

The Impacts of Applying the Agile Approach in the Construction Projects: A Case Study of Two Construction Projects

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Abstract - Construction projects often face issues like poor planning accuracy, weak schedule control, and slow responses to changes, leading to increased interest in Agile methodologies. However, empirical evidence on Agile applications across both planning and execution phases in construction remains limited.

This study explores the impact of Agile practices through two case studies. Project One used a hybrid Agile-traditional model for planning a residential villa, tracking progress with weekly performance indicators. A qualitative comparison with traditional methods assessed the added value. Project Two utilized Scrum for the maintenance of an administrative building, employing Kanban boards for workflow visualization. Performance was evaluated through sprint reports and surveys of six engineers.

The results indicated significant improvements. In Project One, one of the work items that initially faced performance delays saw progress increase from 81% to 94.9% after implementing short planning cycles. This approach also enabled faster responses to changes through multiple execution scenarios and facilitated earlier detection of deviations. In Project Two, 90% of the planned tasks were completed on schedule. Sprint reviews played a crucial role in identifying delays early and allowing for timely adjustments to priorities. Additionally, an engineer survey reported an average satisfaction score of 4.4 out of 5 regarding communication, collaboration, and clarity of responsibilities.

The study highlights the benefits of Agile approaches in developing-country construction, emphasizing hybrid models and short planning cycles. It also highlights the need for structured training and organizational readiness for successful Agile adoption

Keywords - Agile, Hybrid, Construction, Execution Phase, Planning Phase.

I. INTRODUCTION

Construction project management faces ongoing challenges in planning accuracy, schedule reliability, and stakeholder coordination. Despite advancements in technology, traditional linear approaches often struggle to adapt to changes and unexpected site conditions, leading to delays and cost overruns. This highlights the need for more flexible management frameworks. And the possibility of application of Agile Project Management to construction requires careful consideration, given that resources are unlikely to remain fixed if the scope of the project is varied [2].

Agile methodologies, developed for software development, focus on iterative planning, quick feedback, and continuous stakeholder engagement [3]. Recent studies indicate that Agile principles, such as incremental work cycles and collaborative decision-making, can provide benefits in construction settings characterized by uncertainty and change. However, current research mainly analyzes single project phases or focuses on design and pre-construction rather than execution.

There is a notable lack of empirical evidence on Agile's application in construction, especially in developing countries like Sudan, where conditions differ significantly. Few studies merge performance indicators with qualitative insights regarding Agile practices on-site.

This study examines two real-world construction projects: a residential villa project using a hybrid Agile-traditional model in the planning phase, and an administrative building maintenance project implementing Scrum during execution. It aims to evaluate how Agile enhances progress tracking, communication, and adaptability to change, providing evidence to advance the understanding of Agile adoption in construction project management.

II. METHODOLOGY

This study adopted a mixed-methods research design to comprehensively evaluate the impacts of applying Agile project management practices in construction projects. The methodology combined qualitative and quantitative techniques to ensure the assessment of performance, communication, and adaptability across two real-world case studies. The research process consisted of four main components: literature review, case study selection, data collection, and data analysis.

III. RESEARCH DESIGN

A mixed-methods approach was selected because Agile implementation in construction requires an understanding of both measurable performance outcomes and the human factors influencing teamwork, communication, and decision-making. Quantitative data were used to track progress, productivity, and task completion rates, while qualitative insights were collected to interpret team behavior, challenges, and perceived benefits.

A. Case Study Selection

Two construction projects were purposefully selected based on the availability of detailed project documentation, access to real-time performance data, and the willingness of project teams to adopt Agile practices. The selected projects also represent two different phases of construction, the planning phase and the execution phase.

Case Study one, A residential villa project in the planning phase, where a hybrid model was introduced, the baseline was scheduled with the traditional method. Figure1 shows the steps of implementing the hybrid model in the project one.

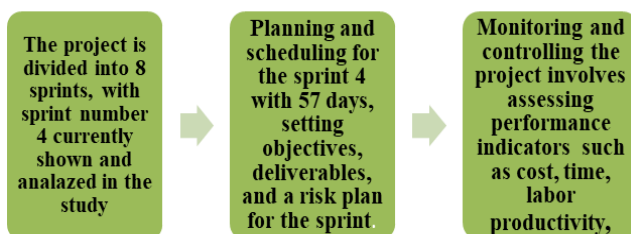


Figure1: Steps Of Implementing The Hybrid Model In Project One

Case Study two, a maintenance and rehabilitation project for an administrative building during the execution phase, where Scrum practices were applied through these steps in Figure2.

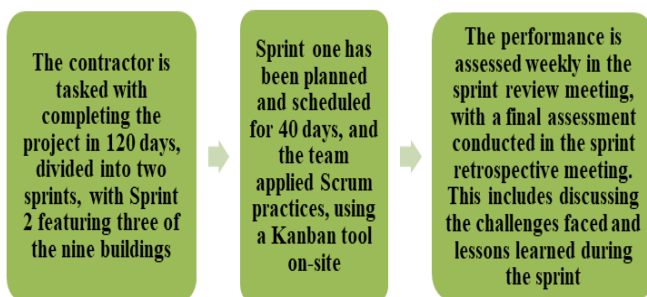


Figure 2: Steps Of Implementing Scrum Practices in Project Two

B. Data Collection Methods

Multiple data sources were used to strengthen the validity of the findings through triangulation:

1. Project Performance Reports, weekly progress reports, sprint logs, labor productivity records, and KPI dashboards were collected from both projects. These documents enabled quantitative measurement of

schedule control, progress accuracy, and corrective responses.

2. Direct Field Observations, Regular site visits were conducted in the execution-phase project to document task flow, collaboration patterns, and the use of Kanban boards for workflow visualization.
3. Sprint Reports (Execution Project), For the Scrum-based project, sprint review and sprint retrospective reports were analyzed to assess task completion rates and identify emergent issues.
4. Questionnaire Survey \ Team feedback, A structured survey was administered to the six engineers involved in the execution-phase project. The questionnaire measured perceptions of communication, collaboration, responsiveness to change, and clarity of responsibilities using a 5-point Likert scale.
5. Comparative Analysis (Planning Project), Weekly KPIs from the hybrid model were compared qualitatively with conventional planning practices to identify added value.

Table 1: Summary of Data Collection Methods for Both Case Studies

Project	Phase	Agile Approach	Data Collection Methods	Data Types
Residential Villa	Planning	Hybrid (Agile& Traditional)	Weekly KPIs, progress reports, labor productivity records, comparative analysis	Quantitative & Qualitative
Administrative Building Maintenance	Execution	Scrum + Kanban	Sprint reports, on-site observations, workflow boards, and team survey	Quantitative & Qualitative

C. Data Analysis Techniques

Both quantitative and qualitative analysis techniques were employed:

1. Quantitative Analysis, Progress percentages, actual vs. estimated performance, and task completion rates were calculated and compared across weeks and sprints. Descriptive statistics were used to analyze the survey responses; the responses provided qualitative insights that support the quantitative performance data but do not form the sole basis of the study's conclusions.
2. Qualitative Analysis, Observational notes, sprint retrospectives, and feedback from engineers\ stakeholders were thematically analyzed to identify patterns related to adaptability, communication flow, and decision-making improvements.

IV. RESULTS

The analysis demonstrated clear improvements in project performance following the application of Agile practices. In the residential villa project, weekly performance indicators showed a measurable increase in planning accuracy and progress control.

The monitored percentages highlight the performance of the specific delayed activity, rather than the overall project activities, which remain stable. After implementing a short planning cycle, we observed a significant improvement. The completion rate increased from 81% in the first week to a cumulative total of 94.9% by the third week. This progress demonstrates more effective monitoring and faster responses to design changes, as illustrated in Table 2.

Table 2: Activity Performance Progress Under the Hybrid Model

Activity: Plastering			Start Date: 6\Jan\2024	
Quantity:1776M²			Finish Date: 1\Feb\2024	
Report	Actual Performance (m2)	Estimated performance (m²)	Progress	Note
14\Jan\2024	370	453.6	81%	Deviations detected early
30\Jan\2024	1650	1738	94.9%	Corrective actions improved accuracy

The adoption of hybrid planning allowed for the early identification of deviations and the implementation of timely corrective actions compared to the traditional approach. Key areas of comparison are presented in Table 3.

TABLE 3 : COMPARATIVE ANALYSIS: TRADITIONAL VS. AGILE-BASED PRACTICES

Category	Traditional Management	Agile-Based Approach	Observed Impact in the project
Flexibility	Fixed, less flexible	Iterative, adaptive	Faster response to changes. Multiple execution scenarios assessed to adjust schedules based on on-site conditions.
Monitor & Control	Monthly or long-cycle updates	Weekly KPIs / Sprint reviews	Early detection of deviations, the sprint was monitored continuously with updated sprint risk plans.
Risk Response	Reactive	Proactive through short cycles	Improved recovery from deviations

Productivity and Project Tracking	End-of-phase	Continuous	Closer alignment with estimates and Initial weekly progress was 81% , improved to 95% after applying corrective actions
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In project two, the Project performance reports and the team survey demonstrated clear improvements resulting from the application of Agile practices during the execution phase. Quantitative performance data showed that approximately 90% of the planned tasks were delivered on time across the first sprint, as shown in Table 4, indicating strong workflow stability and improved coordination. Sprint reviews enabled early detection of delays and supported timely adjustments to priorities, which contributed to maintaining steady progress throughout the project.

Table 4: Sprint performance due to the sprint report

Sprint Report: 30\Nov\2022					
Maintained buildings during the sprint	Start Date	Finish Date	Delivered works	Residual work	Note
3	11\Oct 2022	30\Nov 2022	90%	Roof Isolation	The remaining work will not impact the building's usage.

The survey in Figure3 was designed not for statistical generalization, but to capture the lived experience and perceptions of the implementation team (N=6). This qualitative insight is crucial to understanding the 'human factors' such as collaboration and clarity that drove the measurable productivity improvements shown in the project report.

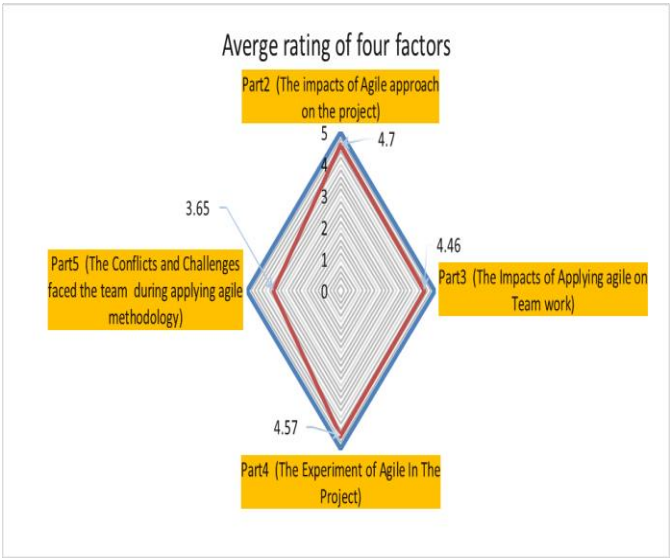


Figure 3: Average Rating Of Four Questionnaire Parts

The quantitative results confirmed significant enhancements in responsiveness to change, achievement of project goals, project control, and team collaboration. Table 5 summarizes the average scores across the five key evaluation areas

Table 5: Summary of Quantitative Survey Results

Key Area	Average Score (Out of 5)	Interpretation
Responsiveness to change & uncertainty	4.70	Very strong adaptability across the sprint
Goal achievement, value delivery, and client\ business satisfaction	4.57	High alignment with client requirements
Project control & task prioritization	4.57	Improved visibility and clarity of priorities
Team collaboration & communication	4.46	Strong teamwork supported by Scrum practices

V. DISCUSSION

This study explored the application of Agile methodologies in construction projects through a hybrid Agile-traditional approach during planning and Scrum practices during execution. The findings from both case studies demonstrate that Agile principles can be effectively adapted to construction environments characterized by uncertainty and frequent design changes.

In Project One, the improvement in the plastering activity from 81% to 94.9% within three weeks highlights the effectiveness of short Agile planning cycles in early deviation detection and timely corrective actions. As this activity represented the only measurable delay and covered its complete lifecycle during the observation period, the results provide clear evidence of improved schedule control. These findings are consistent with previous studies emphasizing the role of iterative planning and frequent performance monitoring in enhancing time management [8].

In Project Two, the application of Scrum practices resulted in enhanced coordination, timely task completion, and improved workflow stability. Although the survey involved only six engineers and does not support statistical generalization, it provides valuable qualitative insights into team collaboration, communication, and role clarity. Similar improvements in team dynamics have been reported in earlier studies [1,7]. Given that Agile methodologies remain relatively new within the Sudanese construction context, the observed outcomes also reflect a growing tendency toward Agile adoption in the sector [5].

Overall, the findings align with previous research reporting improved communication [1], adaptability and decision-making efficiency [7], and enhanced collaboration through Scrum frameworks [4,6]. Notably, the rapid improvement observed in Project One suggests that short sprints may exert a stronger influence on labor productivity than commonly reported. Further research with larger samples and diverse project types is recommended to validate these findings and examine the long-term impacts of Agile methodologies on productivity, cost control, and risk management.

VI. LIMITATIONS

The study had several limitations affecting the interpretation of findings. Notably, the small project teams of six members may limit the generalizability of results. Data collection was hampered by incomplete quantitative information from the first project, restricting comparisons with traditional project management. Furthermore, since Agile project management is relatively new in Sudan, team members needed training, which impacted the implementation process.

Finally, the researcher's role in facilitating the adoption of Agile practices may have introduced novelty or observer effects. Future studies should incorporate longer observation periods, multiple activities, and comparative baselines to strengthen the empirical rigor.

VII. CONCLUSION

This study examined the application of Agile methodologies in two construction projects and demonstrated their potential to improve planning accuracy, communication effectiveness, and overall project performance. The results showed that integrating Agile into the planning phase through a hybrid model enhanced progress control and responsiveness to changes. At the same time, the use of Scrum during execution contributed to timely task completion and stronger team coordination. Despite limitations in team size, data availability, and organizational familiarity with Agile practices, the findings indicate that Agile offers a practical, flexible management approach that aligns well with the dynamic nature of construction projects. Future research should explore Agile implementation in larger and more complex project settings, investigate long-term performance impacts, and assess the role of digital tools in supporting Agile adoption across the construction industry.

VIII. REFERENCES

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