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Methodical ICT Project Management

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Abstract

The main aim of this publication is to provide the practitioners and theoreticians of project management with an indispensable insight into the offer of the best methods of ICT projects and their best adjustment to the organization's actual needs. The morphological analysis was used to construct the tool for evaluation of the needs and level of support offered by the ICT project management methods. The use of morphological matrix as a research tool allowed to carry out a comprehensive analysis of the needs within implementation of particular problem areas.

Keywords: ICT projects, branch methods of ICT project management, morphological analysis.
JEL Classification: C31; M15; O22.

Introduction

The contemporary reality is characterized by an increased number of problems and their interrelationship in all spheres of human activity, as well as management problems. This results in an increased risk within the organization's activity. To confine the risk, the problem solutions are more and more often

searched through establishing and management of the project [Špaček, Vacík 2016, pp. 14-30]. This results in an enhanced interest in professional methods of project management.

The project management worked out a comprehensive and differentiated offer of management methods. The abundance of these methods results from the complexity and specificity of projects and from individual experiences and preferences of project managers and participants.

On the one hand a comprehensive offer enables a choice of methods relevant to the projects specificity and conditions of their accomplishment, on the other hand it requires a good knowledge of a wide spectrum of existing methods, their limitations and possibilities [Trocki (ed.) 2011, p. 7].

ICT projects, pursuant to a more comprehensive depiction used in the article, comprise all projects the final product of which is based on the Information and Communication Technology[1] (ICT), connected with communication, collecting, processing and dispatching of information. These are projects devised to be used by external clients – public enterprises and institutions, combining the projects whose final product is mostly related to creation of software or services connected with its development, servicing and maintenance, the projects whose final product mostly comprises the hardware or services connected with it, telecommunication projects, as well as electronic and electro technical projects, or these are interdisciplinary projects in which we could hardly indicate a dominant specialty, e.g. corporation networks projects.

Searching for a reply to the question how to improve implementation of ICT projects was a cause of the interest in methodologies of management of such undertakings.

Until recently in Poland, to increase the effectiveness and efficiency of project management, universal methodologies such as PMBoK®, PRINCE2 or Project Cycle Management [Wyrozębski 2010; Kaczorowska 2013; Trocki (ed.) 2015] were carried out. So studies on special, complex and detailed methods of ICT project management were undertaken with the aim to fill in the diagnosed research gap.

As the projects are very often used as tools for accomplishment of the organization's objectives [Nowak, Trzaskalik, Twardoch 2013, pp. 49-64] and because of the multitude of project management methodologies, this subject should be discussed comprehensively.

Selected for the analysis were MSF (Microsoft Solutions Framework) methods, RUP (Rational Unified Process) and SCRUM as representatives of ICT project management methodologies, i.e. involving the specificity of this type of

[1] So according to the conditions reported by the International Standard Industrial Classification [2008] it is a product of the ICT sector activities.

undertakings. Furthermore, all methodologies selected for the analysis are based on a spiral approach to ICT project implementation (this facilitates their comparative analysis). Excluded from the analysis was the HERMES methodology – project management within ICT (worked out by the Swiss federal administration) because its scope comprises the management of single projects of ICT and ASAP Accelerated SAP – worked out by Systems Applications and Products in Data Processing because it focuses on one of the last phases of the information project lifecycle, i.e. implementation of the ready-made information system SAP R/3.

The article consists of two parts – theoretical and empirical. The former comprises a survey of specialist literature. The most important results of empirical part include the general and personalized (taking into account the characteristics of organization from the ICT sector and the projects it implements) model of evaluation of the needs and selection of methodological support for ICT project management. In conclusion, contribution of this study for the field of research is underlined, limitations are indicated and implications for future research and practice are presented.

1. Literature review

1.1. Methodological issues of project management

A summary characteristic of the project management autonomy in management sciences is the development of a complete and coherent system of knowledge of project management comprising the terminological, theoretical, instrumental and normative knowledge. The instrumental knowledge, otherwise defined as pragmatic or methodical, is the knowledge enabling the development of the project management reality consisting of statements about the relationships between terminological, theoretical, instrumental, and normative knowledge. The instrumental knowledge, otherwise defined as pragmatic or methodical, is the knowledge which enables the development of the project management reality consisting of statements about the dependence between the project management goals and means (methods, instruments) of achieving them [Trocki (ed.) 2011, p. 10].

This method is a superior methodological term and „according to the general definition commonly adopted in specialist literature it is a deliberately and intentionally formed and reusable group of recommendations as to the way of solving the project management problems" [Trocki (ed.) 2011, p. 11].

We have arranged the project management methods according to their usage area, problem scope, and details of recommendations which form them. The

usage area allows to discern universal methods and special methods – used in management of only a specific type of projects. In view of the problem scope the methods are divided into complex ones which contain recommendations as to the entire cycle of project management [Trocki 2012, p. 400] and segmental (related to partial problems and processes of project management). „The details of recommendations contained in the project management methods are determined by the division of these methods into detailed methods containing detailed recommendations and general methods containing general recommendations" [Trocki 2012, p. 14]. The division into detailed and general methods is based on standardization of activities.

The project management methodologies are complex and detailed project management methods which precisely determine the procedures used to achieve the intended result. Usually they also contain a list of detailed methods necessary to use while solving the partial problems of project management.

1.2. Analysis of branch ICT project management methodologies

Within the project management issues we deal with many methodologies under a specific hierarchy (canons of knowledge → universal methodologies → branch methods → company methodologies → author's methodologies) conditioning the scope of their use and resultant possibility to include the projects specificity. The article analyses only the branch methodologies of project management – adjusted to specificity of IT projects.

The representatives of the spiral approach to project implementation are MSF, RUP and SCRUM methodologies. MSF applies to the projects of universal, non dedicated software scope, thereby minimizing the risk of misassessment of the demand for the prepared functionality [Turner 2006].

After the agile approach to project management had been introduced, some primary versions of methodologies were extended. For example MSF was supplemented with two models. The first – MSF for Agile Software Development (MSF4ASD) is earmarked for the production of software involving the agile approach, „to implement relatively small projects having unstabilized structure of works" [Bukłaha 2011a, p. 226]. The other one – MSF for Capability Maturity Model Integration Process Improvement (MSF4CMMI) is dedicated for complex projects demanding a higher formalization of activities.

RUP is an objective methodology of IT project management based on a spiral approach to the development of software. Within the process of creating this methodology the characteristics of failed projects were diagnosed. Its most characteristic feature are *Building Blocks* (*Content Elements*), i.e. the so called

blocks which consist of Roles, Products and Tasks [Kruchten 2003]. They describe „what is to be created, which skills are required for this and, step by step, what the production process should look like" [Bukłaha 2011b, p. 213]. This methodology is formed by a series of interrelated processes within software engineering. The processes consist of orderly sequences of activities aimed to form as a final product the IT project exhibiting the quality expected by the principal.

For many years the SCRUM methodology has acquired the information projects management area by storm. The article entitled *Scrum and CMMI Level 5: A Magic Potion for Code Warriors!* [Sutherland et al. 2007] presented the results of research conducted by he ICT sector company on the fifth CMMI level (optimized) where after the SCRUM method had been applied the cost of information projects was decreased by 50%, whereas the level of errors – by 40%, with maintained highest level in the project maturity model.

An unquestionable advantage of the SCRUM method is a possibility to use it not only in ICT projects but also in many other branches and undertakings, especially those of a high level of complexity and innovativeness [Hundermark 2009; Deemer et al. 2010].

Advantages and disadvantages of analyzed methodologies are presented in Table 1.

Table 1. Advantages and disadvantages of analyzed methodologies

METHODOLOGY	ADVANTAGES	DISADVANTAGES
1	*2*	*3*
MSF and Microsoft Operations Framework (MOF); models supplementing MSF4ASD and MSF4CMMI	• Flexible model to form applications (MSF Process Model, MSF Governance Model; basing the process on phases and main and indirect milestones). • High dynamics of the project implementation process (it is recommended that one cycle of production does not last longer than 6 months) [Szyjewski 2004]. • Consolidation of employees around the project (responsibility of each member of the team before the team and stakeholders of the project; rejection of hierarchical dependence of the team's members; fulfilled role within a given stage of the work determines a position in the team and not a place in hierarchy; cyclic assignment of the right to supervise the team). Continuous aiming at reaching the highest quality (responsibility of each member of the team for the project quality). • Scalability of management – from small to large and complex projects. • Makes exemplary documents available (patterns of the project schedule, analysis of risk or post-realization analyses) used in each of the phases	• Lack of concentration on precise determination of the final user's expectations, maintenance and servicing of software after it is introduced into the market. • Dedicated to construction of systems without a clearly specified functionality scope. • A failure to include into the analysis the risk of interaction of risks (each risk is analyzed separately; lack of evaluation of the global risk for the whole project)

Table 1 cont.

1	*2*	*3*
	• Rendering available in the form of the project management structure (may be personalized to adjust it to specific project needs)	
RUP	• Plan of phases (each phase is treated as a project) and iteration plan (it occurs in turn for each iteration). • Active alleviation of risks (each phase is focused on the risk in a concrete area; risk management in concrete areas gives rise to changes of proportion between disciplines in each iteration). • Quality of communication in the project team resulting from the documented process of production and mutual terminology. • Development Kit – a tool supporting configuration of the process of producing the software for a given organization's needs	• Simultaneous implementation of all disciplines* (6 technical disciplines and 3 supporting ones) in the first projects may cause nonoccurrence of the effect of enriching each new project with experiences from the previous ones
SCRUM	• Distinguishing the roles (product owner, scrum master, scrum team) with unambiguously ascribed responsibilities [Sutherland 2012]. • Delegating to the teams the decisions about the amount of accepted work and the ways of performing it. • Resignation from multitasking (members of the team should be wholly involved in its work; resignation from additional job outside the project, participation in many projects or products simultaneously). • Short regular stages of implementation (sprints) enabling a high level of control of the course of the project. • Early achievement of important elements of the project giving measurable business profits [Wyrozębski 2011, p. 267]. • Fast pace and accomplishment of consecutive iteration cycles pursuant to constant frequency contributing to increased rate of product development. • Easy connection and integration with other iterative methods of IT project management**	• Does not provide (as a framework method) the teams with a detailed set of practices to project management. • Lack of an offer of unambiguous solutions of problems and anomalies in project implementation. • Difficult use in large geographically dispersed teams, as well as in poorly integrated teams. • Limited use in projects of critical importance for the organization's functioning [Schwaber 2004]

* Disciplines represent logically grouped areas of cooperation of roles (they define sets of required skills, competencies, and responsibilities) in accomplishment of tasks in the area of different specialties.
** SCRUM is integrated with both RUP practices and Extreme Programming methods.

Source: Based on: [Trocki (ed.) 2011, pp. 197-270; Kruchten 2003; Turner 2006; Hundermark 2009].

1.3. Models of assessment and choice of methodical support for ICT project management

The results of the studies conducted by P. Wyrozębski [Trocki (ed.) 2011, p. 247] clearly confirmed the legitimacy of the interest in the project management methodologies as an important factor of the project's success. In those studies:

– all respondents expressed their conviction as to the positive impact of the use of project management methodology on the project implementation success,

- 55% of the respondents defined that impact as high, whereas 43% as average,
- 2% (2 replies of 134 questionnaires) pointed to an insignificant impact of the methodology on the project's success.

The morphological analysis was used for construction of the model of assessment of the needs and level of support provided by the methodologies. The choice of this research tool is justified by a complex nature of the issues of methodical support for project management, and in the context of the article – support offered by the ICT project management methods.

For identification of the organization's expectations in relation to the methodology, after literary analysis of branch methodologies of ICT project management [Trocki (ed.) 2011, pp. 189-269] and having involved the specificity of those projects [Kaczorowska 2013, pp. 75-79; Jasińska, Szapiro 2014, pp. 142-150], the following (variable) problem areas were defined:

A. Organization and management of the project team.
B. Project phases and lifecycle (approach involving differentiation of activities undertaken during the project implementation).
C. Defining of the project.
D. Project environment and context (relating the project to its implementing environment).
E. Planning of the course of the project.
F. Tracing and controlling of the project.
G. Management of the change (approach to changes in the project, rate of including and level of documenting them).
H. Risk management (method of implementing the activities connected with servicing of identified risks).
I. Quality management (method of implementation of activities undertaken to assure the project's implementation conformity with qualitative requirements).
J. Management of requirements.
K. Documentation of the project (level of mapping of the project course in documentation).
L. Evaluation of the project.
M. Easy use in the project.
N. IT support for methodology.

There is no variable among the problem areas – adjustment to the project type, because analyzed were only branch methodologies aimed at ICT project management.

The morphological analysis was used for construction of the tool evaluating the needs and level of support offered by the methodologies.

Parameters – problem variables – are in rows, whereas their corresponding values (possible status of each parameter which describe the degree of advancement and complexity of managerial solutions within a given problem variable) in columns of the table called the morphological table or matrix.

2. Research methodology

To accomplish the research goal we have adopted a research method which comprises the following activities:

- detailed literature analysis of branch methodologies MSF, RUP, SCRUM,
- preparing a list of advantages and disadvantages of the analyzed methodologies,
- identification of expectations related to ICT project management methodologies according to the studies carried out by the following authors: Paweł Wyrozębski [2010], Katarzyna Jasińska and Tomasz Szapiro [2014, pp. 151-228] and Anna Kaczorowska [2013],
- development of a general model (morphological matrix) of evaluation of the needs and choice of methodological support for ICT project management,
- identification of the characteristics of organization and ICT projects affecting the choice of methodological support for management of such undertakings,
- proposal to construct a model for assessment of methodological support including specific characteristics of the investigated organization and ICT projects which it implements,
- conclusions and recommendations from a comparative analysis of identified needs and established scope of methodological support offered by the branch methodologies of ICT project management.

The morphological matrix [Pawlak, Trocki 1986; Romanowska (ed.) 2001] of methodological support for ICT management projects, used as a research tool, will enable an individual assessment of the needs of a given organization within the actual expectations as to the methods and tools of project management. A comparison of the profile of needs with the profiles of methodological support proposed by analyzed standards of project management creates a possibility to choose a method which meets the organization's needs as much as possible. A choice of a morphological analysis as a research tool is justified by a complex character of the issues of methodological support for project management.

3. Results of the studies

A comprehensive literature analysis of branch methodologies of ICT project management allowed to draw up a list of advantages and disadvantages of these standards (Table 1).

Morphological matrix allows to indicate a combination of various levels of support for each of the 14 problem variables, and thereby recognition of all possible variants of the problem solution. For 14 problem variables and 4 values of each variable (status 1 – insignificant level of support, status 2 – average, status 3 – high level of support, status 4 – the highest level of support) it is possible to develop 268 435 456 (4^{14}) potential variants (profiles) of needs of methodical support for ICT project management. Table 2 presents the morphological matrix structure for singled out problem variables and 4 statuses of each variable.

The applied measuring scale of the methodological support solutions is based on regular activities standardization forms pursuant to the increasing level of the scope of methods used to solve problems in a given area (a given problem variable).

Table 2. Total profile of the needs of methodical support for problem areas within A-N and 4 levels of support for each area

PROBLEM VARIABLES	**VARIABLE VALUES – GENERAL PROFILE OF METHODIC SUPPORT NEEDS**			
	1 – low (or insignificant) support	**2 – average support**	**3 – high support**	**4 – very high support**
1	*2*	*3*	*4*	*5*
A. Organization and management of the project team	a_1 insignificant support or lack of support	a_2 framework guidelines of creation and management of the project team	a_3 precise principles of responsibility and procedures of forming and managing of the project team	a_4 self-organizing and self-disciplining project team
B. Project phases and lifecycles	b_1 insignificant support or lack of support	b_2 specification of consecutive phases of the project	b_3 specification of the project phases and main milestones	b_4 complete and precise description of phases and processes in the project lifecycle
C. Defining of the project	c_1 insignificant support or lack of support	c_2 framework defining of the project's main parameters	c_3 detailed identification of purposes and assumptions for the project implementation	c_4 very precise defining and describing of the system's functionality
D. Environment and context of the project	d_1 insignificant support or lack of support	d_2 identification of the project's key stakeholders	d_3 strong inclusion of interdependencies and interrelations of the project with the environment	d_4 effective adaptation of signals coming from the project's environment

Table 2 cont.

1	*2*	*3*	*4*	*5*
E. Planning of the course of the project	e_1 insignificant support or lack of support	e_2 long term plan developed for the whole project, exhibiting deterministic and decisive nature	e_3 detailed plan worked out for the whole project	e_4 adaptational construction of the project's plans (detailed plan for the nearest iterations, general plan of further phases of the project)
F. Tracing and control of the project	f_1 insignificant support or lack of support	f_2 framework control of the project implementation	f_3 tracing and control of implementation of the project works	f_4 tracing and control of implementation of the project works with the use of most effective tools
G. Managing the change	g_1 uncontrolled introducing of changes	g_2 framework principles of responding to changes in the project	g_3 changes are analyzed and conclusions based on them are drawn for the future	g_4 complex and precise procedures of servicing of changes
H. Risk management	h_1 insignificant support or lack of support	h_2 very general principles of risk servicing	h_3 detailed procedures of identification and servicing of risks (not the risk management system)	h_4 detailed procedures of risk management from the beginning of the project to its closure
I. Quality management	i_1 insignificant support or lack of support	i_2 general principles sensitizing to quality in the project	i_3 framework procedures assuring quality in the project	i_4 detailed procedures of complex management of quality
J. Management of requirements	j_1 requirements management ad hoc	j_2 general principles of requirements management	j_3 control of cohesion and unequivocalness of requirements	j_4 complete and complex procedures of requirements management
K. Project documentation	k_1 insignificant support or lack of support	k_2 basic documents creating the project's documentation	k_3 framework documentation of the project course	k_4 complete and complex documenting of the project implementation
L. Evaluation of the project	l_1 insignificant support or lack of support	l_2 general guidelines on settlement of the project	l_3 framework procedures of the project evaluation	l_4 settlement of the project using complex evaluation methods and referring them to the projects effectiveness account
M. Easy use in the project	m_1 insignificant support or lack of support	m_2 easy to implement	m_3 difficulties in implementation	m_4 complicated implementation
N. IT support for methodology	n_1 insignificant support or lack of support	n_2 basic IT support	n_2 management of single projects	n_4 servicing the programmes and portfolio of projects

Source: Based on: [Wyrozębski 2010; Trocki 1975].

Analysis of data collected in the matrix (Table 2) will allow to form a synthetic generalized profile of the needs of methodological support for the organization willing to evaluate its needs by itself. The percentage indicators from cross-section of the row (problem area) and column (support intensiveness level) will inform about the frequency of indications of the value within a given problem variable (values in rows of Table 2 add up to 100%). Analysis of concentration of indications (Table 2) will allow to identify the areas of expected methodical support. Independent (carried out individually by each company) assessment of solution variants will allow to choose the best solutions for further detailed analysis of the data presented as in Table 3.

On the other hand the list of data such as that in Table 3 allows to carry out a cross-sectional analysis which will enable to obtain precise profiles depicting differentiation of needs according to respective features of the investigated organization and the ICT projects implemented by it. Such study may be carried out independently by each of the organizations aiming at determination of their own level of needs for methodical support for project management depending on six forming factors (columns in Table 3).

Including the results of research on the main market trends and implementation of projects in the ICT sector [Jasińska, Szapiro 2014, pp. 101-150] and *Chaos Report 2015* [Standish Group 2016] for each variable its corresponding values were determined, depicting differentiation of needs according to respective traits of the organization. The following values were singled out: organization's size, share of foreign capital, intensity of projects in the organization's activity, magnitude and complexity of the project, innovativeness level of the project, multiproject environment of projects implementation [Sońta-Drączkowska 2012].

The detailed profile obtained due to analysis of data in Table 3 will depict the differentiation of needs according to respective features of the tested organization and ICT projects implemented by it.

Indications in rows of Table 3 should also add up to 100%. Capturing of the highest values within the rows will allow to choose a solution which will be even better adjusted to the organization' actual needs within methodical support for undertaken ICT projects.

The use of matrix as a research tool allows to carry out a general (Table 2) and detailed (Table 3) analysis of needs within implementation of respective problem areas in the organization and to compare the profile of needs with the profile of solutions offered by respective methodologies.

Table 3. Proposal of the structure of a detailed profile of support for methodical needs of the ICT project management

PROBLEM VARIABLES	a ORGANIZATION'S SIZE	b FOREIGN CAPITAL SHARE	c INTENSITY OF PROJECTS	d MAGNITUDE AND COMPLEXITY OF THE PROJECT	e INNOVATIVENESS LEVEL OF THE PROJECT	f MULTIPROJECT ENVIRONMENT
A. Organization and management of the project team						
B. Phases and lifecycle of the project						
C. Project definition						
D. Environment and context of the project						
E. Planning of the course of the project						
F. Tracing and control of the project						
G. Management of change						
H. Management of risk						
I. Management of quality						
J. Management of requirements						
K. Project documentation						
L. Project evaluation						
M. Easy use in the project						
N. IT support for methodology						

Source: Based on [Trocki (ed.) 2011, pp. 345-365; Sońta-Drączkowska 2012; the Standish Group 2016].

The results of the studies on the needs and possibilities of methodical support for project management in the ICT sector lead also to the following conclusions and recommendations:

1) quality of analyzed methodologies depends on specialist competencies of the institutions which endorse them;
2) availability of branch methodologies of project management is usually limited, and the costs of acquisition are relatively high;
3) more and more common is the approach in which the ICT project is an investment without a concretely defined user;
4) traditional (cascade), static methodologies cannot be used in situations where the success of the non dedicated software structure project depends on the level of market acceptance of the product;
5) iterative passing through consecutive phases of the project has the following consequences:
   5.1) integration of software is simpler and less expensive,
   5.2) separately designed elements of software are more apt to be used again,
   5.3) the risk is identified earlier,
   5.4) changes of requirements are detected sooner and their management is easier;
6) important becomes configurability of the project management process, because none of the detailed methodical recommendations are appropriate for all specific types of the projects undertaken in the ICT sector.

Conclusions and postulates for future research

Within the actual functioning of contemporary organizations it is no longer sufficient to conduct the projects sporadically, according to one's own experiences, acting intuitively and achieving an average level of undertakings. To gain and maintain a high competitive position the organizations reach for methods and methodologies of project management. In this way they want to achieve a repetitive success of ongoing projects.

Implementation of the project management standard is a complex and inimitable venture which significantly affects the way the organization is functioning. Additionally, the organizations which want to take advantage of a comprehensive offer of the solutions of methodical support for ongoing projects face an important and difficult decision to evaluate their own needs and then make a proper choice.

To achieve the goal of the main study, all activities specified in the adopted research model have been implemented. Morphological matrices have been prepared (general – Table 2, and personalized – Table 3) for individual evaluation

of organization from the ICT sector in view of its needs for methodical support of ICT projects implementation.

Development of a complete morphological matrix for methodologies predisposing to ICT project management is the greatest added value of the article. How could we put the findings into practice? The organization which determines the general profile of methodological support simply selects the value from a respective column of Table 2 (remembering that the values in consecutive columns assume an increase in intensity – the lowest in column 1, and the biggest in column 4 – methodological support). Instead, the concentration on indications within the problem areas of methodologies allows to increase the precision of choosing a level of support.

Another value of the study is the proposal to construct a personalized model (Table 3), enabling to specify more precisely the needs for methodological support of a concrete organization within the ICT sector through involving of both its important characteristics and the projects undertaken by it.

Both the general profile and the personalized profile of methodical support may constitute a starting point for further extensive research. The general model (Table 2) may be extended with further rows (e.g. integration management of the project or orders management in the project) once significant features of the methodology supporting the ICT projects management are identified. The leitmotif of the study of a personalized model (Table 3) was the best possible adjustment of the methodology to actual needs of the organization. The list of forming factors (columns in Table 3) is open and should be extended with further important characteristics, such as for example the share of „soft" or hybrid projects.

While indicating the drawbacks of special methodologies used in ICT project management some limitations were captures in the research area concerned.

Other limitations of the research result from the use of the morphological matrix as a research tool; they may be the problems connected with looking for variable problem conditions (during the problem analysis) and reduction of the morphological space (within the problem synthesis). Approximately 95% of combinations are rejected during the reduction of morphological matrix due to the common nature of the solution or its absurdity.

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