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Agile-forest strategies : Selecting heuristic frameworks for successful commercial software deployment

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Abstract

Project development success rates have improved as a result of the growing use of Agile methods in recent years. The intricacy of choosing the right approaches contributes to the difficulty of fully realizing success in projects employing Agile methods. 15 Agile experts from 10 teams in three different countries were interviewed for the study, which was carried out as a Grounded Theory investigation. The study found sixteen factors that fall into five categories and influence the selection of twenty Agile methods. These factors are grouped in

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accordance with the Ground Theory of Agile method selection. Agile team members can use these factors—which include project type, development team expertise, project constraints, customer involvement, and organizational culture—as a guide to determine which methods are best for various organizations and projects.

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1. Introduction

The launch of operational, high-grade systems in reasonable, manageable timeframes is given top priority by many businesses. As a result, there has been a general shift toward Agile methodologies, with an understanding that different factors must be taken into account when choosing these methods for different projects. When selecting from various Agile methods, considerations like the type of project, the skill of the working team, company culture, client engagement, and the limitations of the project must be made.

Even though Agile approaches are being used more often in software development, some businesses still believe that choosing an appropriate Agile method is a difficult task. Moreover, there aren't many studies discussing the challenges of choosing an Agile method that works. The purpose of this study is to help members of Agile teams choose the best approaches for the various project scenarios. A grounded theory investigation was carried out to investigate the ways in which team members can benefit from having more information when selecting an Agile method. Section 2 of the paper provides background information on Agile methods and related techniques. Section 3 of the paper outlines the research methodology. The grounded research study's findings are presented in Section 4, and the Agile methods choosing simulation is presented in Section 5. Section 6 wraps up and provides an overview of potential forthcoming study topics.

2. Related Work

The author provides a succinct synopsis of Agile methods' history and the primary criteria for choosing them in the section. A set of seventeen software managers worked organized in 2001 to improve methods for system development; they introduced Agile methods, which are based on the twelve principles and four values stated in the Agile Manifesto. These

values place a strong emphasis on people and their interactions, functional software, customer cooperation, and adaptability to change. The manifesto's twelve guiding principles help developers and project managers comprehend and use Agile techniques. Prominent tenets encompass the efficacy of in-person interactions, the appreciation of evolving demands, the significance of autonomous groups, and the importance of simpilicity. Since then, a number of Agile techniques and approaches have been created in order to adhere to and fulfil these principles. Some of these techniques include prioritizing in-person interactions, keeping system designs simple, minimizing work-in-progress, and encouraging collective ownership as an Agile modelling approach.

3. Research Methodology

Prior research emphasizes the importance of carefully considering Agile method selection; however, no empirical results have shown how integrated choosing variables are used in the selection process. The main goal of this study is to prove how Agile practices can be selected that are acceptable for different groups and endeavors in various types of organizations. Grounded theory was determined to be the best strategy for answering the research question, despite having the option of multiple research designs. Here are some reasons why using grounded theory makes sense.:

3.1 *Exploration of New Themes*

When investigating fresh subjects and topics or offering a fresh perspective on a well-established occurrence, grounded theory is utilized. 15 interviews with Agile specialists on the choice of Agile methodologies were conducted for the study. The methods used in this study are described in the following sections.

3.1.1 Data Collection (Interviews)

Semi-structured in-depth interviews with open-ended questions were conducted to understand the views, experiences, perceptions, and viewpoints of 15 Agile experts from different organizations and countries.

3.1.2 Data Analysis (Grounded Theory Approach)

The identification of procedures and variables impacting the choice of Agile techniques was done using grounded theory.

Three coding techniques—open coding, axial coding, and selective coding—were employed to analyse qualitative data.

Initial codes, such as project size, maturity, and criticality, were categorized under higher-order headings like the nature of the project.

Selective coding identified core categories, such as project constraints, consisting of scope, time, quality, and cost/value/ROI, along with sub-categories like requirements volatility and cost of change. These core categories served as hubs for other identified categories.

4. Result

The results will be presented in the upcoming parts in order to explain the Agile Methods Selection theory. These findings are the consequence of a study of interview data, with a focus on investigating how Agile methodologies might be found to be appropriate for different projects and teams in a range of businesses. The elements impacting the selection of Agile methods are explained by the Agile Methods Selection model. All technique can be worked for diverse categories of projects and situations. The succeeding clarification includes statements that were obtained from the interviews.

4.1 *Project Type*

Since no two projects are the same in terms of scale or criticality, no one Agile technique is suitable for everyone. problems with organization [5]. Put otherwise, the nature of the project (matureness, criticality, size, and decomposability) must be investigated and taken into account when choosing agile techniques.

4.1.1 Size of the Project

The examination uncovered that the size of a project significantly impacts the choice of Agile methods. For smaller projects (with fewer than 10 stakeholders), preferences lean towards XP, SCRUM, Crystal Clear, DSDM, and Kanban. This preference is attributed to the collaborative nature of methods like XP and SCRUM, facilitating close face-to-face teamwork within a small team during project development:

- R13 (Project Manager): "We assemble a compact team, allocating distinct tasks to each member, and have found DSDM and Kanban to be well-suited."

- R14 (Chief Knowledge Engineer): "SCRUM, Crystal Clear, and XP prove effective for small teams as they minimize the need for additional collaboration and communication."
- However, smaller projects with ten to one hundred stakeholders may benefit more from scaled approaches like SCRUM of SCRUM, LeSS, Nexus, and Crystal Red:
- R10 (Senior Consultant): "In the case of sizable product groups, such as 8 groups with eight people in each group, opting for the LeSS Framework or Crystal Red could be fitting. Nexus is also a viable option."
- R8 (Manager of the Agile Organization): "SCRUM of SCRUM is inherently designe for scaling, accommodating approximately20, 30, or 40 stakeholders without requiring additional measures."

If a single group is engaged in a substantial project surpassing 100 developers, scaling methodologies such as DAD, SAFe, Nexus+, and the Spotify scaling methods become apt. These approaches are well-suited for managing large teams, especially in sizable projects where preliminary planning is crucial to address dependency issues and establish a comprehensive architectural framework, clarifying each team's specific implementation responsibilities.

- R10 (Senior Consultant): "Considering the project's magnitude, if it exceeds 100 people, I opt for Nexus+, while for projects up to 100 people, Nexus is preferable. This approach is well-suited for scaling SCRUM."
- R14 (Chief Knowledge Engineer): "When dealing with a singular program of work, additional elements like project management, work value management, cross-team collaboration, and robust tooling become imperative. Governance processes need to be more robust for extensive work. In such scenarios, guidance from DAD, LeSS, SAFe, and Spotify proves beneficial."

4.1.2 Project –criticality

Project criticality pertains to initiatives that have the potential to incur significant financial losses or pose risks to human lives [5]. Evaluating the criticality of a project proves beneficial in discerning variances in outcomes when employing various Agile methods. The majority of respondents

emphasized that, for the development of critical projects, primary methods include XP, TDD Agile modelling, Lean Startup, DAD, and SAFe.

- R5 (Project Manager): "XP practices should be adopted for critical projects and you should apply TDD."

4.1.3 Project maturity

Project maturity necessitates consideration of distinct product maturity levels at various developmental phases when choosing Agile methods. The analysis identified four stages of product maturity: legacy product, new product, development stage, and maintenance stage.

- R3 (Delivery Manager): "If the team is coding legacy code, TDD will be difficult for them because the design of the code is such that some codes are really written in a way that is very difficult to test. So, TDD will always be difficult to be used for a legacy product."
- R9 (Agile Adoption Change Leader): "For legacy code, XP practices such as pairing and refactoring are good at ensuring you don't create any more technical debt."

4.2 *Development Team Competence*

Achieving success with Agile methods hinges on the proficiency of the team. For example, the effectiveness of team communication skills is paramount in the selection of Agile methods. Given that proficiency levels can vary among different organizations, this factor becomes crucial when choosing a specific Agile method. Project managers play a pivotal role in confirming the team's proficiency, enabling informed decisions on which Agile methods to adopt. The subsequent sub-section outlines the factors falling under the category of team proficiency.

4.2.1 Communication Skills of the Team

The triumph of Agile method adoption is contingent upon robust communication skills within the team. The analysis underscores the influence of team communication skills on the choice of Agile methods. Respondents asserted that XP and SCRUM prove highly effective in enhancing communication skills within the team.

- R4 (Chief Executive Officer): "SCRUM forces us to communicate in different stages of the project."

4.2.2 Team Domain Expertise

Proficiency in team domain knowledge has proven to be a significant factor in the effective application of Agile methods [13]. The team's familiarity with the project domain is considered pivotal in the choice of Agile methods [14]. The empirical study's analysis underscores that the team's domain knowledge plays a crucial role in the selection of Agile methods. When the team lacks a comprehensive understanding of the project and how it aligns with customer needs, Lean Startup emerges as the optimal method to consider.

- R1 Project Manager: "The knowledge of domain for the developers must be very high when selecting DevOps."

4.2.3 Team Proficiency

In the context of this empirical study, proficiency encompasses both team maturity, signifying the team's practical knowledge of a particular Agile technique or past endeavours using the same method, and the technical capabilities enabling the adoption of a particular Agile method. Both aspects are detailed below:

4.2.3.1 Team Maturity

Different teams require different considerations depending on how mature they are in using Agile approaches at different points in time. As such, it becomes crucial to match the methodology with the team's experience level and level of maturity with Agile practices. Agile approaches are widely used in organizations, and different practices are incorporated according to team maturity.

4.2.3.2 Team Technical Proficiency

The technical skills possessed by the team constitute a crucial factor influencing the choice of Agile methods. Many organizations encounter individuals with limited skills, unable to utilize certain methods or lacking the technical acumen necessary for adopting specific methodologies. Methods like TDD and XP demand elevated technical proficiency for selection, given that a significant portion of their practices is rooted in engineering practices:

4.3 *Customer Engagement*

Active customer involvement is pivotal in Agile methods, and when absent, teams should consider Agile approaches adept at understanding customer needs proactively. Adaptive Software Development (ASD), for instance, employs joint application development sessions to enhance customer participation [15]. Encouraging and persuading customers about the importance of their involvement is crucial. Client dedication, client specialist expertise, and customer cooperation are factors that influence the choice of Agile method in this situation.

4.3.1 Customer Collaboration

Unlike traditional methods such as Waterfall, Agile methods necessitate ongoing and active collaboration between customers and development teams. While Agile methodologies like XP, SCRUM, and Kanban offer flexibility for varying levels of customer engagement, their suitability diminishes when customers fail to collaborate effectively with the development team, as revealed in this empirical study.

4.3.2 Customer Commitment

Customer commitment is the term used to describe the prepared, accountable, and driven ways in which customers contribute enough needs and test completed sprints. Nevertheless, our empirical data analysis indicates that customer commitment can vary across projects. Some customers may be occupied, hindering their ability to participate as expected during development processes. Insights from interviews highlight that the Disciplined Agile (DAD) technique helps define duties and responsibilities for customers in an organized way, therefore it's useful when there's not much commitment from the client. In contrast, Kanban and SCRUM may not be as effective, necessitating a degree of upfront planning during the planning stage.

4.4 *Organizational Culture (Organizational Type)*

Typically, Agile methods presuppose a collaborative team structure as opposed to a hierarchical one. However, this empirical analysis brings to light that certain organizations maintain a hierarchical framework yet express eagerness to embrace Agile practices. To facilitate the adoption of Agile methods, these organizations need to adapt their culture. In this

context, methods such as Kanban and SAFe prove beneficial, offering mechanisms for top management to oversee the development progress.

4.5 *Project Constraints*

While the development team enjoys flexibility in choosing methods aligned with their preferences, strict constraints, dependent on the context, come into play. Organizations grapple with challenges like ensuring product quality, addressing time-to-market concerns, managing scope variability, and controlling project costs. The empirical analysis uncovers additional constraints like requirement volatility and the cost of change. These represent primary considerations during Agile methods selection. In essence, the team must identify a method that best aligns with these constraints, as detailed in the following paragraphs based on respondent feedback.

4.5.1 Time

Various organizations confront distinct challenges, with time-to-market being a significant hurdle influencing the choice of Agile methods in two key ways. Firstly, the emphasis on swift delivery aligns with the purpose of DevOps. Additionally, XP and Kanban were identified as methods focusing on expeditious project delivery. XP is more focused on programming and continual adaptation, whereas Kanban prioritizes flow management over iterations, allowing for faster development.

4.5.2 Quality

Agile methods, as a general principle, prioritize enhancing product quality. When challenges revolve around maintaining and boosting quality efficiently, specific Agile methods and practices become essential. XP methods and TDD emerged as the most suitable approaches for elevating quality and effectively addressing such challenges.

4.5.3 Scope Variability

The scope of Agile projects is determined by a high degree needs such as user narratives rather than by specific ones. Analysis indicates that scope variability influences Agile method selection. In cases where there is a lot of scope variability and difficulty mixing specifications over a two-week period., Kanban and Lean development prove to be fitting methods.

4.5.4 Requirements Variability

High requirements volatility implies significant and frequent changes in project requirements. In such scenarios, Kanban stands out as the most suitable method. The appropriateness of the method depends on the stability of the customer's requirements.

4.5.5 Cost/Value/ROI

Certain Agile approaches place a special emphasis on cost-effectiveness, even though the majority of them aim to lower software development expenses. Using these Agile techniques reduces additional features, delays, and faults, which in turn lowers development costs. Some approaches concentrate on providing exactly what the client asks for, keeping effort to the minimum and eliminating extraneous details. Supported by many Agilists, DevOps/Continuous delivery and XP techniques were shown to be successful in cutting project expenses.

5. Discussion

The elements impacting the choice of Agile techniques are illustrated by the Agile techniques Selection Model, which depends on the previously described findings. The central box in illustrates the Agile approaches whose efficacy is influenced by other variables that have been discovered. Every factor has a range of beliefs which may be applied when choosing distinct Agile methods. The analysis categorized these factors into five distinct groups. The Agile group employees should call an assembly to discuss the intended initiatives and the elements influencing method selection in order to effectively address the significance of each identified factor in a particular project. The collaborative team meetings in the Agile method selection process were endorsed by different respondents as a means to identify the most suitable Agile methods.

The analysis's conclusions help choose the right Agile approaches for a range of development projects being undertaken by various enterprises. Consequently, this makes it easier to produce top-notch software in an economical and timely manner.

6. Conclusion

Choosing Agile methodologies carefully is essential for any firm, considering a variety of teams and projects. Any project's ability to be

implemented successfully is greatly influenced by the selection of appropriate Agile methodologies. This research offers a number of suggestions regarding the circumstances that Agile methodologies may be considered appropriate. The study employed one-on-one interviews to examine the customary practices. Agile groups adhere to when deciding which approaches are best for particular projects and teams inside different organizations. Grounded theory analysis was utilized to uncover many components after the data was processed using NVivo, a software application for qualitative data analysis. The major study issue is addressed by the results, which clarify the role that each element has in the selecting process. Subsequent initiatives should investigate appropriate Agile techniques and approaches for requirements reuse, a crucial topic. Furthermore, when developing particular projects, new variables and Agile techniques could surface, necessitating a reassessment of the process for choosing the best Agile techniques.

References

[1] S. C. Misra, V. Kumar, and U. Kumar, "Identifying some important success factors in adopting agile software development practices," *J. Syst. Softw.,* vol. 82, no. 11, pp. 1869–1890 (2009).

[2] M. K. Alqudah and R. Razali, "Key Factors for Selecting an Agile Method: A Systematic Literature Review," *Int. J. Adv. Sci. Eng. Inf. Technol.,* vol. 7, no. 2, pp. 526–537 (2017).

[3] A. Sharma and R. K. Bawa, "A Framework for Agile Development Method Selection using Modified PROMETHEE with Analytic Hierarchy Process," *Int. J. Comput. Sci. Inf. Secur.,* vol. 14, no. 8, p. 846 (2016).

[4] A. Alliance, "Agile manifesto," Online at http://agilemanifesto.org/, vol. 6, no. 1 (2001).

[5] A. Cockburn, Crystal Clear: A Human-Powered Methodology for Small Teams: A Human-Powered Methodology for Small Teams. Pearson Education (2004).

[6] D. J. Anderson, "Kanban." Blue Hole Press Sequim, WA (2010).

[7] J. Sutherland and K. Schwaber, "The scrum guide. The definitive guide to scrum: The rules of the game," Scrum. orgOctober (2013).

[8] K. Beck, Extreme programming explained: embrace change. addison-wesley professional (2000).

[9] B. Sayed, Z. Shamsi, and M. Sadiq, "A Method for the Selection of Agile Methods Using AHP," in Proceedings of the 5th International Conference on Frontiers in Intelligent Computing: Theory and Applications, pp. 297–303 (2017).

[10] H. Ayed, B. Vanderose, and N. Habra, "A Context-Driven Approach for Guiding Agile Adoption: The AMQuICk Framework," ICSEA 2015 Tenth Int. Conf. Softw. Eng. Adv. A, no. c, p. 6 (2015).

[11] B. G. Glaser, "The grounded theory perspective III: Theoretical coding". Sociology Press (2005).

[12] A. Strauss and J. Corbin, "Basics of qualitative research: Procedures and techniques for developing grounded theory." Thousand Oaks, CA: Sage (1998).

[13] M. R. Hilkka, T. Tuure, and M. Rossi, "Is extreme programming just old wine in new bottles: A comparison of two cases," *J. Database Manag.*, vol. 16, no. 4, p. 41 (2005).

[14] F. Q. B. da Silva, A. C. C. França, M. Suassuna, L. M. de Sousa Mariz, I. Rossiley, R. C. de Miranda, T. B. Gouveia, C. V. Monteiro, E. Lucena, E. S. Cardozo, and E. Espindola, "Team building criteria in software projects: A mix-method replicated study". *Information and Software Technology*, vol. 55, no. 7, pp. 1316–1340 (2013).

[15] F. Paetsch, A. Eberlein, and F. Maurer, "Requirements engineering and agile software development," in Enabling Technologies: Infrastructure for Collaborative Enterprises, 2003. WET ICE 2003. Proceedings. Twelfth IEEE International Workshops on, pp. 308–313 (2003).

[16] M. Alqudah and R. Razali, "A review of scaling agile methods in large software development," *Int. J. Adv. Sci. Eng. Inf. Technol.*, vol. 6, no. 6 (2016).

[17] M. Alqudah and R. Razali, "A comparison of scrum and Kanban for identifying their selection factors," in Electrical Engineering and Informatics (ICEEI), 6th International Conference on, pp. 1–6 (2017).

[18] K. Almajed, W. Medhat and T. El-Shishtawy, "An Iterative Hybrid Agile Methodology for Developing Archiving Systems". *International Journal of Software Engineering & Applications* (IJSEA), vol. 10 no. 1 (2019).