

Agile Project Management Impacts Software Development Team Productivity

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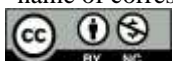
Abstract: The agile nature of the software development sector calls for flexible and effective project management techniques. Agile Project Management (APM) is emerging as a significant method that supports team cooperation, iterative improvement, and flexibility. This paper looks at how agile project management might affect software development team output. This study investigates the primary Agile methodologies Scrum and their impact on team productivity by means of a thorough literature review and empirical analysis. A mixed-methods approach employs qualitative comments and quantitative measures to provide a comprehensive view of output changes. We examine several software development teams inside a mid-sized technology company over 12 months using a case study approach, comparing productivity measures before and after Agile practices, including team satisfaction, development pace, and code quality. Furthermore, team member surveys and interviews offer an understanding of the supposed advantages and difficulties of switching to Agile approaches. Teams showing more efficiency, improved communication, and better morale point to a notable rise in productivity. Notable improvements included improved adaptability to shifting project needs and a shorter time-to-market for software products. This paper offers an insightful analysis of Agile Project Management's ability to revolutionize software development processes, helping companies trying to improve project results. This study has consequences for managers and practitioners because it provides valuable instructions for implementing Agile approaches to achieve the best team performance. Future directions of study will include investigating the long-term effects of Agile methods and their relevance in various organizational settings.

Keywords: Agile Project Management; Software Development Productivity; Scrum and Kanban; Team Collaboration; Development Efficiency

INTRODUCTION

Over the past few decades, the software development industry has experienced a substantial change due to the necessity for quick innovation and the ability to adjust to market fluctuations. Agile Project Management (APM) is a prominent and growing methodology in software project management (Hindarto, 2023b). APM, with its prioritization of adaptability, ongoing refinement, and enhanced team cooperation, provides a reassuring solution compared to conventional approaches like Waterfall. This methodology enables teams to promptly and effectively adapt to changes, which is crucial in a dynamic and ever-changing setting. Technology companies have widely embraced agile methods, such as Scrum and Kanban, to enhance productivity and the quality of their products. Scrum offers a framework that

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assists teams in managing intricate tasks by utilizing brief iterations known as sprints, whereas Kanban emphasizes the visualization of work and the management of workflow. Adopting these methodologies has been proven to enhance transparency, collaboration, and efficiency in software development. Furthermore, Agile methodology facilitates swift modification of project priorities in response to user feedback, leading to the development of products that are more aligned with market demands.

Despite the numerous advantages demonstrated by Agile Project Management, notable obstacles remain in its implementation that impact the efficiency of software development teams. An issue frequently faced is the team's ability to adjust to swift and ongoing modifications in the project. Moreover, the presence of ambiguity in both time and resource allocation frequently hinders teams from attaining optimal productivity. This study aims to investigate how the adoption of APM, specifically utilizing Scrum and Kanban methodologies, can effectively address these challenges and inspire a new level of team productivity. It is crucial to analyze this matter because the efficiency of software development teams directly influences the project's success and the company's competitiveness in the global market. When comparing Agile and Waterfall in the context of project management (Afarini & Hindarto, 2023), it becomes evident that traditional approaches are frequently rigid and resistant to change. On the other hand, Agile provides a more flexible and responsive solution. Companies can enhance their productivity by comprehending the precise influence of Agile Project Management (Hindarto, 2023a). This understanding enables them to incorporate appropriate best practices and steer clear of typical challenges when implementing this methodology. This research will not only offer valuable insights for project managers but also make a significant contribution to the academic literature on the efficacy of Agile methodologies in diverse organizational contexts.

Research by published in the journal Information and Software Technology, discusses the factors that influence psychological safety in software development teams using Agile methods (Alami et al., 2023). Exploring issues of story-based effort estimation in Agile Software Development (ASD) (Iqbal et al., 2024), published in the journal Science of Computer Programming, explored challenges in story-based effort estimation in Agile software development. Impact of project managers' emotional intelligence on megaprojects success through mediating role of human-related agile challenges: Project management as a moderator (Arslan et al., 2024), published in the journal Acta Psychologica, examined the effect of project managers' emotional intelligence on megaproject success through human-related agile challenges. Interpretative case studies on agile team productivity and management (Melo et al., 2013), published in the journal Information and Software Technology, conducted interpretative case studies on Agile team productivity and management..

This study addresses the literature gap on how Agile project management affects software development team productivity using Scrum and Kanban methods. Previous research has examined Agile psychological safety and effort estimation challenges, but this study will expand our understanding of how Agile affects team productivity (Hindarto et al., 2023). This study will measure productivity by measuring code quality, development speed, and team satisfaction before and after Agile implementation using quantitative and qualitative methods. The expected result is increased software development team efficiency and collaboration. This research provides project managers with practical advice on how to optimize Agile implementation for better results. It provides a comprehensive analysis that has not been widely discussed in previous research.

The main objective of this study is to evaluate the impact of implementing Agile Project Management, specifically Scrum and Kanban methods, on the productivity of software development teams. The research aims to identify critical factors that affect productivity in the context of Agile implementation and measure changes in team productivity through analysis of performance metrics such as code quality, development speed, and team satisfaction levels.

This research will contribute to the existing body of knowledge by providing a comprehensive evaluation of the impact of Agile Project Management on software development team productivity.

1. How does the implementation of Agile Project Management, precisely the Scrum method, affect the productivity of software development teams? (Research Question 1).

2. What are the key factors that affect team productivity in the context of applying Agile methods? (Research Question 2).

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LITERATURE REVIEW

This literature review examines Agile Project Management, specifically Scrum, in software development.

Agile Project Management has grown in popularity due to the technology industry's need for flexibility and adaptability. The research found that project managers' emotional intelligence affects mediating factors and social interactions in stressful work environments, making it crucial to CPEC project success (Arslan et al., 2024). The study found that Agile practitioners in Colombia prefer expert judgment-based estimation techniques but rarely analyze their accuracy (Cubillos et al., 2024). It suggested standardizing measurements, using datasets, accuracy measurement, and knowledge management to improve estimation accuracy. Agile methodologies, known for their adaptability, are suitable for small projects in various software industries but face communication challenges when applied to large, globally dispersed teams. This research explores the communication issues faced by such teams through in-depth interviews and quantitative analysis of 50 developers (Aziz et al., 2024). The findings showed significant communication deficiencies, which affected the development process. To address these issues, the research proposes an innovative software solution designed to improve the efficiency and effectiveness of Agile practices in large-scale, globally dispersed development. The study prioritized Agile practices and improvement goals in software development using the Analytic Hierarchy Process (AHP) method, involving four organizations and 40 professionals in Colombia. The results show that the AHP method is effective for prioritizing key elements that can be implemented incrementally while others can be considered in the future (Maturro et al., 2024). This research identifies and categorizes 90 problems associated with the downside of Agile software development methodology based on a literature review of 70 articles (Meckenstock, 2024). The results show that issues such as reduced developer welfare, product quality, and development productivity are some of the main problems, with customer misbehavior and delivery pressure as other significant causes. Many organizations are adopting Agile principles to increase value for their customers, including in the space industry. This article analyzes the experiences of 33 individuals from NASA's Agile team, provides findings and recommendations to support Agile transformation, and offers guidance for organizations that consider Agile risky and costly (Silva-martinez, 2024). The research found that team climate in Agile is influenced by team members' abilities and personality traits. Neuroticism had a negative correlation with team climate, while responsibility had a positive correlation, and the combination of these two factors explained 25.7% of the variation in team climate (Vishnubhotla & Mendes, 2024).

This research provides important insights into the various factors that influence team productivity in the context of Agile Project Management implementation. Although each study highlights different aspects, they all agree that communication, collaboration, management support, and training are crucial to Agile implementation. This literature provides a strong theoretical basis for further research on how the Scrum method, as one of the Agile approaches, can improve the productivity of software development teams.

METHOD

Agile Project Management methodology (Lalmi et al., 2021), (Wang, 2023), (Hayat et al., 2019), specifically the implementation of Scrum, is an iterative and incremental approach that focuses on flexibility, collaboration, and continuous improvement. The process begins with sprint planning, where the team determines the sprint backlog, which is a list of tasks to be completed within a specific period, usually two to four weeks. During the sprint, the team holds daily stand-ups to discuss progress, identify bottlenecks, and align work efforts. Once the sprint is complete, a sprint review meeting is held to assess the deliverables and receive feedback from stakeholders. Furthermore, a sprint retrospective is conducted to evaluate the process, identify areas of improvement, and plan improvement steps for the next iteration. The Scrum master is instrumental in removing obstacles that hinder the team's performance. At the same time, the product owner is responsible for prioritizing the backlog and ensuring that business needs are reflected in the selected tasks. Through these iterative cycles, Agile Project Management enables teams to adapt to change, reduce project risk, and improve product quality.

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on an ongoing basis. This approach creates a collaborative and responsive work environment, which is critical to the success of complex and dynamic software development projects.

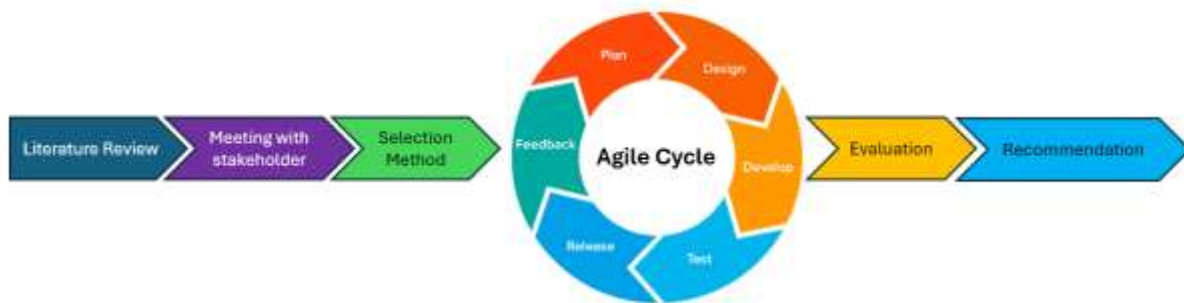
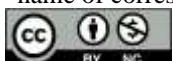


Figure 1. Research Method

Figure 1 shows the Agile Project Management implementation process structured in several stages. The following is an explanation of each component in the figure:

1. Literature review is an essential first step in the research process, particularly in the context of Agile Project Management. This stage involves an in-depth search and analysis of relevant previous studies. This process begins with the identification of keywords and related phrases such as "Agile Project Management," "Scrum," "software development team productivity," and "software project management." Once these keywords were established, searches were conducted on various reputable academic databases such as Scopus, IEEE Xplore, and Google Scholar to gather relevant journal articles, books, and conferences. Each source found was then evaluated for its relevance, credibility, and contribution to a better understanding of Agile Project Management. The primary purpose of this literature review was to understand the various concepts and methodologies that have been adopted in Agile Project Management (Lalmi et al., 2021), as well as to evaluate the results of previous research. Through the literature analysis, recent trends in Agile implementation, factors affecting successful implementation, and challenges often encountered can be identified. This review also aims to identify gaps in the existing literature, which can form the basis for further research
2. Once the literature review is complete, the next stage in the research process is to conduct meetings with stakeholders. These stakeholders can come from various backgrounds, such as project managers, development team members, end-users, and other parties involved or affected by the project. The primary purpose of this meeting is to identify and understand the needs and expectations of all parties involved in the project. Through open and collaborative dialog, a comprehensive insight can be gained into what each stakeholder wants and needs, as well as the challenges they may face in project implementation. Stakeholder meetings aim not only to gather information but also to build trust and cooperation between the research team and the parties involved. In the context of Agile Project Management (Arya, 2024), it is essential to ensure that all stakeholders have a common understanding of the project objectives and methodology.
3. After the information obtained from the literature and meetings with stakeholders is analysed, the next stage is the selection of the most suitable Agile method to be applied to the project. This selection process is done by considering various factors that affect the success of Agile implementation (Bechtel et al., 2022). First, the type of project is the primary consideration. Complex and dynamic projects with frequently changing needs would benefit more from a flexible Agile methodology. For example, a software development project that requires rapid iteration and continuous feedback would be best suited using the Scrum method, which allows dividing the project into short sprints to ensure high adaptability. In addition to the type of project, the composition and capabilities of the team are also essential factors in choosing an Agile method. Teams that already have experience with Agile can directly adopt methodologies

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such as Scrum or Extreme Programming (XP). However, if the team is relatively new to Agile, more straightforward approaches such as Lean or Kanban may be more appropriate as a first step before moving on to more complex methodologies. The work environment and organizational culture also play an essential role in the selection of Agile methods. Organizations with a culture that supports collaboration and open communication will find it easier to adopt Agile methods effectively.

4. Agile Cycle:
 - a. Plan: Planning iterations and sprints, determining the tasks that need to be accomplished within a certain period.
 - b. Design: Designing a solution based on predefined requirements and specifications.
 - c. Develop: Develop the software according to the design that has been made.
 - d. Test: Test the software to ensure there are no bugs and that it conforms to the specifications.
 - e. Release: Releasing the software to users or customers.
 - f. Feedback: Collecting feedback from users for improvement in the next iteration.
 - g. Plan: The re-planning stage for the next iteration based on the feedback received.
5. After several iterations of Agile have been implemented, the evaluation stage becomes critical to assess project performance and results comprehensively. This evaluation covers various aspects, from analysing the achievement of project goals to the effectiveness of the team in applying Agile methodologies. One approach used is the sprint retrospective, where the team comes together to discuss what went well, what needs to be improved, and the corrective steps that can be taken for the next iteration. Through these retrospectives, the team can identify bottlenecks that may be disrupting the workflow and look for appropriate solutions to overcome them. In addition, performance metrics such as velocity, task completion duration (cycle time), and product quality (bug rate) are analysed to provide a quantitative picture of the project's progress.
6. Based on the comprehensive evaluation results, recommendations for next steps can be formulated to ensure the continued success of the project. These recommendations include various aspects that require changes or adjustments to improve the efficiency and effectiveness of the team in applying Agile methodologies. If the evaluation shows that there are barriers to team communication, it is recommended to increase the frequency and quality of daily stand-ups and introduce more effective collaboration tools. In addition, if it is found that the sprint cycle is too short or too long to achieve the desired goals, adjustments to the sprint duration can be made to suit the needs of the project better. In addition to operational adjustments, recommendations may also include broader strategy changes. For example, if the Scrum method being used does not fully match the team dynamics or nature of the project, then switching to another Agile method such as Lean or Extreme Programming (XP) may be more appropriate. Improving work processes may also involve additional training for the team to enhance understanding and skills in applying Agile effectively.

RESULT

Prior to conducting measurements to assess performance both before and after implementing Agile Project Management. The following are the procedures for gathering the data:

1. Explain the objective of quantifying productivity metrics. Ensure that all members of the development team and stakeholders understand the study's aim.
2. Conducting Case Studies and identifying a limited number of software development teams to be investigated as the focus of the research. The objective is to determine an appropriate duration for observing changes both before and after the implementation of Agile methodology. The chosen time frame for this observation is 12 months.
3. Pre-Agile Implementation Data Collection, see can figure 1.

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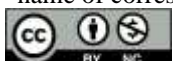
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Table 1. Agile implementation steps

#	Step	Description
A	Code Quality	Utilize code analysis tools to quantify the quantity of defects per 1000 lines of code.
B	Measuring Team Satisfaction	Development Velocity refers to the measurement of the number of features that are developed within a given month. Conducting a survey among team members using a rating scale ranging from 1 to 10.
C	Task Completion Time	Measures the mean duration required to finish a task.
D	Team Retrospective	Performed a retrospective evaluation using a rating scale ranging from 1 to 10.
E	Team Collaboration	Employed a survey utilizing a numerical scale ranging from 1 to 10 to evaluate the level of collaboration.
F	Stakeholder Engagement	Determined the proportion of participation in meetings and the process of development.
G	Iterative Improvement	Measures the percentage of enhancement in the development process.
H	Measuring Customer Satisfaction	Administering a customer satisfaction survey using a numerical rating scale ranging from 1 to 10.
I	Development Iterations	This metric measures the total number of iterations that have been executed.
J	Product Release Frequency	Measures the monthly quantity of product releases.
K	Response Time to Changes	Measures the duration it takes to respond to changes.
L	Assessing the Effectiveness of Team Communication	Employing a survey utilizing a numerical scale ranging from 1 to 10.
M	Collaboration Tool Usage	Assessed the utilization of collaboration tools using a rating scale ranging from 1 to 10.
N	Stress Level	We are assessing the stress levels of the team on a scale of 1-10.
O	Quality	It assesses the quality of documentation using a survey that employs a numerical scale of 1 to 10.
P	Training and Development	Documents the monthly duration dedicated to training.
Q	User Feedback	Gathers both favorable and unfavorable user feedback information.
R	On-time Project Completion Rate	Calculate the percentage of projects that were completed on time.

4. The implementation of Agile, utilizing Agile Project Management for the teams involved. Ensure that all team members possess a comprehensive understanding of the fundamental principles of Agile methodology and that the specific tool employed is Scrum. If the team needs to comprehend Scrum methodology more, it is advisable to provide Scrum training.
5. Gathering of Data Following the implementation of Agile, after a designated timeframe (in this instance, 12 months), identical data will be gathered using the same methodology employed prior to the Agile implementation.
6. Conducting data analysis to compare data prior to and following the implementation of Agile methodologies. Utilize statistical analysis tools to guarantee the validity and reliability of data.
7. Results shall be reported in the following manner: Produce a comprehensive report that presents the research findings in detail—display data using tables and graphs to enhance comprehension.
 - a. Methods and strategies employed:

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- b. Surveys and questionnaires are used to gather qualitative data from both the team and stakeholders.
- c. Code analysis tools, such as SonarQube, are used to assess the quality of code.
- d. Tools for Project Management:
 - Like JIRA or Trello, these tools monitor the progress of iterations, features, and the time it takes to complete tasks.
 - Statistical software, such as SPSS or R, is used for data analysis.
- e. Questionnaire Template for Assessing Team Satisfaction and Collaboration:
 - Team Satisfaction: "Please rate your level of satisfaction with the current software development process on a scale of 1 to 10."
 - Team Collaboration: "Please rate the effectiveness of the collaboration between team members on a scale of 1 to 10."
- f. Illustration of Instruments for Code Analysis: SonarQube is a software tool—an instrument for assessing the quality of code, identifying software defects, and detecting vulnerabilities.

Table 2. Metrics Productivity

Productivity Metrics	Before Agile Implementation	After Agile Implementation
Code Quality (Bugs/1000 lines of code)	15	5
Development Speed (Features/month)	2	5
Team Satisfaction (Scale 1-10)	6	9
Task Completion Time (Days/task)	7	3
Team Retrospective (Scale 1-10)	5	8
Team Collaboration (Scale 1-10)	6	9
Stakeholder Involvement (%)	60	85
Iterative Improvement (%)	30	70
Customer Satisfaction (Scale 1-10)	6	8
Number of Development Iterations	4	12
Product Release Frequency (Releases/month)	0.5	2
Response Time to Changes (Days)	14	3
Team Communication Effectiveness (Scale 1-10)	5	9
Use of Collaboration Tools (Scale 1-10)	4	8
Team Stress Level (Scale 1-10)	7	4
Documentation Quality (Scale 1-10)	5	7
Training and Development (Hours/month)	2	6
User Feedback (Positive/Negative)	40/60	75/25
Project Completion Rate on Time (%)	50	90

Table 2 explanation:

1. Code Quality (Bugs/1000 lines of code): Before the Agile implementation, there were 15 bugs per 1000 lines of code. After the Agile implementation, the number of bugs decreased to 5 per 1000 lines of code, showing a significant improvement in code quality.
2. Development Speed (Features/month): Before the Agile implementation, the team was able to develop 2 features per month. After Agile implementation, the number of features developed increased to 5 per month, showing an increase in productivity.
3. Team Satisfaction (Scale 1-10): The team satisfaction level before Agile implementation was 6. After Agile implementation, the team satisfaction level increased to 9, indicating an increase in team motivation and engagement.
4. Task Completion Time (Days/task): The average time taken to complete one task before Agile implementation was 7 days. After Agile implementation, the completion time decreased to 3 days, indicating higher efficiency.

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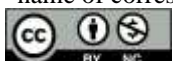


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5. Team Retrospective (Scale 1-10): The quality of team retrospectives before Agile implementation was 5. After Agile implementation, it increased to 8, indicating improvements in the evaluation process and continuous improvement.
6. Team Collaboration (Scale 1-10): Collaboration between team members before Agile implementation was at 6. After Agile implementation, it increased to 9, showing improvement in cooperation and communication.
7. Stakeholder Engagement (%): Before Agile implementation, stakeholder engagement was 60%. After Agile implementation, it increased to 85%, showing an improvement in participation and communication with stakeholders.
8. Iterative Improvement (%): Before Agile implementation, iterative improvement was 30%. After Agile implementation, it increased to 70%, indicating increased adaptability and ability to make continuous changes.
9. Customer Satisfaction (Scale 1-10): The level of customer satisfaction with the final product before Agile implementation was 6. After Agile implementation, it increased to 8, indicating improved product quality and customer satisfaction.
10. Number of Development Iterations: Before the Agile implementation, the team conducted 4 development iterations. After Agile implementation, the number of iterations increased to 12, indicating an improvement in the development cycle.
11. Frequency of Product Releases (Releases/month): Before the Agile implementation, the team released 0.5 products per month. After the Agile implementation, the release frequency increased to 2 products per month, showing an improvement in the release speed.
12. Response Time to Changes (Days): Before the Agile implementation, the response time to changes was 14 days. After the Agile implementation, the response time decreased to 3 days, indicating an improvement in adaptability and flexibility.
13. Team Communication Effectiveness (Scale 1-10): Team communication effectiveness before Agile implementation was at 5. After Agile implementation, it increased to 9, showing improvement in internal communication.
14. Use of Collaboration Tools (Scale 1-10): Before Agile implementation, the use of collaboration tools was at 4. After Agile implementation, it increased to 8, indicating an improvement in the use of technology for collaboration.
15. Team Stress Level (Scale 1-10): Team stress level before Agile implementation was at 7. After Agile implementation, it decreased to 4, indicating an improvement in team well-being.
16. Documentation Quality (Scale 1-10): Documentation quality before Agile implementation was at 5. After Agile implementation, it increased to 7, indicating an improvement in information storage and access.
17. Training and Development (Hours/month): Before Agile implementation, the team spent 2 hours per month on training and development. After Agile implementation, it increased to 6 hours per month, showing a commitment to skill development.
18. User Feedback (Positive/Negative): Before Agile implementation, user feedback was 40% positive and 60% negative. After Agile implementation, positive feedback increased to 75% and negative decreased to 25%, indicating an improvement in user satisfaction.
19. On-Time Project Completion Rate (%): Before Agile implementation, the on-time project completion rate was 50%. After Agile implementation, it increased to 90%, showing improvement in time management and project completion.

The results of this study extend the current understanding of the influence of human aspects on team climate in an Agile context. The finding that neuroticism has a significant negative impact on team climate perceptions highlights the importance of managing team members' emotional well-being. This reinforces the theory that individual psychological aspects influence overall team dynamics and performance. In addition, the finding that personal responsibility has a positive impact on team climate suggests that in addition to technical competence, individual behaviors and attitudes towards responsibility and collaboration are highly influential. These findings encourage a more holistic

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approach to team management, which includes assessing and managing various human aspects, and challenge the traditional view that tends to focus on technical skills alone.

However, there are some limitations to this study that need to be noted. The sample size used may need to be more significant to generalize these findings to all Agile team contexts, and the data collected based on a subjective survey could have respondent bias. The methodology used may also need to fully capture the complex dynamics in more extensive or more diverse teams. Therefore, further research with larger samples and more comprehensive methods is required in order to strengthen these findings. The practical implications of this study include the importance of project managers being aware of and managing the psychological and emotional aspects of team members, as well as encouraging responsibility and collaboration as critical factors in creating a positive team climate. By integrating these findings into management strategies, organizations can increase the effectiveness of Agile teams and achieve better project outcomes.

DISCUSSIONS

How does the implementation of Agile Project Management, precisely the Scrum method, affect the productivity of software development teams? (Research Question 1).

The application of Agile Project Management, precisely the Scrum method, has become an essential topic in the software development industry. Scrum, as one of the most widely used Agile frameworks, offers an iterative and incremental approach that focuses on improving team collaboration, flexibility, and adaptability to change. Research on how the Scrum method affects the productivity of software development teams reveals various aspects that explain its impact. The Scrum method introduces a clear structure and organized work process through a series of practices and artifacts, such as sprints, daily stand-ups, sprint planning, and retrospectives. Sprints, as short work periods that typically last between one and four weeks, allow teams to focus on a small number of specific features or tasks. By dividing the project into small, manageable parts, the team can respond to changes quickly and efficiently. Research shows that this sprint structure helps teams maintain focus and reduces the risk of burnout, as work is done in small, measurable chunks.

Daily meetings, or daily stand-ups, are another critical element of Scrum that influences productivity. These meetings provide an opportunity for all team members to synchronize activities, discuss progress, and identify obstacles that may hinder task completion. Through regular and open communication, daily stand-ups increase transparency and allow teams to address issues as soon as they arise. The results show that teams that implement daily stand-ups tend to be more effective in managing time and resources, as problems can be resolved faster, and tasks can be adjusted as needed. Sprint planning also plays an important role in improving team productivity. In these meetings, the team and product owner, a key figure in Scrum, work together to define the sprint objectives and establish the sprint backlog, which is the list of tasks to be completed in the sprint. The active involvement of the product owner ensures that business priorities are aligned with development activities, so the team works on the things that are of most value to the project. Research shows that good sprint planning helps teams understand goals and expectations more clearly, which in turn improves their motivation and performance. In addition, sprint retrospectives provide an opportunity for teams to reflect on their performance and identify areas that require improvement. In the retrospective, the team evaluates what went well, what didn't, and how to improve the work process for the next sprint. This process, which creates a culture of continuous learning and improvement, is critical to maintaining long-term productivity. The research found that teams that consistently conducted retrospectives showed significant improvements in their work effectiveness and efficiency. The adoption of the Scrum method also has a positive impact on the collaboration and communication aspects of the team. With clearly defined roles, such as scrum master, product owner, and development team members, Scrum ensures that everyone understands their respective responsibilities. The Scrum master, for example, oversees removing obstacles and ensuring that the team can work without interruption. This role helps create a supportive and collaborative work environment where team members feel supported and motivated to achieve common goals.

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What are the key factors that affect team productivity in the context of applying Agile methods? (Research Question 2).

In the context of implementing Agile methods, team productivity is influenced by various interrelated vital factors that affect team project management efficiency. Some of the critical factors that affect team productivity in the application of Agile methods include communication, collaboration, clarity of roles and responsibilities, training and competencies, as well as management support and organizational culture. Effective communication is one of the most critical factors in improving Agile team productivity. Agile methods, such as Scrum, emphasize the importance of regular and open communication through daily stand-ups, sprint planning, and retrospectives. Daily meetings allow team members to synchronize activities, identify bottlenecks, and collaboratively seek solutions. Research shows that teams with good communication tend to solve problems faster, reduce errors, and improve overall work efficiency.

Close collaboration between team members is also an essential factor in an Agile context. Agile methods encourage intensive and cross-functional cooperation, where each team member makes a significant contribution to the achievement of project goals. This collaboration is supported by an inclusive and supportive team culture, where every member feels valued and can voice their ideas and opinions. Research shows that teams with high levels of collaboration tend to be more innovative, responsive to change, and able to produce higher-quality products. Clarity of roles and responsibilities is also a key factor affecting team productivity in Agile implementations. In Scrum, for example, roles such as scrum master, product owner, and development team members are clearly defined. The Scrum master is responsible for removing bottlenecks and ensuring that the team can work without interruption. At the same time, the product owner sets priorities and ensures that business needs are reflected in the sprint backlog. This role clarity helps reduce confusion and conflict and helps team members achieve the same goal.

Team member training and competency also play an essential role in determining the productivity of Agile teams. Adequate training in Agile principles and practices, as well as the necessary technical skills, helps teams to adapt to Agile methods and apply them effectively more quickly. Research shows that teams that receive comprehensive training tend to be more confident and competent in performing their tasks, which in turn improves productivity and quality of work. Management support and organizational culture also influence the successful implementation of Agile methods and team productivity. Management support includes the provision of necessary resources, such as collaboration tools, training, and supportive infrastructure. In addition, supportive management also plays a role in overcoming obstacles and providing motivation to the team. An Agile-supportive organizational culture, which promotes collaboration, innovation, and flexibility, is essential to creating a conducive work environment for Agile teams. Another factor to consider is the team's adaptability to change. Agile methods are designed to respond quickly to change, be it changes in business needs, project priorities, or market conditions. Teams that have good adaptability tend to be more flexible and able to face challenges more effectively. Research shows that this adaptability is closely related to project success and end-user satisfaction. Motivation and engagement are key factors in team productivity. Teams that are motivated and actively engaged in their work processes tend to be more passionate, creative, and committed to project success. Factors such as recognition, responsibility, and career development opportunities can increase team motivation and engagement, leading to a positive impact on productivity.

This study expands our understanding of how human factors affect Agile team climate. Neuroticism negatively affects team climate perceptions, highlighting the importance of emotional wellbeing management. This supports the idea that individual psychology affects team performance. Many Agile studies have focused on technical and methodological factors, but this study adds emotional and psychological wellbeing. The discovery that individual responsibility improves team climate adds to the literature. This suggests that technical competence, personal behaviors, and responsibility and collaboration attitudes are all important. This finding challenges the idea that technical skills are the only essential factors in teamwork and emphasizes soft skills like responsibility and collaboration.

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CONCLUSION

This research answers the main problem statement by asserting that the application of Agile Project Management, precisely the Scrum method, has a significant impact on the productivity of software development teams. The main findings show that the iterative and collaborative structure of Scrum, such as sprint planning, daily meetings, and retrospectives, substantially improves team efficiency and effectiveness. Stakeholder communication and involvement keep the project on schedule and adjust to business needs rapidly. In addition, adequate team training and competencies contribute to increased confidence and technical skills, which in turn improve productivity and quality of work outcomes. Theory and practice implications of these findings in the field of project management and software development are significant. Theoretically, this research reinforces the concept that Agile methods, particularly Scrum, are effective in managing complex and dynamic projects. Practically, the findings provide clear guidance for project managers and organizations on how to adopt and implement Scrum to achieve better results. This research also shows that management support and a supportive organizational culture are critical to successful Agile implementation. However, this study has some limitations, such as limited sample size and specific organizational context. Therefore, future research is recommended to explore the application of Scrum in various industry contexts and use a larger sample size to generalize these findings. Further research can also explore how the combination of different Agile methodologies can provide additional benefits increasing software development team productivity.

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