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Assessment and Analysis of Project Management Tools and Techniques in IT company

Abstract. *Today, the project management system is being actively implemented in various areas of government and business activities. The project approach, methodology, tools and techniques of project management are developed, modified and adapted to a specific industry, including IT. The paper discusses the tools and techniques used in project management methodologies: traditional, agile and hybrid. The main purpose of the study is to assess and analyze the most effective and frequently used project management tools and techniques in the practice of an IT company. The options for applying identified in the study project management tools and techniques in each of the methodologies, are considered in detail. As a result, it was developed a model of using project management tools and techniques, ordered by project life cycle phases and project management methodologies.*

Keywords: *project management, project management tools and techniques, project management methodology.*

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Introduction

In recent years, project management methods and tools have been actively applied in the public administration system in addition to the private sector. The methodology of project management in Kazakhstan is used mainly in private and national companies of the quasi-public sector but only partially used in implementing public projects [1]. Only some processes of implementation of state investment projects comply with project management principles [2]. So, for example, in many IT projects implemented by government agencies, the services of project management consultants are involved in order to introduce project management methodologies, policies, methods, tools and techniques.

In other words, few well-specialized and certified project managers in Kazakhstani companies could effectively apply the project management methodologies, including project management methods, tools and techniques. Therefore, in this article, we provide models for the use of project management methods, tools and techniques classified by project management methodologies and project lifecycle phases.

Thus, this paper aims to develop models for the use of project management methods, tools

and techniques for project managers based on the analysis of interviews with project managers of IT company.

Methodology

This research work is based on the scientific literature and modern domestic and foreign studies materials. The theoretical and methodological basis of this article consists of developments in project management.

When preparing the article, the general and unique methods of scientific analysis were used, such as content analysis, discourse analysis, and graphic method (image visualization results). Processing of the received data was carried out using an Excel Windows package.

For the study, the interview was conducted, the participants of which were project managers of the Kazakhstani IT Company. Qualitative analysis was used to analyze the interview data. The qualitative analysis aims to break down project management methods and tools by project management methodologies and by phases of the project life cycle.

Discussion

The project consists of a series of actions and activities that are all time-limited. The project's actions are all geared at addressing an issue or achieving the project's objectives. The deadline, resources, and customer requirements and needs are the primary aspects of the project.

For proper project management, a unique set of practices is defined. These procedures are usually geared at the implementation of specific processes and approaches. As a result, project managers devise the finest project management strategy to assure continuous project control, development, and implementation [3]. The primary goal of the project management methodology is to allow the project manager to maintain control and oversight of all project management operations. Thus, when determining the success of project procedures, methodologies, and management approaches, the answer to project risks is supplied. There are several ways and methodologies in project management that can be utilized to handle various sorts of projects. Only three types of project approaches such as classic, agile, and hybrid, are studied in this paper. This work considers project management methods, tools and techniques in addition to project management approaches.

Traditional (Waterfall) Methodology. One of the project management approaches is the waterfall model. The waterfall management methodology is a well-known management concept for high-complexity projects. This methodology effectively structures the development process and achieves a high level of implementation. Winston Royce developed the Waterfall Methodology in general in 1970. This management paradigm is employed by many firms while implementing projects. Royce described the principles of producing software and showed the complete project life cycle based on his management technique [4] in his research during the development of the Waterfall Model. In his study, Winston Royce proposed the waterfall methodology for data processing. This notion suggests that a project development should be created in stages. That is, there is no need in the methodology of returning to the previous stage of the project, after its completion. Thus, the project is implemented based on the completion of each phase.

The waterfall model, in general, is a method of breaking large-scale and complex development processes into stages and implementing them one at a time. This paradigm is thought to be the most effective for both large and small projects of varying degrees of complexity [4].

The phases of project implementation must also be noted and documented. After all phases of a project are completed, they are documented and handed to the project clients. According to the PMBOK transitioning from one phase to the next frequently necessitates some technical transfer [5]. As a result, the customer gains control over the project in terms of the finished product.

Agile Methodology. As an attempt to make software engineering more flexible and efficient, the agile project management methodology was established. Agile methodology is a people-centered, results-driven approach to software development that considers a fast-changing environment [6]. Agile methodologies are used in

software projects because of their vital planning, flexible iterations, progressive development, and quick delivery.

Unlike a Traditional methodology, Agile methodology is broken down into smaller cycles called Sprints. Each one is a mini project with a backlog and stages for design, development, testing, and deployment within a pre-defined work scope [6]. In other words, instead of developing the entire program, agile methodology stresses piece-by-piece development. The agile technique emphasizes the ability to respond to changes and splits work into iterations throughout the project.

Agile methodology is a software development alternative to traditional and has more advantages than it. For example, agile methodologies help development teams, business teams, and end-users communicate more effectively [7]. Moreover, it breaks work into small chunks with less planning, requires efficient face-to-face communication with consumers, and makes the client an active participant in the development process.

Hybrid Methodology. A hybrid project management represents a mix of several project management approaches. Companies utilize this methodology to increase the efficiency of project management. The finest practices of several methods are selected and merged into a single methodology for project implementation. It is therefore conceivable to boost efficiency by combining the techniques of traditional and agile approaches to create a new management approach that is relevant to a project. Standard design methodologies will not be able to account for all project risks while performing large-scale projects [8]. In other words, traditional project management procedures will be unable to eliminate all risks connected with project's operations.

Salah et al. proposed a hybrid paradigm for project creation that combines flexible and waterfall methods to address the inefficiencies of traditional waterfall design methodologies [8]. The hybrid approach has set a rule that waterfall aspects will be used to generate project requirements at the start of the project lifecycle, and agile will be utilized for project execution and future stages.

For a variety of reasons, the creation of a hybrid project management approach for business is required. This can be aided by a customized project with features for business implementation, people management, and development difficulties. As a result, it is not always possible to use the same project management strategy for all of the company's projects. If we take the hybrid project management approach as a solution to most of the organization's problems, it can be stated that it is the best option. To overcome project uncertainty challenges, the hybrid project management technique allows projects to use the same tools and artifacts from flexible and waterfall models [9].

The degree to which the waterfall and agile project management models are integrated depends on the type of project and its requirements. In hybrid approach, the project life cycle has five stages. Each stage of the life cycle is interconnected with the one before it and serves to achieve the project's final goal. There are five phases in the project management lifecycle: initiating, planning, execution, monitoring and control, and closing.

There are 132 management tools and techniques included in the PMBOK. Data gathering methods, data analysis methods, data display methods, decision-making methods, communication skills, interpersonal skills, and collaboration are among the 72 tools and strategies they use. In addition, 60 PM tools and methodologies are not distributed by groups [5].

We selected 24 out of 132 project management methods and tools in this research. They are earned value management, regression analysis, hierarchical chart, critical path technique, assessment of the probability and impact of risks, project management information system, conflict management, flexible release planning, rolling wave planning, communication requirements analysis, historical information review, presentations, Gantt chart, decomposition, stakeholder engagement assessment matrix, critical path method, assessment of the probability and impact of risks, quality management, change management, flowcharts, probability and impact matrix, technical performance analysis, decision tree analysis, parametric estimating [5].

Qualitative analysis. In interviews with the company's project managers, a comparative qualitative analysis is utilized to determine the degree of usage of Project Management tools and processes in IT Company. In general, the answers to the first question, "What project management methodologies, tools and techniques do you employ in IT Company?" were analyzed. IT Company employed 16 project management tools, which were recognized during the interview. Simultaneously, the extent to which the above-mentioned PM tools and techniques were used in each of the company's project management approaches was assessed. As a result, the degree of application of PM tools and techniques in waterfall, agile, and hybrid methodologies was assessed. Analytics tools (72,85%), communication plan (68,02%), project charter (66,37%) are the most often used Project Management Tools. At the same time, project management information tools (54,47%), hierarchical charts (52,83%), meetings (50,67%), presentations (49,27%), Gantt chart (45,62%), decomposition (45,62%), and stakeholder engagement assessment matrix (41,47%), testing (40,4%) are some of the most commonly used tools. Let us also explore the tools used in project management at a lower level. The critical path method (39,02%), risk assessment (35,02%), quality management tools (24,07%), and change management tools (21,17%) are among them.

It is necessary to mention the three most often used project management tools in order to examine the degree of use of these tools in each methodology independently. Thus, project charter (75,4%), hierarchical charts (67,9%), and communication plan (54,4%) are applied in the classic Project Management Methodology. Work Breakdown Structure and Organizational Breakdown Structure are included in hierarchical charts, according to participants' responses.

It is vital to notice the three most often used tools in Agile methodology. Analytics tools (93.2%), project management information tools

Table 1 – Degree of usage of project management tools in each Project Management Methodology

Tools	In traditional (%)	In hybrid (%)	In agile (%)	In all (%)
Analytics tools (DBeaver, Magicdraw, Axure, BPMN, Use Case, UML, State machine, Prototypes, Microsoft Office Suite, Figma)	49,30	76,05	93,20	72,85
Communication Plan	54,40	71,35	78,30	68,02
Project Charter	75,40	69,70	54,00	66,37
Project management information tools (MS Project, Jira, Confluence)	16,80	57,00	89,60	54,47
Hierarchical charts (WBS, OBS)	67,90	54,70	35,90	52,83
Meetings	11,40	53,20	87,40	50,67
Presentations (Demo, discussions)	19,40	51,80	76,60	49,27
Gantt chart	21,30	48,15	67,40	45,62
Decomposition	35,40	48,15	53,30	45,62
Stakeholder engagement assessment matrix	53,00	44,00	27,40	41,47
Testing (Postman, SoapUI)	1,20	41,60	78,40	40,40
Critical path method	52,10	41,55	23,40	39,02
Development (Extremal programming, Gitlab, PostgreSQL 12)	1,50	41,25	73,40	38,72
Assessment of the probability and impact of risks	43,20	37,55	24,30	35,02
Quality management tools	19,30	26,60	26,30	24,07
Change management tools	4,20	23,70	35,60	21,17

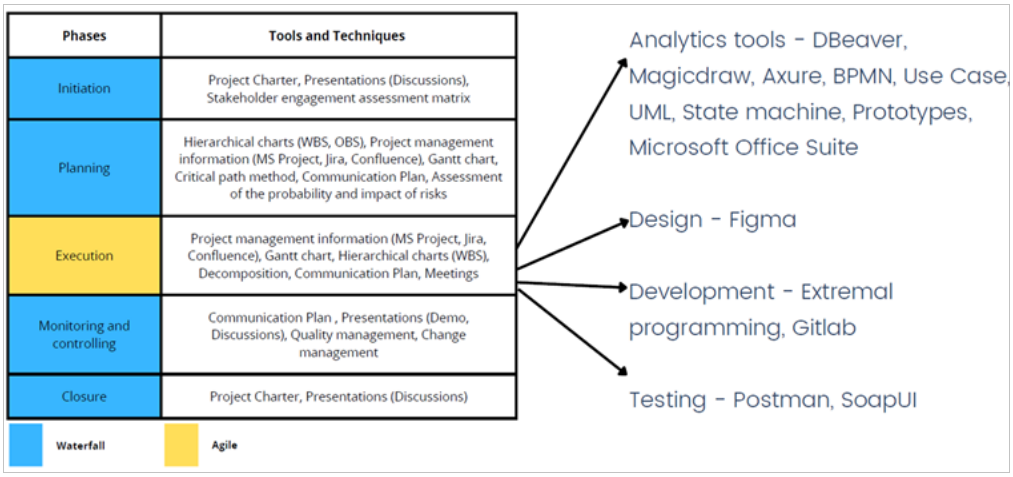

Figure 1 – Arrangement of PM tools and techniques at different phases of the project

(89.6%) and meetings (87.4%) are among these tools. Jira, Confluence, and Microsoft Project were mentioned as project management information tools by respondents.

Finally, when it comes to the degree to which project management tools are employed in Hybrid methodology, it's important to mention the three most commonly used tools based on responses. Analytics tools (76,05%), communication plan (71,35%), and project charter (69,7%) are among these tools (Table 1).

Additionally, respondents were asked to organize the selected PM tools per project phases to establish their application at each step (Initiating, Planning, Executing, Monitoring, and control Closure). Consequently, the data in the following table was obtained (Figure 1).

Most project managers have defined tools such as project charter, presentations (discussions), and a stakeholder engagement assessment matrix to the first Initiation phase.

At the same time, project management tools and techniques such as hierarchical charts, project management information tools, Gantt chart, critical path method, communication plan, and risk assessment matrix are mentioned in the Planning phase of the project lifecycle.

Project managers at IT Company employ project management information tools, Gantt chart, hierarchical charts, decomposition, communication plan, and meetings throughout the execution phase.

Project management tools and techniques such as communication plan, project charter,

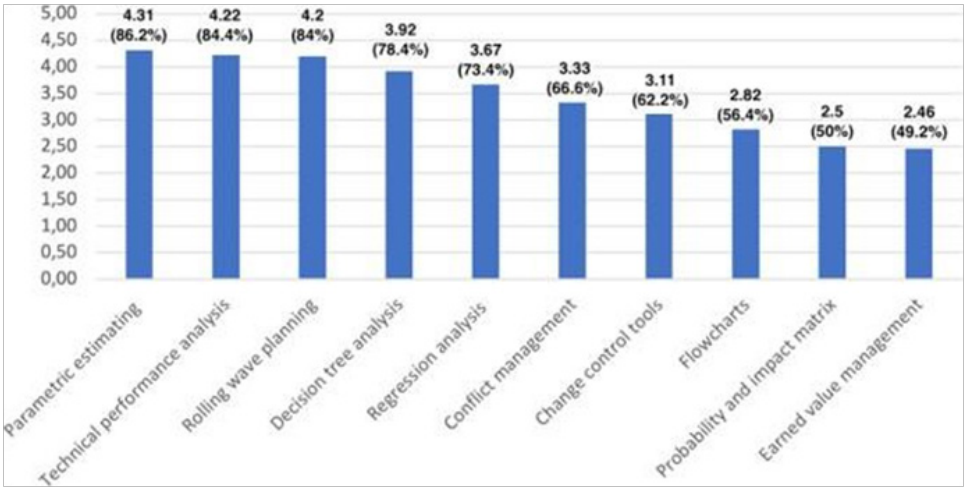

Figure 2 – Degree of effectiveness of usage project management tools

presentations, quality management and change management are described in the last two stages of the project life cycle monitoring and control, closing.

The following question identifies the project management tools and techniques that might be useful in IT Company projects in the future. Earned value management, regression analysis, rolling wave planning, block-chain, change control tools, probability and impact matrix, technical performance analysis, conflict management, decision tree analysis, and parametric estimating were identified as significant, useful and effective tools and methods based on project managers' responses.

Following that, respondents were asked to rate the usefulness of various tools and techniques on a five-point scale. Parametric estimating (86.2%), technical performance analysis (84.4%), rolling wave planning (84%), decision tree analysis (78.4%), regression analysis (73.4%), conflict management (66.6%), and change control tools (62.2%) are the most effective tools, according to the study, while flowcharts (56.4%), probability and impact matrix (50%), and earned value management (49.2%) are the least effective tools (Figure 2).

Results

In order to assess the degree of use of project management tools and techniques in IT Company, a qualitative analysis was applied. This analysis showed how strong the use of various PM tools and techniques in each of the methodologies in the IT Company. So, it was determined that the most frequent tools of the project manager are analytics tools. It is assumed that such results were influenced by the fact that most of the company's projects work according to the Hybrid methodology, which implies the application of this management tool by a fairly high degree. Also, the analysis notes the grouping and arrangement of identified PM tools and techniques for each stage of the project (initiation, planning, execution, monitoring and control, closure). The result of the assumptions is that more technical management tools are used in the execution phase.

In order to reveal the importance and effectiveness of project management tools and techniques in IT Company, a qualitative analysis was used. In the course of this analysis, ten PM tools and techniques were selected, each of which was subsequently evaluated on a five-point scale to determine the effectiveness in use. This analysis showed the significance of application and adoption of PM tools and techniques in the company future practice by project managers. Thus, it was determined that parametric estimating, technical performance analysis and rolling wave planning are considered as the most effective tools for project management. It is believed that with the adoption of these project management tools and techniques, the company's projects would be more successful in operation and management.

Recommendations. According to the study, project managers are interested in putting new project management tools and techniques into practice. They stated that project management tools and techniques such as parametric estimating, technical performance analysis, and rolling wave planning are more effective for managing public and social IT projects.

Conclusion

In this paper, agile, traditional, and hybrid project management methodologies were studied. The main topic of the study is to determine project management tools and techniques that are most often used and applied in IT Company management.

The essential aim of this research is to make a contribution to the existing literature, analyze the utilization of certain project management tools and techniques in practice of IT company as well as to identify the need for additional significant and effective PM tools and techniques for increasing the number of successful projects. The data for the analysis were collected using interview conducted within the framework of IT Company. In general, 62 responses of the company's project managers were collected for the research work.

The most effective action will be the application of a hybrid methodology tools and

techniques into the project management of IT Company. By combining various methods, tools and techniques of PM methodologies, project managers can adapt the project's workload and team members to the complexity of the project to achieve greater work efficiency.

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Оценка и анализ применения инструментов и методов управления проектами в IT компании

Аннотация. На сегодняшний день система проектного менеджмента активно внедряется в различные сферы государственной и бизнес деятельности. Проектный подход, методология, инструменты и методы управления проектами разрабатываются, модифицируются и адаптируются к определенной отрасли, в том числе и IT.

В статье рассматриваются инструменты и методы, применяемые в методологиях управлении проектами: традиционной, гибкой и гибридной. Основной целью исследования является оценка и анализ эффективных и наиболее часто используемых инструментов и методов управления проектами в практике IT компании. Подробно рассмотрены варианты применения, определенные в исследовании, инструменты и методы управления проектами в каждой из методологий. В результате была разработана модель использования инструментов и методов управления проектами, упорядоченных по фазам жизненного цикла проекта и методологиям управления проектами.

Ключевые слова: управление проектами, методы и инструменты управления проектами, методология управления проектами.

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IT компанияларында жобаларды басқару құралдары мен әдістерін қолдануды бағалау және талдау

Аңдатпа. Бүгінгі таңда жобалық менеджмент жүйесі мемлекеттік және бизнес қызметтің түрлі салаларына белсенді енгізілуде. Жобалық тәсіл, әдістеме, жобаларды басқару құралдары мен әдістері белгілі бір салаға, соның ішінде IT-ға қарай бейімделеді, әзірленеді және өзгертіледі.

Мақалада жобаны басқару әдістемесінде қолданылатын құралдар мен әдістер қарастырылады: дәстүрлі, икемді және гибридті. Зерттеудің негізгі мақсаты-IT компаниясының тәжірибесінде жобаларды басқарудың тиімді және жиі қолданылатын құралдары мен әдістерін бағалау және талдау. Зерттеуде анықталған қолдану нұсқалары, әр әдіснамадағы жобаларды басқару құралдары мен әдістері толық қарастырылған. Нәтижесінде өмірлік циклінің кезеңдері мен жобаны басқару әдістемелеріне сәйкес реттелетін жобаны басқару құралдары мен әдістерін қолдану моделі жасалды.

Түйін сөздер: жобаларды басқару, жобаларды басқару әдістері мен құралдары, жобаларды басқару әдістемесі.

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Сабден О. – ҚР БҒМ Ғылым комитеті Экономика институтының экономикалық саясат және жаһандану бөлімінің меңгерушісі, МАГИ, РАЕН, ҚР ҰИА академигі, Алматы, Қазақстан.

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