Berezutskyi Ihor

Postgraduate of the department of information technologies,
https://orcid.org/0009-0006-9701-8531
Kyiv National University of Construction and Architecture, Kyiv

METHOD FOR ANALYZING PROJECT CHARACTERISTICS

Abstract. Project management methodologies play a crucial role in determining the success or failure of a project. Selecting an inappropriate methodology can lead to inefficiencies, budget overruns, delays, and even total project failure. This article investigates the correlation between project failure and the incorrect selection of project management methodologies through a structured survey conducted among project managers with direct experience from past projects. The research aims to quantify the impact of methodology selection on various project outcomes, including stakeholder involvement, risk identification, and the effectiveness of mitigation strategies. The survey is carefully designed to capture comprehensive data on past project characteristics, including project size, complexity, industry, team composition, and the frequency of methodology changes. It also examines the reasons behind methodology selection, the rationale for methodology changes, and the effect of these decisions on final project outcomes. By focusing on both successful and failed projects, the study identifies common risk factors and assesses how specific methodologies either contributed to or mitigated those risks. A key aspect of the analysis involves using statistical calculations to evaluate project failure and success rates, resource availability, stakeholder engagement, and the extent to which an incorrect methodology influences project deliverables. By employing formulas such as project success rate, stakeholder involvement, resource availability, initial methodology that was used, wrong methodology, correlation between project failure and wrong methodology, most remediated and not remediated risks, correlation between risk monitoring frequency and project failure, correlation between team composition and project failure and correlation between project complexity and project failure This approach allows for an objective evaluation of the degree to which incorrect methodologies correlate with project failures and highlights patterns of risks that are most frequently remediated or left unresolved. The findings from this research will offer actionable insights for project managers and organizations, enabling them to make more informed decisions when selecting methodologies. By understanding the relationship between methodology choice and project outcomes, organizations can adopt best practices to minimize project risks, improve project success rates, and ensure greater alignment between the chosen methodology and the unique needs of each project. Additionally, the study's statistical framework can be applied in future research to further refine the analysis of project management methodology effectiveness.

Keywords: Project; method; survey; Project Risk; Project methodology; Pearson coefficient; correlation

Introduction

Project management methodologies serve as structured frameworks that guide teams through project execution. The choice of an appropriate methodology such as Agile, Waterfall, or Hybrid can significantly influence a project's success. However, many projects fail due to an unsuitable methodology that does not align with project needs, industry standards, or stakeholder expectations. This research aims to explore the relationship between project failure and project management methodology selection, utilizing data collected from project managers through an online survey. By identifying common failure factors and their correlation with methodologies, this study seeks to provide recommendations for better methodology selection in future projects.

Analyze of scientific sources

Most of the articles [1 – 4] work on aspects of decisions that needs to be made in order to successfully continue project development. Some of articles [5 – 8] provide specific implementation for different methods to sustain project, but no particular articles that analyzes actual outcomes of the project in survey form. Usually it's lessons learnt for the each given project but no overview for set of the projects. And there were no additional studies for searching for the correlation between wrong methodology and project failure. Also there no studies about risks quantified risks values that converted or not-converted into the issues, only general information about it's importance.

The Aim of the Article

The objective of this article is to analyze whether project failures are linked to the incorrect selection of project management methodologies. Additionally, the study aims to identify the most common risk factors that contribute to project failure and success. The research seeks to answer the following questions:

• Does an incorrect project management methodology increase the likelihood of project failure?

• What are the primary risk factors that lead to project failure?

• How do methodology changes during a project impact its outcome?

• What are the best practices for selecting an appropriate methodology?

By addressing these questions, the article contributes to the development of improved project management strategies.

Main part

Surveys are widely used in research to collect primary data. The structured approach ensures reliability and repeatability of results. In this context, article utilizes a structured questionnaire focused on past projects and their methodologies to analyze patterns. The survey includes questions on project duration, complexity, industry, team structure, stakeholder involvement, and methodology selection.

To ensure clarity and effectiveness, the survey should follow these guidelines:

• Simplicity and Structure: Questions should be concise and structured logically, moving from general project characteristics to methodology specifics and outcomes.

• Types of Questions: Use a mix of multiple-choice, Likert scale, and open-ended questions to gather qualitative and quantitative data.

• Anonymity and Confidentiality: Respondents should feel comfortable sharing information without fear of disclosure.

• Time-Efficient: The survey should not take more than 10–15 minutes to complete to encourage participation.

This study employs an online survey targeting project managers. The audience consists of professionals from different industries with experience managing projects of varying sizes and complexities. The survey is distributed via professional networks, ensuring relevant participants. The collected responses are analyzed using statistical methods to determine correlations between project outcomes and methodology selection. Composed survey is shown in Table1.

*Table 1 – **Project results survey***

Type	Question	Answer	Answer options
General	Past project duration	Select	Less than Year; Year; 2+ Years
General	Past project size	Select	Small (up to 10 people); Medium (11-50); Large (50+)
General	Past project nature	Checkbox	KTLO/Support; Integration; Development; Infrastructure; Other
General	Past project complexity	Select	Simple, Moderate, Complex
General	Past project industry	Select	Tech; Healthcare; Retail; Finance; Transportation; Food and beverages; Logistics; E-Commerce; Edtech; Government; Oil&Gas; Manufacturing; Other
General	Stakeholder involvement	Select	Monthly;Bi-weekly;Weekly;Twice per week; Daily
Team	Team was fully staffed on time and budget	Select	Yes;No
Team	There were cases of team member retention	Select	Yes;No
Team	What caused retention	Checkbox	(if previous answer was "Yes") Client; Performance; Person related; Budget related; Other
Team	All team members where expected seniority	Select	Yes;No
Methodology	Which PM methodology was used	Checkbox	Scrum; Kanban; Waterfall; Hybrid; No methodology; Other
Methodology	Why was this methodology chosen	Checkbox	Client insist; Applicability to the project; Familiarity with methodology; Other
Methodology	Methodology was changed during project	Select	Yes;No

Methodology	Why methodology was changed	Checkbox	(If previous answer was "Yes") Mitigate risks; Client insist; Methodology not suitable; Other
Methodology	Which PM methodology was used after the change	Select	(if previous answer was "Yes") Scrum; Kanban; Waterfall; Hybrid; No methodology; Other
Outcomes	What was the final project outcome	Select	Delivered on time and within budget; Delivered but exceeded budget or timeline; Not delivered or failed
Outcomes	Challenges on the past project were because	Checkbox	Client related; Budget related; Project team related; Methodology related; Infrastructure related; Other
Outcomes	To what extent did the PM methodology contribute to the past project deliverables	Scale	Very much contribute - Not contributed
Risks	Did risks stated in the start or before start of the past project	Select	Yes;No
Risks	there were some risks that were converted into issues	Select	(If previous answer was "Yes") Yes;No
Risks	Most common risks that were converted into issues	Checkbox	Scope creep; Budget overrun; Team retention; Unclear requirements; Other
Risks	Most common risks that was mitigated	Checkbox	Scope creep; Budget overrun; Team retention; Unclear requirements; Other
Risks	Did risks stated for the past project	Select	Yes;No
Risks	How frequently were those risks monitored	Select	Monthly;Bi-weekly;Weekly;Twice per week; Daily

This survey will provide us with necessary information about project characteristics, such us overall success ratio, percentage of failed project due to methodology, the most remediated and not remediated risk and many more.

Project failure rate:

$$P_f = \frac{N_f}{N} \times 100,$$

where P_f – Project failure rate, N_f – number of failed and N – number of Projects. By "failed" meant projects that have answer "Delivered but exceeded budget or timeline" and "Not delivered or failed" for question "What was the final project outcome".

Project success rate have similar formula:

$$P_f = \frac{(N - N_f)}{N} \times 100.$$

Expected that success rate will be around 60-70% of overall quantity of the projects.

In [2] where used different characteristics, like stakeholder involvement and team availability, so let provide correct formulas to calculate those characteristics. According to article results should be in scale high-medium-low. Formula for stakeholder involvement will look this way:

$$S_i = \frac{N_t}{N} \times 100,$$

where S_i – stakeholder involvement and N_i – number of interaction quantities and they should be combined in this way: for high interactions answer "Daily" should be used, for low – "Monthly" and for medium – sum of the rest answers for the "Stakeholder involvement" question.

For resource availability formula will be more complicated because it gathers information out of three questions from Teams type.

$$R_a = \frac{N_{positive}}{N_{Team}} \times 100,$$

where R_a – resource availability, $N_{positive}$ – number of positive ("Yes") responses for questions "Team was fully staffed on time and budget", "There were cases of team member retention" and "All team members where expected seniority" in Teams type. N_{Teams} – quantity of answers for those three questions, typically should be three times more than N.

Next formula is for digesting methodology that was initially used in given Projects. Formula:

$$M_i = \frac{N_i}{N} \times 100,$$

where M_i – each methodology type from the question "Which PM methodology was used" and N_i – number of answers for each methodology type.

Quite interesting will look metrics about correlation between methodology that was initially used and used after the change, but this not direct scope of this article.

Next and the most important characteristic that needs to be digested is correlation between project failure and wrong methodology. To calculate it Pearson correlation coefficient will be used.

$$r = \frac{\sum(P_f - P_f^-)(M_f - M_f^-)}{\sqrt{\sum(P_f - P_f^-)^2} \times \sqrt{\sum(M_f - M_f^-)^2}},$$

where r – Pearson correlation coefficient, P_f^- and M_f^- – means of corresponding items and M_f – wrong methodology indicator that calculates with next formula:

$$M_f = \frac{N_{Change}}{N_{Methodology}} \times 100,$$

where N_{Change} – number of answers "Methodology not suitable" and "Client insist" in question "Why was the methodology changed" and $N_{Methodolo}$ – overall quantity of answers on this question.

In result this Pearson correlation coefficient should show us actual correlation between methodology and project failure and with value more that zero direction will be positive that will mean that have correlation between those characteristics exists.

As for the risks there two simple formulas for most remediated and not remediated risk:

$$R_i = \frac{Rr_i}{N_{Rr}} \times 100,$$

where R_i – each remediated risk from question "Most common risks that were mitigated", Rr_i – number of answers for each remediated risk and N_{Rt} – number of overall answers in the question. Similar for not remediated:

$$Rn_i = \frac{Rnr_i}{N_{Rr}} \times 100,$$

where Rn_i – each not remediated risk from question "Most common risks that were converted into issues", Rnr_i – number of answers for each not remediated risk.

Another important formula is formula for correlation between risk monitoring frequency and project failure. This formula can show if risk monitoring is important for project failure or not. To calculate this value another variant of Pearson correlation coefficient will be used:

$$r = \frac{n\sum(R_{mf} - P_o) - \sum R_{mf} \sum P_o}{\sqrt{[n\sum R_{mf}^2 - (\sum R_{mf})^2][n\sum P_o^2 - (\sum P_o)^2]}},$$

where R_{mf} risk monitoring frequency, P_o project outcome and n number of responses. But to calculate this

formula semantic values needs to be normalized into numeric ones like shown in Table 2 and Table 3.

*Table 2 – **Normalized values for risk correlation***

Survey value	Numeric value
Monthly	1
Bi-weekly	2
Weekly	3
Twice per week	4
Daily	5

Higher value represents better impact on project outcomes.

*Table 3 – **Normalized values for project failure***

Survey value	Numeric value
Success	0
Partially succeed	1
Fail	2

Since desired outcome need to have more value and for that reason Fail value have higher numeric value than Success

Next value that needs to be assessed is correlation between team composition and project failure. To calculate this value firstly needs to be assessed team composition values. Like in previous formula semantic values needs to be normalized into numeric ones like it shown in Table 4 (project values can be reused from Table 3) and example in Table 5.

Next team composition score needs to be calculated with next formula:

$$T_s = S + R + \sum C + E,$$

where T_s team composition score, S staffing status from the question in Table 4, R retention status, $\sum C$ sum of retention cases and E expected seniority value. In that case max value of T_s should not exceed 5.

Since team composition value logic calculated overall Pearson coefficient for correlation between team composition and project failure can be calculated with next formula

$$r = \frac{n\sum(T_s - P_o) - \sum T_s \sum P_o}{\sqrt{[n\sum T_s^2 - (\sum T_s)^2][n\sum P_o^2 - (\sum P_o)^2]}},$$

where T_s team composition score, P_o project outcome and n number of responses.

*Table 4 – **Normalized values for team composition***

Survey question	Survey value	Numeric value
Team was fully staffed on time and budget	Yes	1
	No	0
Team retention occurred	Yes	1
	No	0
What caused retention (if retention occurred)	Client related	1
	Performance	0
	Person-related	0
	Budget-related	1
	Other	1
All team members had expected seniority	Yes	1
	No	0

*Table 5 – **Example dataset for one project***

Question	Survey value	Numerical value
Team was fully staffed on time and budget	No	0
Team retention occurred	Yes	1
What caused retention (if retention occurred)	Client-related, Person-related	1+0
All team members had expected seniority	No	0
Project outcome	Not delivered or failed	2

Last but not least formula is correlation between project complexity and project failure. Like in previous two formulas normalization is needed. Results of normalization presented in Table 6. Values for project failure will be reused again from Table 3.

*Table 6 – **Normalized values for project complexity***

Survey value	Numeric value
Simple	1
Moderate	2
Complex	3

Pearson correlation formula will have next view

$$r = \frac{n\sum(P_c - P_o) - \sum P_c \sum P_o}{\sqrt{[n\sum P_c{}^2 - (\sum P_c)^2][n\sum P_o{}^2 - (\sum P_o)^2]}},$$

where P_c project complexity, P_o project outcome and n number of responses.

Conclusion

The findings of this study contribute to a deeper understanding of the role of project management methodologies in project success or failure. The research identifies key risk factors that lead to project failure and emphasizes the importance of selecting the right methodology based on project characteristics. The statistical analysis demonstrates that there is a measurable correlation between incorrect methodology selection and project failure. A positive correlation value indicates that incorrect methodology choices contribute to project failures. Different correlation formulas show different aspects of the project itself, like correlation between risk monitoring frequency and project failure, correlation between team composition and project failure, correlation between project complexity and project failure. Those calculations will help to better understand internal linkage between not directly connected characteristics that could be under the radar and not play part in overall overviews of each given project.

By applying the proposed formulas, project managers can assess the impact of different factors on project outcomes and make data-driven decisions. The study highlights the need for continuous monitoring of project risks, team health, retention rate, complexity awareness and methodology suitability to improve overall project performance. Future research can focus on refining these formulas and developing predictive models for project success assessment.

References

1. Young R. (2024). Why Projects Fails | Incorrect Methodology https://ligsuniversity.com/why-projects-fail-incorrect-methodology/, LIGS University.

2. Berezutskyi I., Honcharenko T., Ryzhakova G., Tykhonova O., Pokolenko V., Sachenko I. (2024). Methodological Approach for Choosing Type of IT Projects Management, Conference: 2024 IEEE 4th International Conference on Smart Information Systems and Technologies (SIST), May 2024, URL: DOI: 10.1109/SIST61555.2024.10629587.

3. Berezutskyi I., Honcharenko T. (2024). Potential implications of artificial intelligence for project management information systems. URL: https://ceur-ws.org/Vol-3709/paper3.pdf.

4. Berezutskyi I. (2023). Possibility to use decision-making methods for project management information system, *Management of Development of Complex Systems*, URL: DOI: 10.32347/2412-9933.2024.57.12-19.

5. Honcharenko T., Akselrod R., Shpakov A., Khomenko O. (2023). Information system based on multi-value classification of fully connected neural network for construction management, *IAES International Journal of Artificial Intelligence*, № 12 (2), 593–601. URL: https://ijai.iaescore.com/index.php/IJAI/article/view/21864.

6. Ryzhakova G., Malykhina O., Pokolenko V., Rubtsova O., Homenko O., Nesterenko I. (2022). Construction Project Management with Digital Twin Information System, *International Journal of Emerging Technology and Advanced Engineering*, Vol. 12, Issue 10, pp. 19–28. https://doi.org/10.46338/ijetae1022_03.

7. Khan, A., Hasana, M. K., Ghazal, T. M., Islam, S., Alzoubi, H. M., Mokhtar, U. A., Alam, R., Ahmad, M., (2022). Collaborative Learning Assessment via Information and Communication Technology, in: Proceedings, RIVF 2022., pp. 311–316.

8. Bushuyev S., Bushuyeva N., Bushuiev D., Bushuieva V. (2023). Integrated Intelligence Model for Assessment Digital Transformation Project, *IEEE International Conference on Smart Information Systems and Technologies* (SIST). URL: http://dx.doi.org/10.1109/SIST58284.2023.10223578.

9. El Khatib M., Al Falasi A., (2021). Effects of Artificial Intelligence on Decision Making in Project Management, *American Journal of Industrial and Business Management* 11, pp. 251–260.

10. Harvard Business Review Analytic Services, The Evolution of Decision Making: How Leading Organizations Are Adopting a Data-Driven Culture. URL: https://hbr.org/resources/pdfs/tools/17568_HBR_SAS%20Report_webview.pdf

11. Nicoara R. (2023). Project Management Methods. URL: DOI: 10.1007/978-1-4842-9663-9_12

12. Moura R. L., Carneiro T. C. J., Dias T. L. (2023). VUCA environment on project success: The effect of project management methods, Brazilian Business Review 20 (3). URL: DOI: 10.15728/bbr.2023.20.3.1.en

13. Nekrasova M. (2023). Using methods of probability theory and mathematical statistics in project management, Bulletin of the National Technical University «KhPI» Series Dynamics and Strength of Machines. URL: DOI: 10.20998/2078-9130.2023.2.293040

14. Turney S. (2024). Pearson Correlation Coefficient (r). Guide & Examples, https://www.scribbr.com/statistics/pearson-correlation-coefficient/

The article has been sent to the editorial board 27.02.2025

Березуцький Ігор
Аспірант кафедри інформаційних технологій,
https://orcid.org/0009-0006-9701-8531
Київський національний університет будівництва і архітектури, Київ

МЕТОД АНАЛІЗУ ХАРАКТЕРИСТИК ПРОЄКТУ

Анотація. Методології управління проєктами відіграють вирішальну роль у визначенні успіху чи провалу проєкту. Вибір невідповідної методології може призвести до неефективності, перевищення бюджету, затримок і навіть повного провалу проєкту. У цій статті досліджується взаємозв'язок між провалом проєкту та неправильним вибором методології управління проєктом за допомогою структурованого опитування, проведеного серед керівників проєктів, які мають безпосередній досвід роботи з минулими проєктами. Дослідження спрямоване на кількісну оцінку впливу вибору методології на різні результати проєкту, включаючи залучення зацікавлених сторін, ідентифікацію ризиків та ефективність стратегій пом'якшення. Опитування ретельно розроблено для збору вичерпних даних щодо характеристик минулих проєктів, включаючи розмір проєкту, складність, галузь, склад команди та частоту змін методології. Він також досліджує причини вибору методології, обґрунтування змін методології та вплив цих рішень на кінцеві результати проєкту. Зосереджуючись як на успішних, так і на невдалих проєктах, дослідження визначає загальні фактори ризику й оцінює, як конкретні методології сприяли або пом'якшували ці ризики. Ключовим аспектом аналізу є використання статистичних розрахунків для оцінки показників невдач і успішності проєкту, доступності ресурсів, залучення зацікавлених сторін і ступеня, до якого неправильна методологія впливає на результати проєкту. Використовуючи такі формули, як рівень успіху проєкту, залучення зацікавлених сторін, доступність ресурсів, початкова методологія, яка використовувалася, неправильна методологія, співвідношення між невдачею проєкту та неправильною методологією, найбільш виправлені та невиправлені ризики, кореляція між частотою моніторингу ризиків і невдачею проєкту, кореляція між складом команди та невдачею проєкту та кореляція між складністю проєкту та невдачею. Цей підхід уможливлює об'єктивно оцінити ступінь кореляції неправильних методологій із невдачами проєкту і висвітлення шаблонів. ризиків, які найчастіше усуваються або залишаються невирішеними. Результати цього дослідження запропонують практичну інформацію для керівників проєктів і організацій, допомагаючи їм приймати більш обґрунтовані рішення при виборі методології. Розуміючи взаємозв'язок між вибором методології та результатами проєкту, організації можуть прийняти найкращі практики, щоб мінімізувати ризики проєкту, підвищити рівень успіху проєкту та забезпечити більшу відповідність між вибраною методологією та унікальними потребами кожного проєкту. Крім того, статистичну основу дослідження можна застосувати в майбутніх дослідженнях для подальшого вдосконалення аналізу ефективності методології управління проєктами.

Ключові слова: проєкт; метод; опитування; ризики проєкту; методологія проєкту

Link to publication