

Agile Methodology :A Study On The Use Of Agile Methodology In Managing Software Development Projects

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Abstract: Agile Project Management has become a critical methodology for project delivery into a rapidly changing environment. This research paper covers the basics of Agile, its core principles, methodologies, and benefits, explores the historical context, compares Agile to traditional management, and covers its impact on the overall project landscape. At the same time, this paper defines a few potential problems that may arise during Agile implementation and suggests potential solutions and ways to alleviate possible negative consequences. The paper covers all the essential aspects of the topic and is not limited to the established Agile frameworks since several others exist, such as SAFe or Lean Startup. The centralized issue behind Agile is the increased efficiency, higher business satisfaction, faster time-to-market, and increased power and adaptability of the workforce. While the future of Agile seems nothing but bright, the landscape is not devoid of challenges. The paper has also highlighted potential problems, such as change resistance, scoping, and unsteadiness in requirements, as well as the need for alternative success metrics. The last topic is the potential influence of the discovered problem/aspect and what can be advised to concentrate on further. Based on the past failures and positive corrections, the teams have the potential for full success.

Keywords: Agile Project Management, Kanban, SAFe, Lean Startup, Agile metrics

Introduction

The modern business environment is a continuous maelstrom of change. Customer expectations change quickly, new technologies appear with shocking speed, and the market vine swings to and fro. More classic project management methodologies based on a rigid linear strategy struggle to keep up with the pace of change. Agile project management addresses this need by emphasizing flexibility, teamwork, and rapid adaptation.

The Agile method relies on iteration – all projects are divided into smaller units known as sprints. Each sprint produces a working chunk of the product. Thus, with each iteration, the customer receives feedback and real-world results, which guarantees said experiment's high efficiency. This radical approach, updated to novel demand and more frequent modifications of every sector and market, uses a more iterative approach. Scratch that – instead of iterative approach, Agile is animated by a set of central values that stimulate an endless cycle of improvement and value delivery. Customers are no longer some remote people that ordered the service – they have become key Involved parties providing daily input through constructive focus. Agile teams are cross-functional and self-determined, resulting in a high level of independence and inclusion of diverse human resources of each character.

This paper has provided insight into the nature of Agile project management. This paper has analyzed the underlying principles of the philosophy and the various Agile frameworks that enable these principles to work before examining the effect of Agile practices on success. By imparting project managers and teams with an understanding of Agile's underlying principles and practical applications, it enables them to respond to the unpredictable nature of business with the power to adapt and remain focused on delivering value-filled solutions.

Literature Review

Agile project management has become the dominant project delivery framework, especially in the software development sector. This paper reviews the literature on APM by delving into its meaning, principles, methodologies, strengths, and method of implementing it.

A. Core Principles and Historical Context

APM is based on the Agile Manifesto, born in 2001 at the hands of a group of software developers [1]. The Agile Manifesto prioritizes four central main values. These include individuals and interactions over processes and tools, working software over comprehensive documentation, customer collaboration over contract negotiation, and responding to change over following a plan. These values differ greatly from traditional, waterfall-driven project management styles, which entailed a stiff, set approach [2].

Methodologies and Frameworks

Over the years, different agile methodologies have been created, which have their peculiarities and applications. Scrum is an easy-to-adapt framework working on sprints that last for a specific period, usually from two to four weeks, and follow different roles, which include Product Owner, Scrum Master, and Development Team [3]. Alternately, Kanban applies a visual approach with the free and constant working process through several stages [4-5]. Thus, both methodologies propose the opportunity to develop with consideration to the continually adjusting requirements and fluctuations in market demands [6].

Benefits and Impact

The literature highlights numerous benefits associated with APM. Studies suggest that agile practices can lead to increased efficiency, enhanced customer satisfaction, improved flexibility, boosted team morale, and faster time to market [7-8]. Research by Bergmann and Karwowski,(2019) [9] do indicates that APM can contribute to project success, especially in software development projects. However, the effectiveness of APM might vary depending on project type and organizational context [10].

Challenges and Best Practices

Using agile methods is not always easy and comes with its own challenges.. In this, Shifting from traditional, command and control structures to self-organizing teams do require a cultural shift within the organization [7]. Resistance to change from stakeholders accustomed to waterfall methodologies can also be a hurdle [11] as they get comfortable with already established processes. Effective management to control scope creep and the development of appropriate measurement and tracking systems, to control it, are crucial for successful agile adoption [7]. Leadership buy-in accompanying with fostering a culture of collaboration and ongoing training to workers can support a smooth transition to an agile environment [8].

Research Gap

While the current review looks into core principles, methodologies, benefits, and challenges of APM, it primarily focuses on the software development domain. There is a lack of exploration of how APM is adapted and implemented in other domains of projects, such as

construction, marketing, or HR. Although Scrum and Kanban were identified as popular methodologies in the review, the Agile landscape keeps on evolving.

Research Objectives

The present study has the following objectives:

- To understand the agile project management and its benefits.
- To identify the challenges associated with implementing Agile practices and what could be the best practices for overcoming them.

Research Methodology

The essence of the subject matter of the study calls for research using secondary data. Peer-reviewed, journals, published in reputable databases like ScienceDirect, JSTOR, and EBSCOhost are the primary sources.

Analysis

Historical Background

- Agile methodologies did make their ways in the late twentieth century, more specifically in software development. The traditional, waterfall-based way of managing projects resulted in overrunning of budget estimates, with very less customer involvement. By finding these deficiencies, there came a need to develop a more flexible approach to handle the glitches. The Agile Manifesto, published in 2001, formalized these principles, underscoring:

- **People Power over Process Pedantry:** Agile prioritizes the value of individuals and their interactions over rigid processes and meticulously crafted tools. This also includes taking suggestion from people who are directly involved in activity rather than being inflexible and following process instruction without editing. This means fostering collaboration, open communication, and empowering teams to make decisions, not just follow prescribed steps.
- **Working Software, Not Wallpaper Documentation:** the era of considering documentation volume over the actual software has ended. Agile values continue integration of working software transferring into the product in small parts at several occasions. Thus, it allows keeping the result up-to-date and economical in manufacturer's perception.
- **Customer Collaboration, Not Contract Confinement:** Agile demands to place the customer at the centre of the development process. Therefore, new collaboration levels are introduced. One of the fundamentals for the software development concept to work is continuous collaboration with the customer. The contract is merely one of the documents which help maintain it but is never considered to constrain.
- **Embracing Change, Not Escaping It:** the reality is that world of business remains quite unpredictable and customer requests may vary fast. Agile openly invites change and realizes that adjustments are an inevitable part of the process.

The creation of the Agile Manifesto sparked a revolution in software development, under which management of projects by organizations became more flexible and did deliver superb results. The Agile philosophy continues to guide many project management practices. Apart from this, it is enabling them to adjust quickly to rapid changes in project environments.

Core Values and Principles of Agile

Agile methodologies should not be considered just as a set of tools or techniques but they are, in a way, different way of thinking about a project. This outlook is based on a set of values and principles that do underpin entire project execution and decision-making at every level. The core principles upon which Agile was built are the following:

- **Embrace the Iterative Dance:** day are gone in which the entire project needed to be done and result of the entire project will be submitted in one shot. As per the agile approach, the entire project will be divided into smaller time phases instead of a single total timeline. On an average, the average time of time phrases

suppose to be of two to three weeks. In each duration some predefined activities are required to be completed and the overall result of that duration will be shared to reviewers. They will provide continuous feedback and feedback also could manipulate objectives if required.

- **Agile in a continuous never ending journey:** Agile is just like a road, not a destination that could be achieved by putting efforts. It is a journey of continuous learning and improvement. Therefore, the process has been designed in such a way that it includes feedback mechanisms at every level of the project. This ensures valuable insights from customers, stakeholders and even the developing team throughout the process. This results in solving of problems before even they actually becomes a problem.

- **Customer, The Star of the Show:** Traditional project management tools treat customers as a lower priority. Agile corrects this mistake by putting customers into the project at every step. Project managers are expected to work closely with customers from the very beginning. This means that, as needs and expectations evolve, projects are developed to ensure that we give the customer everything they require. It also includes regularly presenting working progress to the customer to provide early and continuous feedback.

- **Empowered Teams, Owning Their Success:** Owning Their Success: Self-organization can be difficult for those who have spent a lifetime in hierarchical structures. It is complicated by Agile methodology, which ensures teams are made up of individual with artificially different skills. As a manager, you have to learn to let go of almost all the control because you empower the team. Instead of only being responsible for the output, the one with the most experience on the team decides almost everything, which increases motivation and accountability.

Flexibility, The Agile Advantage in a Changing World: The dynamism of the business world is a constant change. Technologies are ever evolving customer preference shift and new challenges arise at every corner. While most methodologies struggle with this change, Agile welcomes it by promoting flexibility. The project can adapt to new information and requirements along the way, making it highly likely that the project will stay relevant while changing.

Contrasting Agile with Traditional Project Management

Project management has undergone a series of significant changes in recent years. Waterfall and more dynamic Agile approaches represent the leading project management systems . As noted by Antonova and Melnik , the leading distinctions are as follows:

1) *The Waterfall, A Structured Cascade:* The first methodology is called traditional project management, and it resembles a waterfall due to its linear, sequential nature:

- *Upfront Planning:* A highly detailed list of requirements is drawn at the beginning of the project. This exhaustive planning allows for as few surprises along the way as possible.

- *Phased Approach:* The project goes through several distinctive phases, such as design, development, testing, deployment. Transition from one stage to another is contingent on the completion of the previous one.

- *Limited Flexibility:* Changes in the project's requirements beyond the initial planning phase are not encouraged or are prohibitively expensive. This is done to maintain the budget of the project and avoid scope creep.

- *Focus on Documentation:* Various extensive documentation acts as a guideline for the project. It has both requirements and a paper blueprint of them.

2) *Agile, Embracing Change and Iteration:* In stark opposition to predicted waterfall project management emphasizes adaptability and constant iteration. The key features are:

- *Iterative Development*: Projects are subdivided into manageable segments known as sprints, which last around 2-4 weeks. They are focused on developing a critical section of the final product.
 - *Continuous Feedback*: Consumer and stakeholder reviews are not saved until the end – they shape the project’s development at every stage. This ensures that the project can act on new knowledge and make required modifications.
 - *Empowered Teams*: The project team must be competent to run as a voluntary exclusive body with as few or as many decisions as practicable within the constraints. All team members feel responsible and accountable.
 - *Adaptability*: More wishes or shifting targets can be handled in forthcoming sprints to keep the project relevant and on the correct path.
- 3) *Choosing the Right Approach*: The best approach to project management varies with the nature of the project and organizational culture.
- 4) • Waterfall may be applied to: clearly defined projects for which all the requirements are known at the outset, projects that carry little risk of change, and projects that demand heavy documentation and compliance.
- 5) • Agile shines in the following types of projects: projects with evolving requirements, projects requiring rapid feedback and iteration, and projects where innovation and adaptability are crucial. *Summarized differences between ‘traditional project management’ and ‘agile project management’ are presented here under :*

TABLE I. **differentiating ‘traditional project management’ and ‘agile project MANAGEMENT’**

<i>Feature</i>	<i>Traditional Project Management</i>	<i>Agile Project Management</i>
Approach	Sequential, linear	Iterative, incremental
Requirements	Defined upfront, fixed	Evolving, adaptable
Customer Involvement	Limited	Continuous collaboration
Team Structure	Hierarchical	Self-organizing, cross-functional
Change Management	Difficult, costly	Embraced and incorporated

- 6) *Popular Agile Frameworks*: Several Agile frameworks have been developed and applied worldwide, each bearing different characteristics and features. Despite that all of them were designed to provide the team with more flexibility and reactivity, their core difference

generally consists of the supporting structure and the flow of existing work. In this regard, mentioning two of the most well-known Agile frameworks would be Scrum and Kanban. This paper will discuss these two frameworks, showing the differences between them and defining the best scope of application in each of these cases.

7) **Scrum, Embracing Fixed Sprints for Focused Delivery:** Scrum is a structured framework best suited for projects with well-defined requirements or scenarios where requirements can change but in a known structure with time. This framework features fixed-length sprints, often lasting 2-4 weeks. Every sprint, the team is committed to delivering a predefined set of user stories, which refer to parts of features or functions valuable to the end user. Major Features of Scrum includes the following:

1. *Sprint Cycles:* Scrum is built around sprints, which defines one measure of time and relays a sense of urgency and focus in this time. Each sprint begins with sprint planning to collectively define what user stories will be finished.

2. *Dedicated Roles:* It also introduces three primary roles: the Product Owner, responsible for prioritizing the product backlog ; and the Development team, accountable for delivering the sprint work; and the Scrum Master, who facilitates the application and ensures the team honors it.

3. *Ceremonies:* Scrum also introduced various regular meetings to retain transparency and communication. For instance, a daily stand-up provides a quick status update, sprint planning and review meetings define and assess sprint goals, and retrospectives ensure improvement.

a) *Ideal Application of Scrum:* Scrum is a good fit for projects with defined yet changing needs that can be adapted in each sprint cycle. It thrives in an environment of software development and product formation, where regular releases and user input are essential.

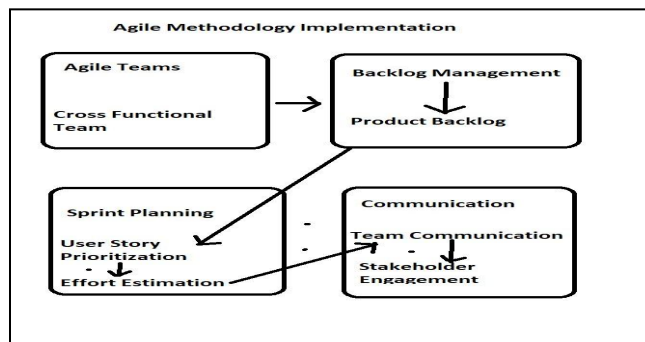


Fig. 1 Agile Method

8) *Kanban, A Continuous Flow for Unpredictable Work:* There have been several Agile frameworks that have been developed, and each has unique defining features a Key Features of Kanban . Scrum, for instance, is a very constrained frame ideal for projects with well-specified requirements or those can change given time criteria. The Scrum

frame employs sprints of set length, usually 2-4 weeks . During each sprint, the teams pledge themselves to delivering a user story set. User stories are the deliverable features or functionalities that add value to the end-user. As identified by Toyer , the Key Features of Scrum are:

a) *Visual Workflow Management:* The Kanban board provides a visual portrayal of workflow status. It is possible to determine a bottleneck and ideal the workflow.

b) *Focus on Work in Progress (WIP) Limits:* Kanban stresses WIP boundaries, avoiding multitasking to reduce overload and ensuring that work is completed uninterrupted before the beginning of new tasks.

c) *Continuous Improvement:* This is the most crucial approach of Kanban, and essential Geertz states that teams can constantly improve flow and process efficacy.

d) *Ideal Application of Kanban:* Kanban is best employed in situations with current, unpredictable work streams. It is suited to sustaining and supporting activities, multimedia campaigns with altering priorities, or activities when requirements regularly change.

Implementing Agile Methodologies: Agile methods promise a trajectory and an adaptable approach to the project. An adequate strategy supported by a well-designed plan is also needed for successful modelling.

9) *cultural shifts within the organization:* However, some key considerations can help lay the groundwork for setting up the environment for a thriving Agile model. They include::

a) *Forming Cross-Functional Teams:* Agile relies on the concept of cross-functional teams. In siloed departments and units, Agile falls to the ground. Agile's core lies within the cross-functional group's formulation. It enables them to combine their skills to tackle user problems and enhance ownership and autonomy. An Agile team will typically contain developers, designers, testers, and customer consultants. The teams enable them to gather the necessary

b) knowledge to finalize the projects from the beginning to the end. It also leads to increased testing cycles hence eliciting high-quality products. A team-based structure ensure faster development cycles hence gaining competitive advantage over competitors.

c) *Mastering the Backlog, A Roadmap for Development:* This organized list comprising features and functionalities is the Back Log. It is a flowchart for all endeavors that take place within an Agile setting. It contains user stories, which are brief and brief definitions of the functionalities of the end-user . The user story is refined and enhanced depending on client reviews and priority. By managing the backlogs, one ensures the team is working on the current topic. A project-based approach at the beginning of the need is crucial since the outcomes are witnessed along the way. Successful individuals then move to a project-centered mindfulness phase. It is advisable to enhance the increase in the project of empowerment and autonomy. Hence firms need to review their backlogs regularly to retrieve useful information.

d) *Prioritization and Estimation, Setting the Stage for Each Sprint, A Roadmap for Development:* Unsurprisingly, different user stories have varying levels of importance and value. Prioritization becomes crucial in an Agile context. Techniques such as user story mapping and cost-of-delay are used to select the best ones to work on first. Once prioritized, effort estimation also plays a big role. This tool is used within sprints to estimate how much time and effort it will take to implement each user story . Techniques such as relative sizing, planning poker, foster discussion, and commitment among workers. It, in turn, helps establish realistic expectations for the sprint..

e) *Communication – The Cornerstone of Agile Success:* Even in Agile, which is all about speed and dynamism, clear and consistent communication is key. Advanced communication allows not only team members but also stakeholders and clients to work closely together. Regular meetings like daily stand-ups or huddles foster transparency, supporting everyone up to date on progress, problems, and dependencies . And open communication with a customer ensures that the project remains aligned with the customer's needs and expectations. By focusing on these two factors, developing organizations can secure a strong Jackrabbit and start rapidly moving up the Agile maturity curve. Strong cross-functional teams, a prioritized backlog, and open communication with the customer will allow them to deliver value frequently and effectively act on change

10) *Benefits of Agile Project Management:* Traditional project management paradigms can seem rigid and constrictive in today's world of constant change. Agile project management , which values flexibility and continuous learning, is a refreshing approach in the modern era.

Benefits of the Agile project management methodology outweigh traditional project management, as follows:

1. *Enhanced Efficiency and Streamlined Delivery*: Agile implementations are more efficient and deliver a more simplified project. Agile methodologies break projects into scrutinized, focused, and iterative sprints. Teams work in shorter cycles to deliver working functionalities, reducing waste and redundancy. Working in short cycles allows for an early detection and fix of an issue before it becomes a rework and repetition chance later in the project life cycle.
2. *Boosted Customer Satisfaction*: No more will a customer be unveiled after the project is done, and they realize it is not what they ordered. Agile values customer collaboration from the project's beginning to end. Feedback is frequently taken to ensure projects become what the customer needs in the evolving market.
3. *Unlocking Innovation and Embracing Change*: Agile is made to embrace change, and no opportunity comes its way or new technology to be ruled out. Agile projects value the emerging technology and market change to embrace the latest ideas causing a new project. It allows the team to conceive several ideas for projects in the future and has the courage to try them out.
4. *Empowering Teams and Boosting Morale*: Agile models encourage bottom to up approach in management, and members make decisions on a project as they can administer it. It creates a culture of accountability and friendship within them. It gives the team morale to participate in the project and create a positive working environment for themselves.
5. *Faster Time to Market and Early Wins*: Agile models are project-based and allow a product to hit the market faster than the traditional project method. Agile modules allow a product to reach the market fast and for the real market feedback to be obtained. With many participants available in the end-users, there is feedback to allow the introduction of another product if the other one does not meet the user standards..
6. *Improved Visibility and Enhanced Control*: Agile calls for daily meetings, having boards showing daily targets against achieved targets. The information gives control in the project, and more members make decisions, and they can change what will not work and add what is missing. The leadership team can also prioritize the project and adjust the working groups and add more problem-solving tools for them.

Agile Project Management Advantages

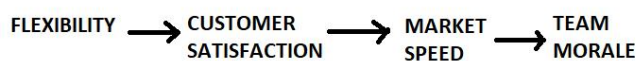


Fig. 2 Agile Project Management Benefits

11) *Challenges of Agile Project Management*: While Agile Project Management comes with many advantages, it is also associated with multiple challenges. Specifically, the fruitful implementation of agile practices requires the team to tackle the following issues.

1. *Navigating the Resistance Rapids*: One of the primary obstacles on the way to a fruitful implementation of agile practices is getting stakeholders, particularly those who find comfort in the predictability of the waterfall methodology, on board with the idea of an iterative and adaptive approach to a project; these people's managerial style is likely to be purist as well, which can make implementing an adaptive framework even more difficult.
2. *Scope Creep: A Looming Threat*: A Looming Threat: Agile projects can be especially susceptible to scope creep, as the ability to refine different requirements throughout the project allows for more possibilities of expanding the project; in the absence of proper control, the

team might find itself overwhelmed with project additions, which will lead to missed deadlines and quality issues.

3. *Taming the Requirement Rollercoaster*: In conclusion, installing pure agility in a project is the idea of frequent requirement updates, given that the main principle of Agile is constant adjustability and feedback; however, some requirements might be too volatile for proper processing, which will create a deadlock for several sprint weeks.

4. *Measuring Up in the Agile Maze*: A traditional project usually benefits from having strong metrics based on certain well-defined parameters, such as time, cost, and content. However, the iterative nature of agile methods can distribute the factors in such metrics unevenly, making measuring on traditional parameters complex: thus, projects need to develop additional metrics benefiting from values such as direct usefulness, volume of work, and microgoals for every sprint, count their value gains, and fulfill a massive communication with every involved stakeholder.

II. Discussion

The current study provides a comprehensive overview of Agile Project Management, comparing APM to traditional project management approaches and collecting core principles, popular frameworks, and benefits. The historical overview manages to trace the origins of Agile methodologies back to the mainstream attitudes toward project management within software development context. First and foremost, it should explore other project management areas where Agile approaches are becoming more common.

The most common Agile frameworks, Scrum and Kanban, are described in the body. The most common Agile frameworks are Scrum and Kanban, but the field is developing. agile the software development context shows the complex nature of the frameworks, but there are many other frameworks shaped to fit diverse projects. SAFe, for example, is designed for working with big, spread-out teams who work on complicated projects.

Next is Lean Startup, which is designed for teams that operate with an extreme level of uncertainty. This framework ensures that MVPs are developed and adjusted continuously on the user testable basis. The benefits of Agile highlighted in the paper also touch upon efficiency, customer satisfaction, and faster time-to-market.

Finally, this paper discusses Agile's several benefits and some risks. The rising number of unsuccessful Agile case studies may provide useful insights that could help avoid some basic mistakes mentioned. Understanding and foreseeing what could go wrong and providing counteraction for these risks promises the successful implementation of Agile and ensures overall superior project quality experience.

III. Findings

Three main findings explain that the Agile methodologies in project management are The flexible and adaptable systems of Agile frameworks compared to the traditional waterfall project management approach, the popular Agile frameworks for project management, and the expanding most Agile landscape as SAFe. The main Project management frameworks Scrum and Kanban applied for Agile approaches based on the specific sides of their use, The key principles of Agile project management serve as the acceleration and leverage of numerous factors that increase the efficiency during the project. The Adaptation within Agile regarding implementation and distribution among the employees has limitations such as resistance to change, scope creep and the nature of fluctuating requirements. Furthermore, alternative metrics are needed to determine the processes' success.

IV. Conclusion

The Agile Project Management has proven to be a compelling and flexible approach in navigating the complex and rapidly evolving field of project delivery. The exploration of its

core values, evolving landscape of Agile frameworks, potential challenges, etc. that has provided the reader with the necessary knowledge to make decisions in the area. However, being successful with Agile depends on much more than merely grasping the mechanics; considerably, it also rely on creating a culture of collaboration, promoting continuous improvement and maintaining the ability to adapt it. That being said, the topics mentioned earlier identified several key avenues for further inquiry. Therefore, further investigations should focus on industry-specific adaptations of Agile, innovative principles of emerging frameworks and the development of alternative indicators of success, relevant within the Agile paradigm.

In addition to that, analyses of cases in which Agile implementation comes out to be unsuccessful could help organizations learn from the mistakes of others, ultimately mitigating the risks of Agile adoption. With an eye to the rapidly changing business environment, Agile Project Management appears to be an instrumental approach to help organizations succeed in a dynamic world.

V. Research Limitations

Following are the limitations for the present study:

1. *Limited Scope*: the study is limited in scope as it is studied Agile in terms of software development. Special dive into industrially oriented modifications of the framework might be required.
2. *Emerging Frameworks*: There are potential additional frameworks within the discussed approaches, such as SAFe and Lean Startup to name some. The detailed analysis of the frameworks' functionality and its direct applicability is beyond the scope of the present study.
3. *Metrics for Agile*: The limitations of traditional project management metrics in Agile environments are highlighted in the study. However, the development of robust alternative metrics for measuring Agile success requires further investigation in the future studies.
4. *Focus on Benefits*: The paper principally focuses on the benefits of Agile. A more comprehensive analysis would definitely benefit by including a deeper exploration of potential drawbacks and limitations of Agile methodologies in specific contexts.

VI. Future Scope of Work

Considering the analysis conducted in the study and findings derived therein following future scope of research is identified:

Conduct in-depth studies on industry-specific Agile adaptations (e.g., Agile in marketing, construction, human resources).

Exploring the potential and application scenarios of emerging Agile frameworks like SAFe and Lean Startup.

Another aspect is to develop and validate alternative metrics for measuring success in Agile environments (e.g., team velocity, sprint completion rates, customer satisfaction surveys).

Analyze case studies of unsuccessful Agile implementations to identify common pitfalls and do need to develop strategies to mitigate risks.

It is also required to Explore the long-term sustainability of Agile practices in a constantly evolving business landscape.

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