Decoding Difficulties in Implementing Agile Principles

Dan Mircea Suciu
Babes-Bolyai University
dan.suciu@ubbcluj.ro

Simona Motogna
Babes-Bolyai University
simona.motogna@ubbcluj.ro

Manuela Petrescu
Babes-Bolyai University
manuela.petrescu@ubbcluj.ro

Alexandru Roja
Babes-Bolyai University
alexandru.roja@ubbcluj.ro

***Abstract*—Agile adoption hinges on adherence to the Agile Manifesto's values and principles, which are interdependent and variably challenging for Agile teams. This exploratory study enhances understanding of these challenges, their causes, and mitigation strategies through thematic and quantitative analysis of survey responses. We found that *Welcome changing requirements* is the most difficult principle to implement, with diverse causes categorized into seven areas. Solutions primarily involve project and process adjustments and improved customer communication.**

***Index Terms*—Agile Software Development, Agile Principles, Empirical study**

I. Introduction

The adoption of an Agile mindset is critical in today's dynamic software development industry for maintaining competitiveness and meeting customer needs. Agile strategies emphasize flexibility, teamwork, and continuous improvement. However, transitioning to an Agile mindset poses significant challenges.

Hohl et al. in [1] differentiate between "doing Agile" (implementing practices) and "being Agile" (embracing a mindset). Our study investigates the latter, focusing on the challenges of adopting an Agile approach by surveying software development practitioners in Agile environments.

The study aims to identify the perceived issues in establishing an Agile mindset and adhering to the Agile Manifesto principles. We conducted a survey and applied thematic analysis to examine the data qualitatively. Our questions targeted the core principles of agility as defined by the Agile Manifesto [2]. We use shorten names and numbers of the principles as presented in the Manifesto.

Our findings reveal that welcoming changing requirements (Principle 2) is the most challenging for practitioners. Various factors, including motivation, mindset, and customer connection, contribute to these difficulties. Mitigation strategies involve process adjustments and enhanced customer communication.

II. Related work

The Agile related research literature considers the 12 principles of the Agile Manifesto to be equally important and forming a cohesive entity [1], [3]–[5]. The way these principles are adapted and applied at the team level is a relevant contributor to the overall organizational embracement of Agile methodology, as several studies have concluded [6]–[8].

One approach is presented in [9], where a sample of 326 individuals were tasked with evaluating the importance of each of the 12 principles. The outcome indicated that 11 of the principles obtained an average rating exceeding 4.1, while one principle received an average rating of 3.8, thus affirming the idea that there are no significant disparities.

The level of Agile adoption is evaluated in [4] across five categories: software development, team, management approach, reflective, and culture-related practices. Each team and business adopts Agile uniquely, and these categories can guide Agile transitions.

Relevant studies include [10], which explores integrating new employees into Agile teams, [11], which examines transitioning from non-Agile to Agile methods, and [12], which forecasts Agile Progress Management's future.

Adopting Agile principles at the team or organizational level is time-consuming and challenging. Our study highlights the most difficult aspects of this process, providing insights that can accelerate Agile adoption.

III. Design and methodology of the study

We aim an exploratory study, seeking insights into Agile practices implementation, and observing patterns, based on practitioners opinions. We chose a mixed quantitative and qualitative analysis. Data wasccollected through a survey investigating perceptions of Agile practices (detailed in Section III-B).

The study was designed according to existing good practices [13], [14] for qualitative surveys, as it is based on data collected from open-ended questions and qualitative analysis was applied to collected responses.

A. Research Questions

The objective of our study is to *"Investigate the perceived challenges for the purpose of fostering an Agile mindset with respect to the adherence to Agile Manifesto principles from*

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TABLE I: Survey Questions

No	Question Name	Type
Q1	Do you work using Agile methodologies?	Yes/No
Q2	What is your current role in Agile team?	Open text
Q3	How many years do you have in the current role?	Single choice
Q4	How many years of professional experience do you have in general?	Single choice
Q5	How large is the current project team (number of members)?	Open text
Q6	Which Agile methodology do you use?	Open text
Q7	Which Agile principle do you consider the most difficult to implement?	Single choice
Q8	In your opinion, which are the most important reasons why it was difficult to implement?	Open text
Q9	If the situation was improved, which mitigation actions were performed?	Open text
Q10	From your experience, what other mitigation actions can be applied?	Open text

the perspective of practitioners within the context of software development teams.", considered in a goal question metric approach [15]. We follow this goal through the following research questions:

RQ1: *Which is considered the most difficult Agile principle to implement?*

RQ2: *Which are the causes associated with the difficulty of Agile principles implementation?*

RQ3: *Are there any mitigation strategies to overcome Agile principles implementation difficulties?*

B. Survey design and data collection

To conduct our exploratory study, we chose the survey as method of investigation [16]. It aims to describe and explain the perceptions of practitioners based on open-ended responses. The questions are presented in Table I. The closed-ended questions mostly targeted demographic information about respondents, while open-ended questions were used as instruments to capture personal experience and perception about the investigated topic. The survey was intended to professional developers with relevant experience in the fields of Agile methods and software development, so we inserted a specific question for this aspect and did not take into account the negative responses.The survey was self-administered, and conducted online using a digital platform.

We collected 55 valid responses, diverse in terms of the roles performed and experience. A replication package https://figshare.com/s/b9fb757d1d597e9befad has been created with the collected responses.

C. Methodology

We used thematic analysis as a method to perform qualitative investigation of the data, represented by a set of texts as survey responses. study is the flexibility in qualitative research and diversity in pathways to identify the right answers to the research questions. We followed the guidelines described in [17]. Phase 1 – search in text for keywords that we then refined and unified into codes. Phase 2 – themes identification and themes refinement from codes. We used structural coding to organize codes into logical grouping of the themes and content coding to extract the meaning from the text. Our approach was inductive to understand and to map the emerging themes. Phase 3 – identify patterns and understand the meaning.

These themes allowed us to identify and provide the responses corresponding to the research questions. Thus, we captured the meanings of the responses in order to build the themes to be analyzed and discussed in correlation with research questions. Our approach was to use the "experiential" and "critical" orientation. The experiential orientation focus on what respondents think, feel and do, with respect to Agile Manifesto The critical orientation determined the dominant patterns of meaning. The study was carried out by the whole team according to good practices [14], with roles of performing, respectively verification and final discussion of the whole team until consensus.

IV. Results

A. Study of the difficulty in principle implementation

In order to respond to RQ1: *Which is considered the most difficult Agile principle to implement?*, we investigated whether participants' opinions on the most difficult principle to implement could be influenced by their overall work experience, the methodology used, and the roles they play in their teams. As a result, the perceptions of the problems they encounter are not similar.

In terms of perceptions related to **the most difficult principle to implement**, the largest group (34.5%) of the set of participants appreciated that principle 2: *Welcome changing requirements*, was the most difficult. Other principles that posed difficulties were principle 1: *Satisfy the customer*(15.5%) and principle 4: *Working together*(12.1%), while the other principles scored less than 10%. as summarized inFigure 1.

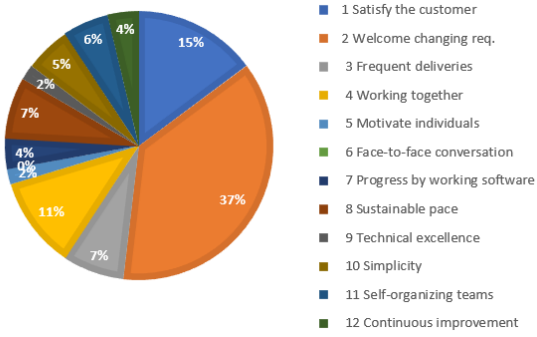

Fig. 1: Most difficult principle to implement

In terms of the principle **most difficult to implement**, we took into account only participants who have working experience in one of the existing Agile frameworks. The predominant methodologies listed were Scrum and Kanban. However, other methodologies less commonly used were mentioned: SaFE, Less, Extreme Programming, and ScrumBan for example.

We classified the responses as due to exposure to one methodology (Scrum or Kanban) or more than one. For each

type of methodology, we analyzed the perception of the most difficult principle and summarized it in Figure 2 a). The second principle: *Welcome changing requirements* appears to have the highest occurrence in all cases.

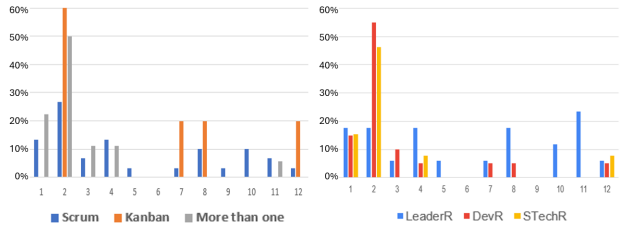

Fig. 2: Most difficult principle to implement nominated by Agile methodology (a) and roles in the team (b)

In terms of **roles**, the participants responded that they fulfill one or multiple roles. We classified the roles as follows: *Leadership roles (LeaderR)*: Agile Coach, Scrum Master, Product Owner, Technical Manager; *Development roles (DevR)*: Developer, Software Developer with less than 10 years experience, tester and *Senior Technical roles (STechR)*: Solution Architect, Technical Architect, Team Leads and Developers with more than 10 years experience.

Principle 2: *Welcome changing requirements* is considered difficult to implement by development roles, regardless of the level of experience, the roles that, in fact, must carry out the implementation effort. In these categories, the second principle exceeds by far all the difficulties raised by the other principles, as can be seen in Figure 2 b).

In conclusion, the largest majority of participants, regardless of their experience or role in the team, considered that the second principle is the most difficult to implement. However, the role in the team influenced the perception of the second and third difficult-to-implement principles.

B. Causes

Application of thematic analysis to responses to Q8 from Table I and summarizes responses to RQ2: *Which are the causes associated with the difficulty of Agile principles implementation?* We identified seven themes, detailed in this section.

Customer: It covers issues related to customer values, views, or availability. Differences between customers and the Agile team can impact Agile principles implementation, such as goals, availability, and business language barriers. These types of issues are mostly associated with principles 2: *Welcoming changing requirements* and principle 4: *Working together* in responses.

Motivational: It groups codes related to personal feelings, motivation, and mindset, directly impacting team motivation. Resilience to change indicates team members' mindset. Participants' emotions affect teamwork and client relationships. Motivational themes are mostly linked to principle 2: *Welcoming changing requirements* and principle 10: *Simplicity* in survey responses.

Software Quality: It clusters aspects related to quality. In some cases, code quality has an impact on implementing Agile principles, while in other cases product quality is mentioned. Software quality theme is mostly associated with principle 1: *Satisfy the customer*.

Resources: It encompasses time, cost and human resources. The implementation of Agile principles might be affected by time restrictions or by working effort or size of the team. This theme is prevalent in principle 2: *Welcome changing requirements*.

Teamwork: It covers various aspects of teamwork. Variations in team experience or productivity impact Agile principles implementation. The prevalence is scattered across several principles, reflecting a cause that impacts overall achievement rather than a specific principle.

Requirements: Even if requirements are the focus of the second principle, our thematic analysis has revealed that issues related to requirements represent causes of difficulties in implementing other principles, especially in principle 4: *Working together*, as respondents mentioned.

Process: With the lowest prevalence of causes, it groups aspects that affect development processes, and were briefly mentioned in regards to some principles. Once more, this is a cause that does not seem to have an impact on a specific principle, but as an overall impediment.

C. Mitigation suggestions

We suggest mitigation recommendations (answering RQ3) to reduce difficulties in implementing Agile principles based on thematic analysis of Q9 and Q10 responses (see Table II). Of 55 respondents, 39 mentioned mitigation strategies, 4 reported no improvement, and 49 noted other past actions. The rest did not answer. Thematic analysis detected five themes: process/project work (44%), customer communication (25%), mindset (19%), technical practices (7%), and team communication (5%).

Process/Project work: It groups different improvements that address processes, including Agile ceremonies, and work on the project. Most of the suggestions provided by the practitioners refer to this theme and indicates: better project organization , improvement of Agile ceremonies or estimations This theme is mostly associated with principle 2: *Welcoming changing requirements*.

Customer communication: Communication dynamics in an Agile context can be divided into intra-team cooperation and external customer interaction. This distinction led to two themes: customer communication, discussed here, and team communication, covered later.

In several cases, practitioners stated that improving various aspects of customer interaction improved the implementation of Agile principles. Cases refer to: customer communication in general customer needs and requirements and feedback.

The prevalence of this theme is connected to principles 1: *Satisfy the customer* and 2: *Welcome changing requirements* and is almost staggering in principle 4: *Working together*.

TABLE II: Main causes and mitigations for Agile principles

Principle	Main causes	Suggested mitigations
1	software quality	technical practices
2	customer, motivational, resources	process/project work, customer communication
4	customer, requirements	-
10	motivational	mindset
11	-	technical practices
12	-	mindset

Mindset: Refers to openness to collaboration and change at individual level and of the whole team. This category of mitigation actions is mostly suggested for principles 10: *Simplicity* and 12: *Continuous improvement*.

Technical practices: It refers to the situations in which Agile implementation was improved by considering software development actions.This type of mitigation was suggested in connection with principles 1: *Satisfy the customer* and 11: *Self-organizing teams*.

Team communication: In some cases (few compared with the other) and in connection with several principles, communication and collaboration within the team contribute to the improvement of Agile implementation.

In summary, five categories of solutions have been identified to facilitate the seamless adoption of Agile principles. Most of the respondents focus their attention on Process/project-oriented solutions, targeting specific tools or practices.

V. Discussion

Using thematic analysis and quantitative and qualitative research on 55 practitioners' survey responses, our findings are in Table II. We learned that principle 2: *Welcome changing requirements* is considered the most difficult principle to implement by 38% of the respondents, followed at a considerable distance by principle 1: *Satisfy the customer* and principle 4: *Working together*.

Our discussion focuses on the most challenging Agile principle to implement, identifying primary causes and mitigation strategies. We also examine how these insights affect practitioners' and researchers' evaluations of Agile adoption.

Change is hard for everyone. In our survey, participants, regardless of the Agile framework used, identified principle 2: *Welcome changing requirements* as the most challenging to implement. This universal difficulty highlights the inherent challenge of change in Agile development, which often pushes individuals out of their comfort zones and requires adaptation. Our findings align with typical organizational change challenges, marked by resistance due to various factors [18]–[22].

The role within the team also affects perceptions. Leaders, besides principle 2, find principles related to *self-organizing teams* (principle 11) and *satisfying and communicating with the customer* (principles 1, 4) particularly difficult. This suggests complexities in fostering self-organizing teams and maintaining effective customer communication, possibly due to necessary shifts in leadership styles or organizational culture.

Knowledge is not understanding. Our analysis indicates that despite the inherent need for adaptability in software projects, Agile frameworks do not necessarily make change more appealing. We identified seven main challenges in implementing Agile principles. Notably, adopting Agile in practice often leads to frustration and stress, primarily due to customer pressures. For less experienced engineers, motivation and mindset are frequent issues, alongside resource management challenges. As experience increases, difficulties tend to arise more from customer-related issues, such as communication and differing values.

Continuous improvement. Most respondents favored solutions related to **process/project work**. Practical experience often leads to recognizing effective, pragmatic solutions that have been tested in similar contexts. The **customer communication** category highlights the importance of principle four of the Agile Manifesto, emphasizing regular, direct cooperation between development teams and clients. Effective implementation of this principle facilitates the application of other Agile principles. Some suggestions fell under the **mindset** category, noting that Agile practices alone are insufficient without a corresponding Agile mindset. Challenges discussed include corporate context, management, values, leadership styles, team collaboration, and project complexity. Professionals' responses were closely tied to their roles.

Addressing these challenges through interventions, communication, and leadership support can ease Agile transformations. Emphasizing Agile principles and targeted training can reduce resistance and foster an Agile-ready culture. Future research should explore the factors contributing to Agile challenges and their impact on project outcomes and company adaptability, enhancing Agile methodologies in software development.

VI. Threats to validity

We adhered to established guidelines [13] and recommendation [23], therefore, we decided to consider three key aspects: construct validity, internal validity, and external validity.

For the **validity of the construction**,we assessed question relevance, pertinence, and coherence. We developed questions in three phases: proposing initial questions, collectively clarifying and refining them, and selecting a subset for the survey. Finally, we validated the questions with feedback from two external Agile team members, leading to modification of one question based on their input.

For **internal validity**, we identified potential threats including participant selection criteria, dropout rates, and author biases. To mitigate participant selection issues, we included individuals with Agile knowledge and experience in Agile roles. Author biases were minimized by adhering to recommended data processing protocols and following specified steps during text analysis.

Considering **external validity**, our study is an experience report and does not aim to provide a comprehensive view of the global IT domain, so we refrained from generalizing our findings.

VII. Conclusions and future work

We conducted an exploratory study to understand difficulties in implementing Agile principles, using thematic analysis and quantitative methods on survey responses from professionals. Principle 2: *Welcoming changing requirements* emerged as the most challenging for all practitioners, irrespective of their roles and Agile frameworks.

Our findings indicate that personal issues such as motivation and mindset, along with customer interaction, are common difficulties across all experience levels. Mitigation strategies focus on process improvements and better customer communication. These insights are valuable for Agile practitioners aiming to refine processes and enhance customer-Agile team interactions. For the research community, the study provides empirical evidence on Agile principles, addressing the need for such research.

Challenges primarily stem from organizational contexts. Future research should analyze both organizational settings and Agile team dynamics to support the implementation of Agile principles.

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