SOFTVERI ZA UPRAVLjANjE PROJEKTOM: KATALIZATORI ILI OGRANIČENjA?

PROJECT MANAGEMENT SOFTWARE: CATALYST OR CONSTRAINT?

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Apstrakt: *Ovaj rad proširuje prethodna istraživanja autora o uticaju softvera za upravljanje projektima na celokupan uspeh projekta. Pomenuto proširenje se ogleda u dubljoj analizi korelacija između projektnih metodologija, upotrebe softvera na projektu, ciljeva održivog razvoja UN i uspeha projekta. Analiza podataka prikupljenih iz sprovedene ankete je pokazala da projekti Agilne metodologije postižu manje ciljeva održivog razvoja UN zbog njene ograničene primenljivosti van IT industrije. Međutim, kako u Agilnoj tako i u procesnoj metodologiji, projekti su uspešniji kada se njima upravlja pomoću softvera nego kada to nije slučaj. U radu se ističu i preferencije prema odabiru softvera: u slučaju Agilnih projekata koriste se Jira i ClickUp, dok se u slučaju procesnih odlučuje za MS Project. Rezultati istraživanja daju značajne nalaze, ističući važnost strateškog odabira softvera usklađenog sa specifičnostima metodologija upravljanja projektima, pružajući profesionalcima i organizacijama mapu puta za unapređenje uspeha projekta i značajan doprinos Ciljevima održivog razvoja UN-a.*
Ključne reči: *Uspeh projekta, Procesna metodologija, Agilna metodologija, Softveri za upravljanje projektima, Ciljevi održivog razvoja UN-a*

Abstract: *This study extends the authors' previous research that investigated the impact of project management software on project success. Conducted research expands the background research by providing a deeper analysis of the correlations between project methodologies, software use on the project, the UN Sustainable Development Goals (SDGs) and project success. Analysing the data collected from conducted surveys showed that Agile projects achieve fewer UN Sustainable Development Goals due to limited applicability outside the IT industry. However, in both Agile and Waterfall methodologies, projects are more successful when they are managed with software*

than when they are not. The study highlighted software preferences: Agile projects use Jira and ClickUp, while Waterfall methodology opt for MS Project. These findings offer valuable insights, highlighting the importance of strategic software selection aligned with specific methodologies, providing professionals and organizations with a road map to enhance project success and meaningfully contribute to the Sustainable Development Goals.
Key words: *Project Success, Waterfall methodology, Agile methodology, Project Management Software, UN Sustainable Development Goals*

1. INTRODUCTION

The basic characteristic of today's environment, in which organizations operate, is its changeability, dynamism and environmental issues. This represents a distinct challenge for one company. Project management in this sense becomes a demanding task, which involves a large number of factors that can have a significant impact (Stare, 2013). We can see companies competing with each other in many areas. An important difference between successful and unsuccessful companies is their ability to manage the business portfolio according to the dynamic environment with the awareness of its impact on the environment. As the development of information technologies made its debut in many fields, as well as in the field of project management, a large number of software solutions appeared, which enable significantly more efficient, environmentally sustainable and successful management of projects. Implementation of these software tools makes an important distinction between high-performing and low-performing organizations (Pellerin et al., 2013).

This study represents a significant advancement in the prior research conducted by the authors. It addresses crucial research inquiries pertaining to the correlation between software utilization and on the one hand and the achievement of the United Nations Sustainable Development Goals (UN SDGs) and the project success on the other hand depending on the applied methodology for project management.

2. LITERATURE REVIEW

2.1. Exploring Project Management Methodologies

There are different methodologies and approaches for project management, however in this paper the focus will be on Agile and Waterfall methodology. Usually, Waterfall methodology is described as linear where phases are done according to the defined starting point of a project (Hass, 2007). This approach presumes that all aspects connected to a project are predictable, since they are being defined precisely before the start of a project. Every phase needs to be completed in order to move to completion of next stage. The main goal and focus of this methodology is on cost management. In addition, the Waterfall methodology does not assume stage overlapping or phase re-execution (Rasch, 2019; Aroral, 2021).

On the other hand, Agile methodology emphasizes individuals and their interactions in terms of successful project delivery. This approach highlights focus aimed at valuable and functioning results, rather on an extensive amount of documentation. The main goal and focus is the satisfaction of customer needs and their expectations. In addition, a highly important characteristic of the Agile approach is flexibility. This means that plans are not immutable and definitive, but rather changeable according to project needs (Koi-Akrofi et al., 2019). This methodology is mainly used for projects with changing and dynamic environments, customer needs, competition and where technology as an element, plays a crucial role (Stare, 2013; Nootebom et al., 2021).

2.2. Dimensions and Critical Success Factors

According to Shenar & Dvir (1997), dimensions of project success are described as distinct perspectives, concerns and time horizons that are important for one organization. Based their research, results implied four dimensions: 1) project efficiency, 2) impact on customer, 3) direct business and organizational success and 4) preparation for the future. More recent study presents three dimensions of project success: 1) project management success, 2) product success and 3) strategic project success (Petrovic et al., 2022). Additionally, the first dimension implies to the significant effect of project management approach in the context of different project constraints, the second dimension is connected to identification of needs and requirements of project stakeholders and the third dimension is connected to achivement of defined goals at the highest level of a business (Stanimirovic et al., 2023). Mitrovic et al. (2020) define critical success factors (CSF) as necessary requirements that can enhance chances possibility of project success, if managed in an appropriate way. There is a large number of different categorizations of CSF according to different authors and in this paper those success factors that are realized by using project management software are selected. Based on them, survey questions related to achieving the success of the project and how to use the respective software for project management were formed.

2.3. Impact of Project Management Software utilization

The impact of the IT industry is becoming more obvious day by day. Information technologies have influenced different industries and areas, as well as project management. Today there is a wide number of project management software that can be used for the improvement of productivity and efficiency of project work. In addition, software tools enhance the capability of an organization to respond to different changes in today's dynamic environment (Overby et al., 2006). A previous authors' study showed that 55.7% of companies use more than one software tool. Furthermore, they keep their focus on one, exact software, but combine it with other software tools (Stanimirovic et al., 2023). Pellerin et al. (2013) have shown that cost performance index (CPI) is correlated with software usage time, where increase of time usage

positively impacts CPI value. In addition, through threw mentioned study, it has been demonstrated that less-performing projects show lower level of system utilization.

3. METHODOLOGY

Data was collected in Serbia in February 2023 through an electronic survey, known for its efficiency in transmitting information and expediting response times (Ball, 2019). The questionnaire included five constructs: demographic information, project characteristics (aligned with Sustainable Development Goals), Likert-scale evaluations of critical success factors from prior research, assessments of software tools' impact on communication and project management, and measurements of project success across management, results, and strategic orientation.

Participants anonymously completed the survey through Microsoft Forms, and data analysis was performed using IBM SPSS 23. Spearman's correlation coefficients were used to explore relationships between project management software tools usage and project success factors in Waterfall and Agile methodologies. In addition, the Chi-square test was used to determine statistically significant relationship between the project management methodology and the achievement of UN sustainable development goals, as well as between the project methodology and the project management software that was used on certain project.

4. RESULTS & DISCUSION

In this study, data were gathered from 70 project-oriented companies headquartered in Serbia, encompassing both Agile (34 projects) and Waterfall (36 projects) methodologies, all of which were valid for analysis. The survey questionnaire was completed by a balanced gender distribution, comprising 36 male and 34 female respondents. Within this cohort, 27 individuals (38.6%) held the role of project manager, while 25 were project team members (35.7%). Moreover, the survey featured participation from 2 CEOs, 9 board of directors members, 2 product owners, and 4 scrum masters.

The projects examined in this research are delineated in Table 1, with respondents providing detailed information about the projects they managed. The study encompassed a diverse array of projects, evident in the large number of industries in which they were implemented and varied Sustainable Development Goals (SDGs) achieved through their implementation. Furthermore, it is noticed that 55.7% of the cases indicated the use of multiple software tools within a single project management framework. Despite their diversity, companies demonstrated fidelity to specific software applications such as Jira, MS Project, Trello, and Click-up, even in cases where multiple software tools were employed.

Table 1. Characteristics of surveyed projects

Characteristic of a project (n=70)	% of sample	Characteristic of a project (n=70)	% of sample
Business sector of organization		**Number of team members**	
Information technology	48.6	2-5	27.1
Education	14.3	6-10	40.9
Financial services	8.6	11-20	18.6
Manufacturing	7.1	21-50	8.6
Media and telecommunications	7.1	>50	5.7
Retail	4.3	**Duration of a project (in months)**	
Public sector	2.9	<6	25.7
Agriculture	2.9	6-12	35.7
Research and development	1.4	12-24	20.0
Construction	1.4	24-36	7.1
Energy and mining	1.4	>36	11.4
Budget of a project			
<100.000€	32.9		
100.000-500.000€	22.9		
500.000-1.000.000€	14.3		
>1.000.000€	30.0		

The analysis of Figure 1 highlights a significant contrast in United Nations Sustainable Development Goals (SDGs) fulfillment between Waterfall and Agile methodologies. Waterfall projects show higher diversification, particularly excelling in achieving SDGs 4 (Quality education) and 9 (Innovation, industry and Infrastructure). Conversely, Agile projects emphasize goals 8 (Dcent work and economic growth), and 9 (Innovation, industry, and infrastructure). This discrepancy is likely due to Agile's limited applicability outside the IT sector, where its focus on innovation and development prevails (Alam et al., 2017). Notably, Waterfall methodology correlates significantly with SDG4 - Quality education, as validated by a chi-square test, indicating the method's substantial influence on this goal. However, no such relationship was found for other SDGs and project management methodologies employed.

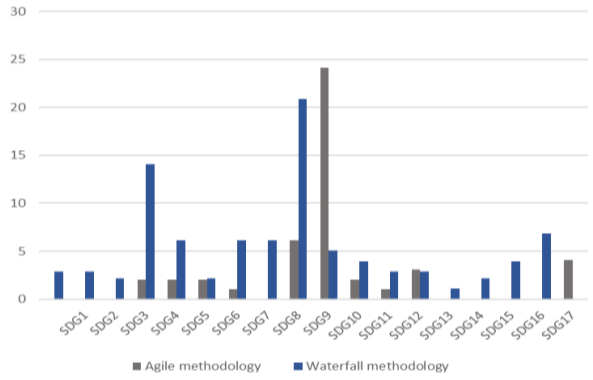

Figure 1. Achieving the UN SDGs according to the project management methodology

Table 2 displays Spearman correlation coefficients between project success factors and project success dimesions for Agile and Waterfall methodology, interpreted according to established criteria by *Cohen, 2013*. In Agile-based companies, stakeholder factors significantly impact project results, and project management factors influence both project management and project strategic success. Conversely, in Waterfall-oriented companies, stakeholder factors bear no impact, and project management factors lack significance across success dimensions. Portfolio management factors significantly affect project results in Agile methodology and impact both portfolio management and project results in Waterfall methodology.

The outcomes observed in this study diverge from prior research, which suggested a universal impact of software utilization on all facets of project success as per selected criteria (Raymond & Bergeron, 2008; Mitrovic et al., 2014; Stanimirovic et al., 2023). Upon methodological analysis, it was discovered that in Agile methodology, software usage significantly enhances project product success, aligning with the methodology's core tenets of customer orientation and the delivery of high-quality project outcomes (Singh, 2021). Conversely, within the Waterfall methodology, software usage exclusively contributes to the success of project management and project products, specifically in the context of portfolio management success factors. These results are anticipated due to the prevalent application of Waterfall methodologies in traditional industries handling multiple projects simultaneously (Mau, 2009; Crespo-Santiago & Cosme, 2011).

Table 2. Correlations matrix project success factors and dimensions according to project management methodology

Spearman's rho	Agile methodology			Waterfall methodology		
	Project management success	**Product success**	**Strategic success**	**Project management success**	**Product success**	**Strategic success**
Stakeholders factors	.337	.420*	.207	.307	.269	.255
Project management factors	.339	.517**	.402*	.270	.304	.234
Protfolio management factors	.310	.405*	.264	.347*	.360*	.239

* significance at the level 0.05; ** significance at the level 0.01

The prevalent project management tools employed in the studied projects include MS Project, Jira, Trello, and Click-Up, with MS Project and Jira being the most frequently utilized, found in 53% and 74% of the cases respectively. Non-parametric Chi-square tests were utilized to investigate potential relationships between software usage and the applied project management methodology. Significantly, a statistically significant correlation was identified solely between the use of Jira software and the Agile methodology. This finding is unsurprising given that Jira is particularly well-suited for

projects managed under the Agile methodology, aligning with its inherent compatibility with Agile project management practices (Sarkan et al., 2011; Razak, 2014).

5. CONCLUSION

The research successfully addressed the research questions. It was found that there is a difference between the achievement of the UN SDGs in the case of the Waterfall methodology in relation to Agile methodology. Waterfall projects demonstrated a broader achievement across multiple SDGs, whereas Agile projects focused on a narrower set, primarily SDGs 8 and 9, due to the limited adaptability of Agile practices beyond the IT sector, concentrating on innovation and economic development. This study also differentiated itself from prior research of many other authors by revealing divergent impacts of project management software tools on project success dimensions based on the methodology employed. Specifically, in Agile methodology, the utilization of Jira emerged as a prominent contributor to success of project products across all identified factors. In contrast, while no specific software demonstrated a statistically significant relationship with Waterfall methodology, significant correlations were established between portfolio management factors and various dimensions of project management success and project product success. These findings underscore the crucial role of appropriate software selection aligned with specific methodologies, particularly highlighting the instrumental role of Jira as a catalysator in achieving project success within the Agile methodology framework.

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