

APPLICATION OF PROJECT MANAGEMENT METHODS USABLE IN THE IMPLEMENTATION PHASE FROM THE PERSPECTIVE OF SELECTED CHEMICAL COMPANIES

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Abstract

The article deals with project management methods applicable in the implementation phase of the project (Project Percent Complete Method, Structured Status Deviation, Milestone Trend Analysis and Earned Value Management) from the perspective of selected chemical companies operating in the Czech Republic. Its main objective is to provide a comprehensive view of the issue. In accordance with defined partial objectives, results were formulated and discussed using analysis, synthesis, comparison and deduction. The authors assessed the suitability of project management methods applicable in the implementation phase in terms of the type of projects. Their software support was evaluated. Their application by selected chemical companies in the Czech Republic was analyzed and evaluated. Strengths and limitations of these methods were summarized and recommendations formulated for their application in practice of chemical companies in the Czech Republic. For the evaluation, the authors used the binary scale as well as Project Management Methods and Tools Oriented Maturity Model. The article thus provides a unique and interesting perspective on the issue.

Introduction

Success in the today's rapidly changing economic world can only be ensured by the ability of enterprises to respond flexibly to changes. With increasing frequency, these responses take a form of projects whose success is determined by the degree of knowledge and the range of use of project management (PM) methods and tools in the enterprise. The knowledge and ability to use PM methods and tools is also taking on added significance in relation to the possibility of co-finance business activities from European Union (EU) sources. For chemical industry enterprises, whose activities are capital intensive on the one hand, and associated with significant socio-economic effects on the other, the possibility to co-finance projects from EU funds is an important opportunity.

Both theory and practice of PM offers a variety of methods and tools that are to a varying extent useful in different phases of the project life cycle (concept, planning, implementation and evaluation phase). The paper concerns itself with one of the groups of PM methods, namely the methods applicable in the implementation phase of the project. Specifically, these are the Project Percent Complete Method, Structured Status Deviation, Milestone Trend Analysis and Earned Value Management.

The main objective of the authors of the articles is to provide a comprehensive view of PM methods applicable in the implementation phase of the project, in the context of the experience of selected chemical companies operating in the Czech Republic. Said main objective can be decomposed into the following sub-objectives:

1. Assess the suitability of PM methods applicable in the implementation phase in terms of the type of projects.
2. Evaluate available software support for the PM methods applicable in the implementation phase.
3. Analyze and evaluate the use of PM methods applicable in the implementation phase by selected chemical companies operating in the Czech Republic, inter alia using the Project Management Methods and Tools Oriented Maturity Model (PM2TOM2).
4. Summarize the advantages and limitations of PM methods applicable in the implementation phase of the project.
5. Formulate practical recommendations for chemical companies operating in the Czech Republic in the subject area.

Literature review

During the implementation phase of the project, scheduled activities and outputs are gradually implemented in accordance with the plans prepared. At this phase, important are methods to monitor the actual status of the project, its comparison with the schedule and managing any changes. These methods mainly allow monitoring project costs and comparing them with the budget, tracking cash flow of the project and its comparison with the plan, monitoring and documenting the project development.

At this phase, we can use several specific PM techniques. These can include the following (Dolezal et al., 2012; Lacko, 2012).

Project Percent Complete Method (PPCM) is a method using which we can assess throughout the project to what percentage extent various project activities are fulfilled. This is a simple method that is, nevertheless, challenging in terms of continuously identifying relevant input data from all members of the project team. (Dolezal et al., 2012)

Structured Status Deviation (SSD) is a method by which the state of completion at some point is determined for all planned activities. Each activity is monitored for whether the activity has not yet begun, is in progress, or whether it has ended. At the same time, information is assigned to each activity as to whether the activity started on time and was completed on time, or whether there were some delays, i.e. deviations from the schedule. The deviations are divided into deviations of the first and second order. Deviations of the first order indicate situations where the activity should have already been under way, but has not yet begun. Deviations of the second order indicate situations where the activity should have already been completed, but has not yet begun. (Lee-Kwang and Favrel, 1988)

Milestone Trend Analysis (MTA) consists in determining a larger number of milestones, i. e. moments when the project team has completed an important phase, interim stage or significant activity; it can also be an important deadline determined by external circumstances. Extending the project plan with a larger number of milestones allows the project team to make an evaluation of the project within the deadline of the respective milestone and assess the achievement of the respective milestone in comparison with the schedule. (Dolezal et al., 2012)

Earned Value Management (EVM) provides the most detailed information on the status of the project. It compares the efforts made and the resulting output of the project with the original plan and using these data it then evaluates the cost and time deviations and performance indices by cost and according to the schedule, using which it is possible to predict the further development of the project. (Association for Project Management, 2012; Storms, 2008) It is possible to determine the estimated costs required for completing the project and the total costs, the time needed for completing the project and the completion date of the project (Svozilova, 2011). However, these predictions require that any further progress of the project be implemented in the same way as it has been until the reference point.

Research methodology

The paper presents the results of a part of an overarching study aimed at assessing the maturity level of PM in the Czech Republic, both from the perspective of the projects co-financed from EU funds and from the perspective of projects by chemical industry companies. This study was elaborated within a dissertation by the main author of the article under the leadership of the co-author of the paper.

In processing the findings, the authors primarily used analysis, synthesis, comparison and deduction. The applied techniques of scientific work and resources of primary and secondary data can be defined in the context of the above objectives. Suitability of PM methods applicable in the implementation phase in terms of the type of projects was assessed (Objective 1) using a binary scale. The authors of the article made use of literature research, their own personal experience and findings emerging from discussions with practitioners as well as academics.

Availability of software support for the PM methods applicable in the implementation phase was evaluated (Objective 2) based on the results of a correspondence survey conducted with representatives of suppliers of selected software applications. In the case of a freeware application and freeware cloud solution, evaluation was made on the basis of user documentation and verification of the functionality of these applications. Chosen for the assessment were applications representing all groups of software applications present in the market. These were representatives of freeware applications (ProjectLibre), freeware cloud solutions (Ganttter), web-interface-based software built by a local producer (Easy Project), a representative of mass-market applications (Microsoft Project Server 2013) and applications for complex project and portfolio management (Primavera P6 Enterprise Project Portfolio Management and Primavera - Instantis PPM Tools). Also in this case, a binary scale was used for evaluation.

The utilization of PM methods applicable in the implementation phase by the selected chemical companies operating in the Czech Republic was analyzed and evaluated (Objective 3) using both a binary scale and PM2TOM2. Primary data were obtained through semi-structured interviews with representatives of the selected chemical companies responsible for PM as well as email and telephone interviews. The selection of companies was based primarily on the database of members of the Association of Chemical Industry of the Czech Republic and subsequently on the database of beneficiaries of EU funds published on January 3, 2014 by

the Ministry of Regional Development of the Czech Republic. Identified were those companies of the Association which implement projects co-financed from European funds. From June to October 2014, 23 representatives of these companies were then interviewed. Data were provided by representatives of eight firms (see Table I). With respect to their anonymity, the companies are hereinafter referred to by the letters A to H.

Table I
Basic data about the monitored companies

Company	Legal form	Corporate stock	Number of employees*	Type of project	No. of applications/projects**
A	cooperative	CZK30m	70	medium	3/3
B	joint-stock company	CZK1.027bn	1,000	large	10/9
C	joint-stock company	CZK1.6bn	350	large	8/7
D	joint-stock company	CZK155m	1,200	large	5/3
E	joint-stock company	CZK1bn	600	large	6/4
F	joint-stock company	CZK260m	1,600	large	9/3
G	limited liability company	CZK5m	570	medium	4/3
H	joint-stock company	CZK103m	220	large	6/6

* No. of employees rounded to whole tens

** No. of applications for support from European Funds/No. of solved projects co-financed by European Funds
Source: Own.

Advantages and limitations of the PM methods applicable in the implementation phase were summarized (Objective 4), based on a literature review, the authors' own experience and discussions with experts from the business practice and academia.

Recommendations for practice of chemical companies operating in the Czech Republic in the area in question were formulated (Objective 5) based on the evaluation of the knowledge gained in the implementation of previous objectives.

Results

The applicability of each PM method is mainly determined by the phases of the project life cycle. The appropriateness of their use must then be subsequently assessed in terms of the type of projects implemented. As part of this assessment, it is useful to classify projects into small, medium-sized and large ones. Taking into account the key characteristics of projects (the size of the budget, time requirements and complexity of the project), we can define types of projects as follows (Kostalova and Tetrevovala, 2015). Small projects are characterized by a smaller budget, being less time consuming and less complicated. Medium-sized projects are characterized by a bigger budget; they are more time-consuming and more complicated. Large projects are those with large budgets, being time consuming and complex, both during the planning process and, particularly, during the project implementation. As is clear from the investigation carried out, with the exception of EVM, these methods are suitable for all types of projects defined above. For more details see Table II.

Table II
Suitability of PM methods applicable in the implementation phase in terms of the type of projects

PM Methods/Type of Project	Small project	Medium project	Large project
PPCM	1	1	1
SSD	1	1	1
MTA	1	1	1
EVM	0	1	1

Source: Own.

Project Management Information Systems (PMIS) may contribute very significantly to the success of the application of PM methods. PMIS mostly reduce the amount of time and paperwork required for the projects. For example, they can provide scheduling, resource planning and management, budget planning and management, project monitoring during implementation or availability of monitored data within the internal

network as well as via the Internet. There are a number of tools available with a diverse range of functionality. These can be simple freeware tools or Web applications in the cloud mode, as well as widespread Microsoft Project applications, but also on complex software applications (Kostalova et al., 2015). As is clear from the investigation carried out, with the exception of EVM, all methods in question are supported by software tools. Table III shows that the EVM is not supported by the freeware cloud solution (Ganttter) and on the web-interface-based software built by the local producer (Easy Project).

Table III
Software support for PM methods applicable in the implementation phase

PM Methods/ PMIS	ProjectLibre	Ganttter	Easy Project	MS Project Server 2013	Primavera P6 Enterprise Project Portfolio Management	Primavera - Instantis PPM Tools
PPCM	1	1	1	1	1	1
SSD	1	1	1	1	1	1
MTA	1	1	1	1	1	1
EVM	1	0	0	1	1	1

Source: Own.

Regarding the evaluation of the application of PM methods applicable in the implementation phase from the practice point of view of selected chemical companies, considering the comprehensive view of the issue, we can proceed from the assessment of the overall level of application of the PM methods by these companies. In doing so, we can use our proposed PM2TOM2. It assesses the maturity level of PM in 7 defined areas, namely project time management, project source management, project cost management, project risk management, project scope management, project organizational arrangement (including education of the staff in PM) and software support of PM. Criteria are defined for individual areas to assess the maturity level of PM, defined primarily as PM methods or tools. These criteria are assigned point values with regard to the complexity of processing a method or tool, primary usefulness in different phases of the project life cycle and the prevailing type of projects investigated. In the case of PM methods and tools that provide a similar benefit to the maturity level of PM, total point scores are used for multiple items.

If we focus our attention on the overall maturity level of PM in the assessed companies, then as for the assessment by PM2TOM2, which distinguishes five maturity levels of PM (low, lower medium, medium, advanced and high management maturity level), we can state the following. In the case of Company G, it is a low management maturity level, in the case of A, B, D, E and H it is a lower medium management maturity level and in the case of Company C and F it is an advanced management maturity level.

If we focus our attention on the use of PM methods applicable in the implementation phase, we can say that with the exception of Company G, the assessed companies use at least one of these methods. In fact, Company C even uses three methods, namely PPCM, MTA and EVM. This company is the only of the chemical companies assessed to use the EVM. MTA can be considered the most widely used method applicable in the implementation phase, using 6 out of the 8 assessed chemical companies. The evaluation using PM2TOM2 suggests that best evaluated is Company C. It gets the maximum possible score (8 points) for the EVM method and the maximum possible score (3 points) for the remaining collectively assessed methods (see the explanation above). The other companies, with the exception of Company G, get the maximum possible score for collectively assessed methods PPCM, SSD and MTA. For more details see Table IV.

Table IV
Evaluation of the use of methods PM applicable in the implementation phase in selected chemical companies in the Czech Republic

PM Methods	Binary scale									Σ	PM2TOM2							
	Company										Company							
	A	B	C	D	E	F	G	H		A	B	C	D	E	F	G	H	
PPCM	0	0	1	0	1	0	0	1	3									
SSD	0	0	0	0	0	0	0	0	0	3	3	3	3	3	3	0	3	
MAT	1	1	1	1	0	1	0	1	6									
EVM	0	0	1	0	0	0	0	0	1	0	0	8	0	0	0	0	0	
Σ	1	1	3	1	1	1	0	2	x	3	3	11	3	3	3	0	3	

Source: Own.

Discussion

The research shows that PPCM, SSD and MTA can be considered methods that are interchangeable. Also, they are among methods that are less technically demanding. Of these three methods, we can recommend using the PPCM and the MTA, whose popularity is evidenced by the use in practice. EVM can then be considered a method of higher order. Unlike the other ones mentioned above, this method cannot be recommended for application in enterprises that deal mostly with small projects. In other types of projects (medium-sized and large projects), all the above methods can be applied. These methods are associated with certain strengths and weaknesses or risks; the main ones are summarized in Table V.

Table V

Advantages and disadvantages of PM methods applicable in the implementation phase

PM Methods	Advantages	Disadvantages
PPCM	<ul style="list-style-type: none"> - simplicity and clarity of project development monitoring - low demands on the project team members in terms of data processing 	<ul style="list-style-type: none"> - lower informative value due to possible inaccuracies in the determination of the fulfilment percentage
SSD	<ul style="list-style-type: none"> - simplicity and clarity of project development monitoring 	<ul style="list-style-type: none"> - lower informative value due to limited ability to monitor the status of activities - no information is available on the completion status of individual activities, only their status and the extent of delays
MTA	<ul style="list-style-type: none"> - simplicity and clarity of project development monitoring - individual settings for details of project monitoring 	<ul style="list-style-type: none"> - need to extend the schedule with a greater number of milestones
EVM	<ul style="list-style-type: none"> - shows details about the current state of the project - simple form of predictions for further development of the project 	<ul style="list-style-type: none"> - unsuitable for projects with fixed costs - prediction of the project development is based on the continuation of previous trends without taking into account possible future changes - does not reflect the quality of project outputs - higher demands on the project team members during data processing

Source: Own.

A generally valid disadvantage of application of PM methods in the implementation phase is the need for continuous updates, which may be quite demanding in terms of time and paperwork. Nevertheless, these demands can be significantly reduced by PMIS. Still, it is necessary to carefully consider the choice thereof with regard to the type of projects investigated since some of simpler software tools do not support the EVM. We also need to point out that the informative value of outputs of the methods is determined by the quality of information provided by members of the project team.

It can be stated that the maturity level of PM in the assessed chemical companies operating in the Czech Republic varies. It ranges from low through lower medium up to advanced management maturity level. With one exception, the companies assessed use PM methods applicable in the implementation phase. Usually, they use the MTA, which can be evaluated positively. However, it can be assessed negatively that the EVM is used by only one of the companies studied. The reason can be both high demands on the project team members and project managers in connection with the collection of data and the technical demands of the application of this method (in particular, the need for continuous data processing, the need to make repeated calculations), but also the limited knowledge of this method. As is apparent from the survey conducted in the Czech Republic in 2014 using a sample of 171 respondents (investigators of projects co-financed from EU funds), 47.8 percent of the respondents do not know the EVM, and this method is only used by 10.8 percent of the respondents (Kostalova, 2015). Another research conducted in the Czech Republic in 2015 using a sample of 178 respondents from among project managers shows that 23 percent of the respondents do not know the EVM, and it is only used by 13 percent of the respondents (Kratky et al., 2015). For comparison, worldwide research by the Project Management Institute (2,800 respondents) shows that the EVM is always used by 12 percent,

often by 24 percent and sometimes by 24 percent of the respondents; the others do not use this method at all or they use it rarely (Project Management Institute, 2015).

Conclusions

The implementation phase of the project is a very demanding phase of the project life cycle. As a rule, the more accurately the previous phases and their outcomes were prepared and implemented, the easier it was to carry out the project. During the implementation phase, there is a gradual implementation of activities defined in different parts of the project plan. The course of the project implementation should always be monitored and evaluated using suitable PM methods until its completion.

With regard to the investigation conducted, the following measures can be recommended to chemical companies operating in the Czech Republic. Primarily, it is necessary to focus on the training of workers in the PM and its methods. We can also recommend the use of external consultants and project managers to gain experience in PM. They can also make use of international certifications to increase and consolidate staff qualifications. In the implementation phase, they need to primarily apply the PPCM or MTA and EVM. The companies must introduce and actively use software applications to support the PM in a wide range of their functionality. Neither can we neglect the requirement for incorporating the project-based approach in the company's strategic management. In applying these measures, we need to take into account the achieved maturity level of PM in the company. The proposed measures should be phased in gradually in order to verify the effectiveness of the respective measures in practice and, if need be, make any necessary corrections.

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