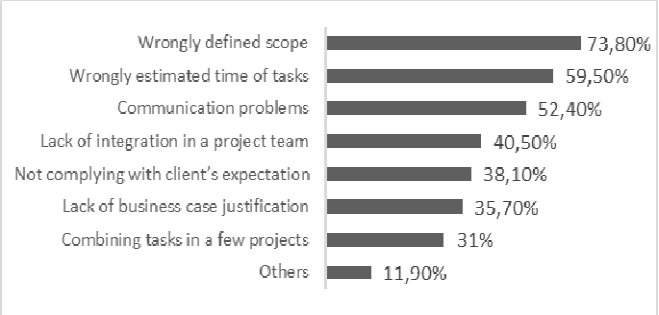

Fig. 2. Problems present in projects

The results of the analysis show that the main problem which occurred in the projects was a wrongly defined scope. This is a particularly essential factor of the project, which, in the event of failure, infringes the classical triple constraint. A significant proportion of the employees also pointed out communication problems. Despite the communication tools available in the company, communication is not satisfactory. This problem may result from an inappropriate information flow, not from a lack of available technical solutions, but from incorrect work organization in a project. This may be caused by the low effectiveness of employees' work or by a bad estimation of the task duration time made by those responsible for project execution.

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Another question referred to the identification of the factors influencing the quality of the products or services delivered within the performed projects. The results are shown in Fig. 3.

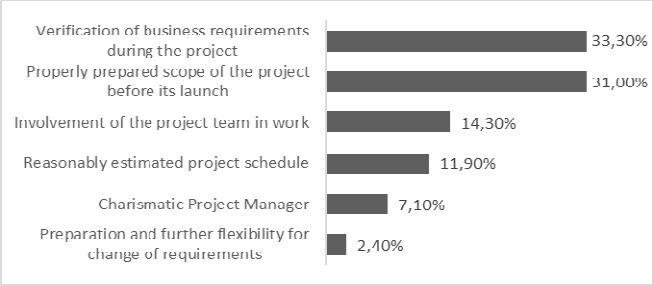

Fig. 3. Factors influencing the quality of products or services delivered

In the respondents' opinion, the biggest influence on the high quality of the product delivered within the project is the possibility of verifying and adjusting the requirements to the business expectations of the company. This is crucial for the changeable environment which IT technologies are. The method of project execution must be flexible enough to be able to adjust to the clients' requirements going beyond the traditional project triple constraint. This factor was probably particularly visible because the leading methodology of conducting projects in the examined company is the classic method concentrating on maintaining the project in a classical triple constraint.

Another question was related to the indication of other factors which according to the respondents' opinion may also influence an increase in the quality of delivered products or services within executed projects. The results are presented in Fig. 4.

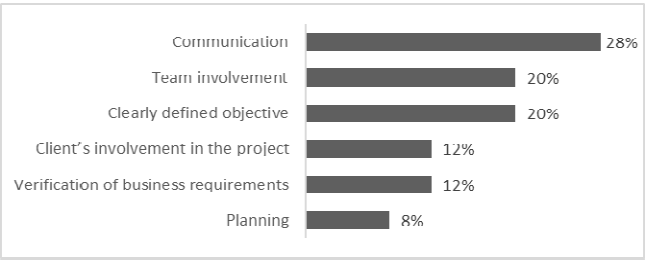

Fig. 4. Factors influencing the quality of delivered products and services – open question

The achieved answers in the majority of cases confirmed problems connected with communication in a project, involvement and willing for cooperation among the participants, a properly defined objective and scope, the verification of requirements and the correct definition of responsibilities in a project. Less frequently, the significance of good planning, work scheduling and solution verification in every stage of project realization were indicated.

The last question required the indication of the preferable methodology of project execution. Thanks to a question formed in such a way, the attitude of the IT project participants towards the possibility of using another (than classic) methodology of project execution could be checked. The results are shown in Fig. 5.

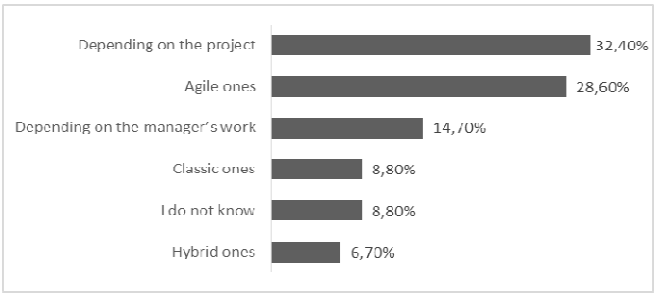

Fig. 5. Preferred methodology of IT project management

The majority of respondents conclude that the best method of project management is a method individually adjusted to the project needs (32,4%). Another group of people support projects run using the SCRUM method, which means performed according to the agile approach (28,6%). Approximately 15% of respondents say that the preferable method of project management depends on the Project Manager's working methods. This means that the method used in the project should undergo changes during its realization under changing project conditions – the hybrid approach. This may imply that the use of the classic approach to project management in a company does not meet the expectations of all of the project participants.

V. DECISION MODEL DEVELOPMENT

The conducted surveys allowed key problems to be identified related to the implementation of projects, for which the solution should be the correct choice of IT project management. In connection with the above, in order to solve the identified problems, the usage of a decision model was proposed. This would ease the Project Managers' selection of the best approach to project management (agile, classic or hybrid). The proposed solution should allow for an overview of the project from the perspective of all project participants. It should also allow for its analysis and be an attempt of deviating from the classical triple constraint in the direction of adaptive solutions. Each project is unique and creating one method for all projects may not be efficient enough.

The proposed model is an adaptation of a rhomboidal model [3], which allows for the classification of the project (Fig. 6.)

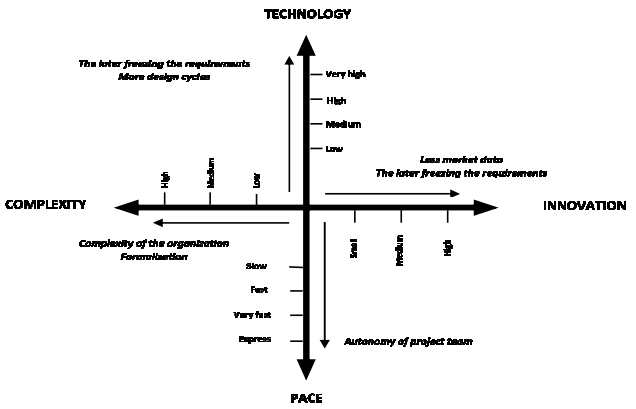

Fig. 6. The rhomboidal model

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The presented model covers four basic variables characterizing the project, meaning: [3]

Innovation: the variable estimating the uncertainty of the product or service delivered within the project. It estimates the level in which we are able to evaluate the requirements and needs of further users. The variable is described by three levels of values.

- *Small* – means that the result of the project refers to classic and repetitive products which can possibly expand the products existing on the market,
- *Medium* – means that the result of the project refers to products which are a new series replacing earlier solutions,
- *High* – means that the result of the project refers to totally new projects being innovative solutions.

Technology: the variable estimating technical uncertainty and its influence on the project. It is described by four levels which characterize projects in the following way:

- *Low* – means using well-known technology exclusively,
- *Medium* – means using well-known technology with elements of innovation,
- *High* – means that the majority of used technologies is not well-known yet but is available on the market,
- *Very high* – means that the used technology does not exist yet and the solution will lead to the designated aim using totally new technology.

Complexity: the variable describing the level of difficulty and formalizing the project scope. The variable is described by three levels of values:

- *Low* – means that the product delivered within the project is simple and/or creates a single set of elements,
- *Medium* – means that the product delivered within the project consists of many subsystems influencing each other, and fulfils different functions,
- *High* – means that the product delivered within the project is very complex and is part of a set of distracted systems.

Pace: the variable describing the pressure of time connected with project realization, taking into account the consequences of the non-respect of the project deadline. The variable is described by four levels of values:

- *Slow* – means that the time of making the product or service is not a measurement of the project success,
- *Fast* – means that possibility of faster project accomplishment is an added value and competitive advantage but it does not determine the success of the project,
- *Very fast* – means that the project has a precisely estimated time of accomplishment regarding upcoming developments and its realization in time determines the failure or success of the project,
- *Express* – means that the project is urgent, with no delays accepted and its execution determines the solution of some problem or crisis.

As a result of the conducted analysis of variables in the examined enterprise and the evaluation of the influence of the variables on project quality, a decision model was developed, (Fig. 7). The model indicates certain tendencies for the project variables. Therefore, it is possible to conduct its analysis, which makes the selection of the project management method easier.

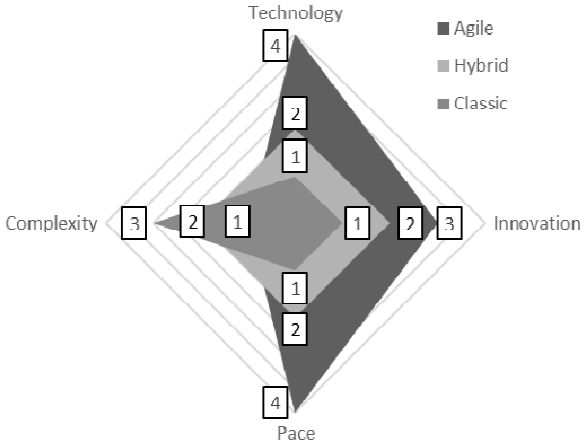

Fig. 7. Rhomboidal model adaptation

The areas where a particular method of management is used were indicated with different colors. In the case of areas not covered with a recommendation, for example, because of high complexity and very advanced technology, the selection of the methodology belongs to the Project Manager.

The more advanced the technology used, the later the freezing of the requirements for the project should take place, because there is more time to change. Therefore, in this case, it is proposed to use the agile approach, which allows for the smooth registration and implementation of changes in particular stages of the project. This is opposed to the situation when the project uses less advanced technology. Often, in such a situation, the requirements are already well-known before launching works. In connection to this, it is suggested to use the classic approach. Similarly, the same is in the case of high innovation. The more innovative the product is and the less the clients' expectations are known, the more agile or hybrid the approach of project management is recommended to be used.

The pace of conducting the project is essential and may be considered in two ways. An additional meeting is a waste of precious time which may be spent on work connected with the direct creation of the product. From the other side, it is time allowing for the earlier verification of the product and the implementation of possible changes. Therefore, in the case of a high pace of project realization, it is recommended to use the agile approach. If time is not so relevant, the classic approach may be used. For a medium pace, the agile or hybrid approach is proposed to be used.

The last issue taken into account in a model is the project complexity, which is a domain of well documented classic methodologies. In the agile approach, the activities are always first and the documents are treated as subsidiary. Therefore, the more complex and documentation demanding

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the project is, the more the classic approach is proposed. However, for solutions demanding a medium level of formalizing, the hybrid model is recommended, particularly in the case of huge technical progress and innovation.

VI. Model validation

At the validation stage, the presented model was verified using data coming from the project accomplishment. The data achieved in this way was analyzed using the rhomboidal model. Next, the data was verified taking into account the opinions of Project Managers. This allowed the identification of whether the used model could enable the selection of the correct project execution method.

The analysed project referred to the implementation of a platform for investments and debts services. The project was conducted according to the classic approach (PMBOK) and unfortunately failed.

The innovation of the product was estimated at level 2 (medium). The projected platform was supposed to replace the existing solution by using various channels for information access. It was supposed to be available for the client in a new, friendlier way.

The technology used was evaluated at level 3 (the highest). It means that the product created within the project was very advanced and the majority of technologies were not known in the company. Nevertheless, this technology was already available on the market.

The complexity of the project was evaluated at level 3 (the highest). In the examined organization it was a very complex and demanding project. It required collating a lot of data which often was not presented on a daily basis and had to be taken from clients from different databases.

The pace of the planned work was established at the highest level - 4 (express). The project had to finish fast because the solutions implemented in this company were also used by competitors, which required priority action.

The statement of the above variable values with the use of the rhomboidal model recommended using the hybrid approach for project execution. The project demanded huge autonomy of the project team and was performed at an express pace. It was characterized by late freezing of requirements with a high level of innovation and using advanced technology. Unfortunately, the project was executed according to the classic approach, which meant that it was not realised in a sufficiently flexible way. According to Project Managers, using hybrid methodology would allow for the creation of detailed documentation and agile team management. The project conducted in such a way would involve more frequent verification of requirements in connection with the business. This would imply that the project is accomplished with success.

In the same way, the proposed rhomboid model has been validated on the basis of three completed IT projects. The validation carried out in this way confirmed the effectiveness of its use.

VII. Summary

The presented model is an attempt to support the people responsible for making decisions in the scope of the selection of the project realization method. The proposed solution allows the analysis of key project parameters (complexity, innovation, technology) and eases the selection of the optimal approach for project management (classic, agile, hybrid).

The advantage of the model is an overview from the wider perspective, which means taking into account the factors and indicators surrounding the project. It can be used for supporting the decision-making process regarding the selection of the best project management model.

The disadvantage of the model may be the necessity of conducting an additional analysis, which is time-consuming. Thus, as results from research, the efficient selection of the project management method is the factor which increases the probability of accomplishing the project with success.

The possibility of model adaptation in organizations is wide. It should be remembered that the problem of the examined enterprise was the fact that all the projects finished with apparent success. The reason for such a situation was the fact that the end user was an internal client. It was the internal client who in every case reported the demand for the product or service and defined the requirements. All project changes (scope, duration, etc.) were realized with the acceptance of the internal client and from a formal point of view, the project was always accomplished with success. In a longer perspective, the project was not successful. It was characterized by low effectiveness and a low client satisfaction level. The presented approach in the examined company was not typical. Therefore, the possible limits and doubts should be verified in the process of further research.

References

[1] Abrahamsson, P., Salo, O., Ronkainen, J., & Warsta, J. (2017). *Agile software development methods: Review and analysis. arXiv preprint arXiv:1709.08439*.

[2] Kerzner, Harold, and Harold R. Kerzner. *Project management: a systems approach to planning, scheduling, and controlling*. John Wiley & Sons, 2017.

[3] Kuchta, D., Skowron D. (2014). Model romboidalny w zarządzaniu projektami badawczo-rozwojowymi. *Zeszyty Naukowe/Wyższa Szkoła Oficerska Wojsk Lądowych im. gen. T. Kościuszki*, (1), 201-220.

[4] Kaczorowska, A. (2015). Traditional and agile project management in public sector and ICT. In *Computer Science and Information Systems (FedCSIS), 2015 Federated Conference on* (pp. 1521-1531). IEEE.

[5] Lechler, T. G., Edington, B. H., & Gao, T. (2012). Challenging classic project management: Turning project uncertainties into business opportunities. *Project Management Journal*, *43*(6), 59-69.

[6] Redlarski K., *The impact of end-user participation in IT projects on product usability*, ACM, 2013.

[7] Redlarski, K., & Weichbroth, P. (2016). Hard lessons learned: delivering usability in IT projects. In *Computer Science and Information Systems (FedCSIS), 2016 Federated Conference on* (pp. 1379-1382). IEEE.

[8] Wells, H., Dalcher, D., & Smyth, H. (2015). *The adoption of agile management practices in a traditional project environment*: An IT/IS Case Study. In System Sciences (HICSS), 2015 48th Hawaii International Conference on (pp. 4446-4453). IEEE.

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