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An Agile–Kpi Based Execution Framework for Residential Construction Projects: A Literature Based Study

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Abstract: *The construction industry continues to face persistent challenges such as schedule delays, cost overruns, rework, quality deficiencies, and limited responsiveness to changing stakeholder requirements. These challenges are particularly evident in residential construction projects, where client involvement is high and requirements often evolve during project execution. Conventional project management approaches, which rely heavily on detailed upfront planning and rigid execution sequences, frequently fail to accommodate such dynamic conditions, leading to inefficiencies and compromised project performance.*

Agile Project Management (APM), originally conceptualized to manage uncertainty in complex project environments, emphasizes flexibility, iterative planning, continuous stakeholder engagement, and collaborative decision making. In recent years, agile principles have attracted increasing attention within the construction sector due to their potential to enhance transparency, coordination, and adaptability. However, the application of agile methodologies in construction remains fragmented and largely conceptual.

This paper presents an in-depth literature-based study examining agile practices, key performance indicators (KPIs), success drivers, and barriers within the context of residential construction projects. A systematic synthesis of twenty-four peer reviewed studies was conducted to identify critical agile factors, commonly used KPIs, and major constraints affecting agile adoption. The findings indicate that agile practices such as iterative planning, continuous feedback, cross-functional teamwork, and adaptive execution can positively influence project performance and stakeholder satisfaction. Nevertheless, organizational resistance, contractual rigidity, cultural constraints, and regulatory requirements continue to limit widespread adoption. The study identifies the absence of an integrated Agile–KPI execution framework as a critical research gap and establishes a robust theoretical foundation for developing such a framework for residential construction projects.

Keywords: Agile Project Management, Key Performance Indicators, Residential Construction, Execution Model, Construction Management, Performance Enhancement

I. INTRODUCTION

The construction industry is a cornerstone of economic development, contributing significantly to employment generation, urban growth, and infrastructure expansion. Despite its importance, the industry has long been criticized for poor productivity growth, frequent project delays, budget overruns, quality failures, and fragmented stakeholder coordination (Harvett, 2013; Serrador & Pinto, 2015). These problems are particularly acute in residential construction projects, which are often characterized by customized client requirements, frequent design changes, tight schedules, and reliance on multiple subcontractors.

Traditional project management approaches, particularly the Waterfall model, have dominated construction practice due to their structured, documentation driven nature. These approaches emphasize comprehensive upfront planning, clearly

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defined scope, and sequential execution of project phases. While such methods offer predictability and contractual clarity, they assume stability in project requirements an assumption that rarely holds true in residential construction (Salameh, 2014). Once construction activities commence, incorporating changes becomes increasingly expensive and disruptive, resulting in rework, schedule slippage, and cost escalation (Owen et al., 2006; Leybourne, 2009).

Agile Project Management introduces a fundamentally different management philosophy by prioritizing adaptability, collaboration, and value driven delivery. Agile approaches encourage short planning cycles, continuous stakeholder interaction, and frequent performance reviews, enabling project teams to respond proactively to emerging issues and evolving requirements (Augustine et al., 2005). In residential construction, where clients frequently request changes to layouts, finishes, or functional elements, agile practices can enhance responsiveness while maintaining project control (Titova, 2020; Chathuranga et al., 2023).

Despite these potential advantages, the adoption of agile methodologies in construction remains limited. Rigid contractual arrangements, regulatory compliance requirements, hierarchical organizational cultures, and limited awareness of agile concepts present significant barriers to implementation (Jethva & Skibniewski, 2022; Abou-Aly et al., 2024). Furthermore, while existing studies discuss agile practices in isolation, limited research has systematically linked agile execution with measurable project performance indicators. The absence of an integrated Agile–KPI execution framework restricts both implementation and evaluation of agile methodologies in residential construction projects (Malla, 2024; Moshood et al., 2024).

This study addresses these limitations by synthesizing existing literature to identify key agile factors, relevant KPIs, and implementation barriers, thereby establishing a comprehensive foundation for developing an Agile–KPI based execution framework.

1.1 KEY PAPERS REFERENCED

Table 1. Key papers referenced

Author(s)	Year
Badran, S. S., & Abdallah, A. B.	2025
Kineber, A. F., Oke, A. E., Elshaboury, N., et al.	2024
Elshaboury, N., Oke, A. E., & Kineber, A. F.	2024
Malla, V.	2024
Abou-Aly, A., Khodeir, L., & ElAbd, N.	2024
Moshood, T. D., Nawanir, G., & Mahmud, F.	2024
Chathuranga, S., Jayasinghe, S., Antucheviciene, J., et al.	2023
Jethva, S. S., & Skibniewski, M. J.	2022
Kalaiarasan, A. K. M.	2022
Thesing, T., Feldmann, C., & Burchardt, M.	2021
Titova, L.	2020
Arefazar, Y., Nazari, A., Hafezi, M. R., & Maghool, S. A. H.	2019
Mostafa, S., Chileshe, N., & Abdelhamid, T.	2016
Serrador, P., & Pinto, J. K.	2015
Sertyesilisik, B.	2014
Salameh, H.	2014
Harvett, C. M.	2013
Demir, S., & Theis, P.	2012

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Demir, S., Sertyesilisik, B., & Koskela, L.	2012
Leybourne, S.	2009
Owen, R., Koskela, L., Henrich, G., & Codinhoto, R.	2006
Augustine, S., Payne, B., Sencindiver, F., & Woodcock, S.	2005
Skibniewski, M. J., & Jethva, S. S.	2002
Koskela, L.	1999

II. REVIEW ON LITERATURES

2.1 AGILE PROJECT MANAGEMENT IN CONSTRUCTION

Agile Project Management is rooted in principles of flexibility, collaboration, iterative development, and continuous improvement. Unlike traditional management approaches that prioritize detailed upfront planning, agile emphasizes adaptive planning informed by real time feedback and evolving project conditions (Augustine et al., 2005; Leybourne, 2009). Agile frameworks such as Scrum, Kanban, and Lean–Agile hybrids promote transparency, shared responsibility, and incremental value delivery.

Several researchers argue that construction projects exhibit characteristics similar to software projects, including uncertainty, complexity, and stakeholder interdependence (Titova, 2020; Harvett, 2013). Empirical studies suggest that agile practices such as frequent coordination meetings, short-term planning cycles, and collaborative problem solving can improve information flow, reduce decision latency, and enhance project adaptability (Arefazar et al., 2019; Chathuranga et al., 2023).

However, the literature also highlights that agile adoption in construction is often limited to specific phases, particularly design and pre-construction. Full scale implementation across the project lifecycle remains uncommon due to fixed contracts, fragmented project delivery systems, and resistance to change among project stakeholders (Owen et al., 2006; Jethva & Skibniewski, 2022). This partial adoption underscores the need for structured frameworks that align agile principles with construction specific constraints.

2.2 AGILE VERSUS TRADITIONAL PROJECT MANAGEMENT APPROACHES

Traditional project management approaches emphasize predictability, control, and compliance with predefined plans. These methods are effective in stable environments where scope and requirements are clearly defined at the outset. However, in residential construction projects characterized by evolving client needs and market uncertainty, rigid planning often leads to inefficiencies and reduced responsiveness (Salameh, 2014).

Agile approaches, by contrast, emphasize flexibility, incremental delivery, and continuous stakeholder engagement. Comparative studies report that agile methodologies enhance innovation, transparency, and client satisfaction by enabling frequent feedback and adaptive decision making (Leybourne, 2009; Serrador & Pinto, 2015). Nevertheless, agile adoption raises concerns related to cost predictability, documentation adequacy, and regulatory compliance issues that are particularly relevant in construction contexts governed by strict contractual obligations (Thesing et al., 2021).

As a result, hybrid project management models that combine agile flexibility with traditional control mechanisms have gained attention in recent literature. Such hybrid approaches are increasingly viewed as practical solutions for residential construction projects, enabling adaptability at the operational level while maintaining contractual and regulatory compliance (Badran & Abdallah, 2025).

2.3 LEAN–AGILE INTEGRATION IN CONSTRUCTION PROJECTS

Lean construction focuses on maximizing value and minimizing waste through efficient planning, workflow optimization, and continuous improvement. Integrating lean principles with agile practices has been shown to enhance productivity, reduce rework, and improve reliability of construction processes (Mostafa et al., 2016; Sertyesilisik, 2014).

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Lean–agile integration supports collaborative planning, visual management, and decentralized decision-making, aligning well with the dynamic nature of residential construction projects. Tools such as the Last Planner System, Kanban boards, and digital collaboration platforms improve transparency and coordination across project teams (Demir & Theis, 2012; Malla, 2024). However, successful integration requires organizational commitment, adequate training, and a cultural shift toward collaboration and continuous learning.

2.4 AGILE FACTORS IDENTIFIED FROM LITERATURE

The identified agile factors collectively influence adaptability, collaboration, execution efficiency, and stakeholder satisfaction. These factors form the basis for designing agile- oriented execution models in residential construction projects.

Table 2. AGILE FACTORS IDENTIFIED FROM LITERATURE

SL NO.	AGILE FACTOR	DESCRIPTION	KEY REFERENCES
AF 1	Iterative Planning	Short planning cycles allowing frequent revisions	Arefazar et al. (2019); Titova (2020)
AF 2	Stakeholder Collaboration	Continuous client and stakeholder involvement	Chathuranga et al. (2023); Jethva & Skibniewski (2022)
AF 3	Cross-Functional Teams	Multidisciplinary team integration	Augustine et al. (2005); Harvett (2013)
AF 4	Continuous Feedback	Regular review and improvement cycles	Leybourne (2009); Serrador & Pinto (2015)
AF 5	Adaptive Decision-Making	Rapid response to uncertainty	Salameh (2014); Thesing et al. (2021)
AF 6	Visual Management	Use of dashboards and visual tools	Demir & Theis (2012); Malla (2024)
AF 7	Incremental Delivery	Delivery in manageable work packages	Titova (2020); Owen et al. (2006)
AF 8	Empowered Teams	Decentralized decision-making	Augustine et al. (2005); Kalaiarasan (2022)

2.5 KEY PERFORMANCE INDICATORS IN AGILE-BASED CONSTRUCTION

Key Performance Indicators (KPIs) are essential for evaluating project success and guiding managerial decisions. Traditional construction projects focus primarily on time and cost indicators; however, agile oriented projects require a broader performance measurement framework (Serrador & Pinto, 2015).

Table 3. Key Performance Indicators (KPIs) Used in Agile-Based Construction Studies

SL. NO.	KPI CATEGORY	KPI	DESCRIPTION	KEY REFERENCES
KPI1	Time	Schedule Variance	Planned vs actual duration	Serrador & Pinto (2015)
KPI2	Cost	Cost Variance	Budget deviation	Badran & Abdallah (2025)
KPI3	Quality	Rework Rate	Frequency of corrective work	Mostafa et al. (2016)
KPI4	Productivity	Labour Productivity	Output per labour unit	Sertyesilisik (2014)
KPI5	Client	Client Satisfaction	End-user feedback	Arefazar et al. (2019)
KPI6	Collaboration	Communication Effectiveness	Team coordination quality	Chathuranga et al. (2023)
KPI7	Safety	Accident Frequency Rate	Safety performance	Moshood et al. (2024)

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III. RESEARCH GAP IDENTIFIED

A review of the selected twenty-four studies indicates that although Agile Project Management (APM) has gained increasing attention in the construction domain, its application remains limited and fragmented, particularly in residential construction projects. Most existing studies focus on the conceptual feasibility of agile methodologies or their application during design and pre-construction stages, with relatively limited attention given to execution-stage implementation.

Furthermore, while several studies identify agile practices and success factors, they often examine these elements in isolation. There is a notable lack of integrated frameworks that systematically link agile practices with measurable project performance outcomes. In particular, the relationship between agile execution and Key Performance Indicators (KPIs) such as time, cost, quality, productivity, safety, and stakeholder satisfaction remains insufficiently explored.

Additionally, existing literature frequently addresses either lean–agile integration or performance measurement systems separately, without combining both within a unified execution framework. Although barriers to agile adoption such as organizational resistance, contractual rigidity, and regulatory constraints are well documented, limited research proposes practical mechanisms to address these challenges during project execution.

Overall, the literature highlights a clear gap in the development of a structured Agile–KPI-based execution framework specifically tailored to residential construction projects. Addressing this gap forms the primary motivation of the present study.

IV. CONCLUSION

This study presented a literature-based analysis of Agile Project Management practices and Key Performance Indicators in the context of residential construction projects. The review demonstrates that traditional project management approaches often lack the flexibility required to manage uncertainty and frequent changes in residential construction. Agile Project Management offers a promising alternative by promoting adaptability, collaboration, iterative planning, and continuous feedback.

The findings indicate that agile practices can positively influence project performance in terms of time, cost, quality, productivity, safety, and stakeholder satisfaction. However, adoption in residential construction remains constrained by organizational, cultural, contractual, and regulatory challenges. A key outcome of this study is the identification of the absence of an integrated execution-level framework that links agile practices with measurable performance indicators.

By synthesizing existing research, this study provides a strong theoretical foundation for the development of an Agile–KPI-based execution framework for residential construction projects. Future research can build upon this foundation by developing and empirically validating such frameworks using real-world project data.

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