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Impact of Artificial Intelligence Adoption on IT Project Performance: A Moderated Mediation Model

by

Nudrat Niaz

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With profound gratitude,

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Abstract

The rapid adoption of artificial intelligence (AI) is transforming how organizations manage projects, yet how this adoption translates into improved project outcomes remains underexplored. This study examines the impact of AI adoption on project performance in software development small and medium-sized enterprises (SMEs) in Pakistan, using a moderated mediation research design. Specifically, the study investigates the mediating role of innovation capability in the relationship between AI adoption and project performance. Furthermore, it examines the moderating effect of managerial AI skills on the relationship between AI adoption and innovation capability, as well as the moderating effects of strategic agility on the relationships between AI adoption and project performance and between innovation capability and project performance. The study is grounded in Dynamic Capability Theory, which provides a theoretical basis for understanding how organizations sense, seize, and reconfigure AI-related resources to build innovation capability and sustain competitive project performance. A quantitative research approach was employed, and data were collected through a structured questionnaire administered to employees and professionals working in software development SMEs in Pakistan. The proposed research model was analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) through SmartPLS 4. The findings indicate that AI adoption has a significant positive effect on project performance, and that innovation capability significantly mediates this relationship. Managerial AI skills significantly and positively moderate the relationship between AI adoption and innovation capability, such that this relationship strengthens as managerial AI skills increase. In contrast, strategic agility exhibits divergent moderating effects: it significantly and positively strengthens the relationship between innovation capability and project performance, but strategic agility negatively moderates the relationship between AI adoption and project performance, suggesting that higher levels of strategic agility weaken the direct positive effect of AI adoption on project performance. This study contributes to the growing body of knowledge on AI-enabled project management by providing empirical evidence from software development SMEs in Pakistan. The findings also offer practical

implications for managers by emphasizing the importance of developing managerial AI skills to maximize the benefits of AI adoption, strengthening innovation capability to improve project performance, and carefully aligning strategic agility with AI adoption to achieve sustainable project performance.

Keywords: Artificial Intelligence Adoption, Project Performance, Innovation Capability, Managerial AI Skills, Strategic Agility.

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Abbreviations

AI	Artificial Intelligence
CI/CD	Continuous Integration / Continuous Development
DCT	Dynamic Capability Theory
DV	Dependent Variable
IC	Innovation Capability
IV	Independent Variable
MAIS	Managerial AI Skills
MLP	Machine Learning Pipeline
PM	Project Management
PP	Project Performance
RBV	Resource-Based View
SA	Strategic Agility
TFP	Total Factor Productivity

Chapter 1

Introduction

The introduction section explains the research background, gap analysis, problem statement, research questions, research objectives, theoretical foundation and significance of the research.

1.1 Background

Artificial Intelligence is leading the Fourth Industrial Revolution and changing the way software development companies produce, develop, and deliver software solutions ([Hossain, 2023](#)). Despite artificial intelligence adoption, software project continuously faces challenges related to the schedule delay, cost overrun, software defects, inadequate stakeholder communication and ineffective project management. In Pakistan, these issues are caused due to poor planning, inaccurate cost and time estimation, weak requirements engineering, inadequate testing, untrained developers, and insufficient stakeholder communication ([Anjum and Mustafa, 2017](#); [Hamid et al., 2020](#); [Sheikh and Sarim, 2023](#)). These constant issues have encouraged software development companies to look for advanced technological solutions that can improve project performance and execution.

In response to these challenges AI adoption has become a strategic requirement rather than just a technological solution. AI technologies help enterprises automate repetitive tasks, facilitate data-driven decision-making, enhance software

quality, and maximize resource usage throughout the software development life cycle (Ghorbani, 2023; Javaid et al., 2022). By facilitating requirements analysis, coding, testing, deployment, and maintenance, applications like machine learning, natural language processing, predictive analytics, generative AI, and intelligent development and operations (DevOps) enable businesses to increase productivity while cutting down on development time and human effort (Abbas et al., 2025).

Adoption of AI also encourages ongoing learning and process improvement, which helps software development companies adapt more successfully to shifting client demands and technological advancements (Allioui and Mourdi, 2023; Elango et al., 2025).

The increasing adoption of AI is further supported by empirical research demonstrating its impact on organizational efficiency and economic outcomes. Dohmke et al. (2023) indicated that over 30% of newly developed code was produced with AI support, highlighting the growing incorporation of AI in software development processes. Similarly, Gao and Feng (2023) founded that a one-percentage-point rise in AI adoption enhanced firm's total factor productivity by 14.2%, while Kikuchi (2025) reported that a 2.4% increase in productivity for Japanese firms are investing in AI technologies. Additionally, Moreira et al. (2024) explained that extensive AI implementation may enhance total labor productivity by 0.5–0.6 percentage points. These findings indicated that AI has emerged as a crucial strategic asset for enhancing organizational efficiency, innovation, and competitiveness.

The importance of adopting of AI is becoming increasingly clear in Pakistan's software sector, where digital transformation has rapidly progressed in recent years. The country's information technology industry grew by 47% from 2020 to 2023, with software exports reaching approximately US\$2.6 billion in 2023 (Arshad et al., 2024). Furthermore, around 34% of software companies in Pakistan have adopted AI-driven technologies into their processes, with the country's AI readiness continuing to improve (Hussain and Rizwan, 2024). Since the small and medium-sized enterprises (SMEs) make up nearly 90% of businesses in Pakistan, contribute around 40% to the national GDP, and represent nearly 25% of total exports (Soomro et al., 2025), the adoption of AI presents a significant opportunity

for software development SMEs to boost operational efficiency, refine decision-making, reduce development cost, and strengthen their competitive position.

Project performance has always been viewed as the primary indicator of project success. Traditionally, project performance was assessed via the "Iron Triangle" including cost, time, and quality. Nevertheless, scholars have argued that these dimensions alone are insufficient to capture the complexity of modern projects (Radujković and Sjekavica, 2017).

Consequently, project performance has transformed into a broader concept that also includes stakeholder satisfaction, effective decision-making, adaptability, and long-term organizational value (Ika, 2009; Su and Ayob, 2025). This broader perspective is especially relevant to software development projects, which operates in settings marked by rapid technical advancements, shifting consumer demands, and ongoing innovation.

While artificial intelligence adoption provides organizations with advanced technological capabilities, technology alone is insufficient to achieve sustainable improvements in project performance. Organizations must have the capability to convert AI-driven insights and technology into innovative products, methodologies, and operational practices. This capability is known as innovation capability, which reflects an organization's capacity to conceive, adopt, and execute new concepts and technologies to improve organizational performance (Moreira et al., 2024). In software development firms, innovation capability allows organizations to adopt AI technology into project tasks, enhance problem-solving, foster ongoing learning, and react proactively to evolving customer and market needs. Consequently, organizations with stronger innovation capability are better adept to utilize AI adoption to enhance project execution and deliver superior project performance (Gazi et al., 2024).

The effectiveness of AI adoption also depends on managerial competencies and strategic agility of organization. Managerial AI skills refer to the capacity of managers to comprehend AI technologies, facilitate their deployment, analyze AI-derived insights, and synchronize AI-driven projects with organizational goals (Mikalef and Gupta, 2021; Raisch and Krakowski, 2021). Managers possessing

robust AI competencies can enhance cooperation among technical teams and promote the efficient application of AI in software development projects.

In addition, organizations require strategic agility to respond effectively to rapidly changing technological and competitive environments strategic agility empowers firms to anticipate environmental shifts, reorganize resources, and modify strategies in response to new possibilities and challenges (Gao et al., 2015; Sherehiy et al., 2007).

This capability is particularly important in software development firms, where rapid innovation and changing customer requirements demand continuous adaptation (Haider and Kayani, 2021).

In developing economies such as Pakistan, the adoption of AI remains challenging because organizations often face shortages of AI-skilled employees, inadequate digital infrastructure, and limited readiness for innovation (Ali et al., 2025; Dwivedi et al., 2021). These challenges are particularly reagent for small and medium-sized enterprises in software development, which need to enhance their capacity to adopt AI technologies efficiently to get better project performance.

Accordingly, understanding how AI adoption, innovation capability, managerial AI skills, and strategic agility collectively influence project performance is important for software development SMEs operating in Pakistan's rapidly evolving technological environment.

1.2 Gap Analysis

Despite the growing adoption of artificial intelligence (AI) is becoming more widely across organization, limited understanding of how AI adoption improves project performance, especially in software development SMEs. this research has largely emphasized the operational and organizational advantages of AI, such as enhanced decision-making, automation, and organizational efficacy (Hashimzai and Mohammadi, 2024; Su and Ayob, 2025). Nevertheless, these studies offer a limited explanation of the organizational processes by which AI generates value at the project

level. Consequently, the relationship between artificial intelligence adoption and project performance remains insufficiently understood, especially in technology-driven project environments.

One potential reason for this gap is that earlier studies have given insufficient focus to the organizational competencies necessary for transforming AI-enhanced resources into efficient project results. Despite the acknowledgment of innovation capability as a significant organizational capability that facilitates knowledge creation and innovation ([Alaskar, 2023](#); [AlTaweel and Al-Hawary, 2021](#),?), there is limited empirical evidence that explains how it mediating the relationship between artificial intelligence adoption and project performance. Recent research recognizes that managers are essential in the execution of AI by analyzing AI-derived insights, promoting organizational learning, and ensuring alignment of AI projects with organization goals ([Giraud et al., 2023](#); [Jöhnk et al., 2021](#)).

Nonetheless, the influence of managerial AI skills in enhancing the connection between artificial intelligence adoption and innovation capability is still remains underexplored. Similarly, although strategic agility is recognized as an essential organizational competency to respond to dynamic business environment and enhancing project results ([Ameen et al., 2024](#); [Doz and Kosonen, 2010](#)), there is limited empirical study which examines whether the strategic agility is strengthening the relationship between innovation capability and project performance.

According to study ([Haider and Kayani, 2021](#)) strategic agility is crucial in converting organizational capabilities into successful project results, underscoring the significance of strategic agility in improving project performance within Pakistan's software industry.

Moreover, the majority of empirical research on AI adoption has been conducted in developed countries or large organizations, but there is relatively limited evidence from software development SMEs in developing countries like Pakistan. Difference in technology readiness, managerial competencies, organizational resources, and business environment may affect the impact of AI on project performance, thereby limiting the generalizability of existing research. Consequently, an in-depth analysis of the correlation between artificial intelligence adoption and

project performance, including the mediating role of innovation capability and the moderating effects of managerial AI skills and strategic agility, is essential in the context of Pakistan's software development SMEs.

This study fills the identified research gap, enhancing the current literature and offering context-specific empirical data on how organizations can effectively leverage AI-enabled capabilities to improve project performance.

1.3 Problem Statement

The rapid adoption of artificial intelligence has prompted software development firms to include AI technology into project planning, software development, testing, resource distribution, and decision-making procedures.

In Pakistan, small and medium-sized enterprises in software development are progressively allocating resources to artificial intelligence technologies to boost productivity, expedite software delivery, and enhance project performance. Beside these investments, many organizations still face project delays, budget excesses, quality concerns, changing customer demands, and inconsistent project results. This indicates that adoption of AI is insufficient to consistently enhancing project performance ([Faraj et al., 2018](#)).

A significant challenge faced by software development SMEs is their limited ability to convert AI-driven technologies into organizational competencies that generate enhanced project results. Although AI can offer significant insights, automate operations, and facilitate data-driven decision-making, organizations frequently have difficulties in efficiently leveraging these capabilities in project environment. A potential rationale is that effective AI implementation relies not only technology adoption but also on the organizational capabilities that enable organizations to transform AI-derived knowledge into enhanced project practices and outcomes ([Hossain et al., 2024](#); [Mikalef et al., 2023](#)).

Moreover, managers must possess sufficient managerial AI skills to comprehend AI-generated insights, enable AI integration, and align AI initiatives with project

objectives, while organizations need strategic agility to swiftly adapt to technological advancements and shifting market demands (de Diego Ruiz, 2023).

Despite the significance of these capabilities for the effective use of AI, their combined impact on project performance through innovation capability is not yet fully comprehended, particularly in software development SMEs that operate in developing economies like Pakistan.

Consequently, it is essential to examine the impact of artificial intelligence adoption on project performance, mediated by innovation capability, while accounting for the moderating role of managerial AI skills and strategic agility.

Addressing this problem will provide empirical evidence to help software development SMEs better utilize AI technologies, strengthen organizational capabilities, and improve project performance in an increasingly dynamic and technology-driven environment.

1.4 Research Questions

The following are the research questions:

1.4.1 Research Question 1

Does the AI adoption affect the project performance in software development companies at the SME level?

1.4.2 Research Question 2

Does the innovation capability mediate the relationship between AI adoption and project performance?

1.4.3 Research Question 3

Do managerial AI skills moderate the relationship between artificial intelligence adoption and innovation capability?

1.4.4 Research Question 4

Does strategic agility moderate the relationship between AI adoption, innovation capability, and project performance?

1.5 Research Objectives

1.5.1 Research Objective 1

To investigate the direct relationship between artificial intelligence adoption and project performance in software development companies at the SME level.

1.5.2 Research Objective 2

To analyze the mediating role of innovation capability between artificial intelligence adoption and project performance.

1.5.3 Research Objective 3

To determine the moderating role of managerial AI skills concerning the relationship between artificial intelligence adoption and innovation capability.

1.5.4 Research Objective 4

To examine the moderating effect of strategic agility on AI adoption, innovation capability, and project performance.

1.6 Research Hypotheses

H1: Artificial intelligence adoption has a positive impact on project performance.

H2: Artificial intelligence adoption has a positive impact on innovation capability.

H3: Innovation capability has a positive impact on project performance.

H4: Innovation capability mediates the relationship between artificial intelligence adoption and project performance.

H5: Managerial AI skills positively moderate the relationship between artificial intelligence adoption and innovation capability, such that the impact of AI adoption on innovation capability is stronger when managerial AI skills are high.

H6: Strategic agility positively moderates the relationship between artificial intelligence adoption and project performance, such that the impact of AI adoption on project performance is stronger when strategic agility is high.

H7: Strategic agility positively moderates the relationship between innovation capability and project performance, such that the impact of innovation capability on project performance is stronger when strategic agility is high.

1.7 Research Significance

This research is significant as it focuses on the increasing demand in order to determine how the artificial intelligence adoption may improve project performance in software development SMEs within Pakistan. Even though businesses are investing more in AI technologies to improve project planning, decision-making, and operational efficiency, there is still a lack of empirical data demonstrating how AI improves project performance, especially in developing nations ([Barata et al., 2023](#); [Su and Ayob, 2025](#)). This analysis explores the link between the artificial intelligence adoption and project performance, while considering the mediating role of innovation capability and the moderating influences of managerial AI skills and strategic agility. As a result, the study provides a more complete knowledge of the organizational capabilities required to realize the benefits of AI adoption in project environment.

This study also contributes to the existing literature by offering empirical evidence on the mediating role of innovation capability which explains how businesses convert AI-enabled knowledge into better project performance.

Although previous studies highlight the role of AI in encouraging innovation, there is limited empirical research focusing on innovation capability as the mechanism between artificial intelligence adoption and project performance, particularly in software development SMEs ([Alaskar, 2023](#); [AlTaweel and Al-Hawary, 2021](#)).

By examining this relationship, the study contributes to the growing body of knowledge on AI-enabled project management and extends the application of dynamic capability theory in technology-driven project environments.

In addition, this analysis explores the moderating effects of managerial AI skills and strategic agility, aspects that have been limited studied in previous studies on AI and project management.

Managers equipped with substantial AI capabilities can more effectively analyze insights produced by AI, synchronize AI initiatives with project goals, and promote the efficient application of AI technology ([Mikalef et al., 2023](#)).

In a comparable manner, organizations demonstrating superior strategic agility are better equipped to address technological shifts, reorganize resources, and adjust project strategies in response to evolving business environment ([Ameen et al., 2024](#); [Doz and Kosonen, 2010](#)).

Examining these capabilities provides practical insight on the scenarios in which AI adoption can produce improved project performance.

Furthermore, the findings of this study are expected to benefit software development organizations, project managers, high-level executives, and politicians by supplying data-driven recommendations for the successful integration of AI technology.

The analysis presents practical recommendations for strengthening innovation capability, managerial AI skills, and expanding strategic agility to optimize the benefits of AI adoption and boost project performance.

The findings may moreover facilitate the digital advancement of Pakistan's software industry by helping enterprises establish AI-enhanced abilities that boost competitiveness, innovation, and enduring organizational efficacy.

1.8 Theoretical Foundation

There are several theoretical approaches that can be used to evaluate the variables in this research, including Resource-Based View (RBV), Innovation Theory, and Socio-Technical Systems Theory. However, to analyze the particular linkages among all key variables, adoption of artificial intelligence, project performance, innovation capability, managerial AI skills, and strategic agility, the research has been undertaken based on dynamic capability theory, because it focuses on how organizations combine, restructure, and reallocate their resources to emerge successful in rapidly changing technological environments (Teece et al., 1997). According to DCT, the key elements of competitive advantage in rapidly changing environments are sensing, seizing and transforming (Teece et al., 1997; Teece, 2007). When implementing this in the software development context, DCT can help clarify the role of AI as a tool that can facilitate constant evolution within an organization. The dynamic capabilities that a company builds and maintains determine its capability to convert technology potential into performance (Ma et al., 2021).

In this context, adoption of AI provides the sensing dimension by providing organisations with the ability to identify project risk, respond to market signals and to process complex data environments in real time (Mikalef et al., 2019; Yoshikuni et al., 2024). The seizing mechanism is the innovation capability, which buffers the relationship between adoption of AI and project performance, as it is the organization's ability to translate AI insights into actionable innovations, new processes, and project improvements (Ashrafi et al., 2019; Eisenhardt and Martin, 2017; Teece et al., 1997). The relationship between AI adoption and innovation capability is moderated by managerial AI skills, which are part of the transforming dimension: managers with high managerial AI skills are more likely to interpret the information provided by AI, to lead its incorporation in project activities, and to translate the AI recommendations into strategic decisions that enhance the organization's innovation capability (Dess and Picken, 2000; Mikalef et al., 2023; Raisch and Krakowski, 2021). Likewise, within the transforming dimension,

strategic agility is found to moderate the relationship between innovation capability and project performance, allowing organizations to quickly reorient resources and project structures to take advantage of new innovations enabled by AI ([Doz and Kosonen, 2010](#); [Teece et al., 1997](#)). This study offer a theoretically sound and empirically analyzable framework with a foundation in DCT to study the effect of the adoption of AI on the project performance of software development firms at the SME level in Pakistan.

1.9 Definitions of Variables

1.9.1 Independent Variable: Artificial Intelligence Adoption

Artificial intelligence adoption refers to the extent to which an organization incorporates AI technologies into its project management and business operations. It reflects the use of AI technologies such as machine learning, natural language processing, predictive analytics, and intelligent automation, are used by organizations to support decision-making, optimize resource allocation, enhance project planning, anticipate risks, and boost operational efficiency. In the project management domain, AI is applied to automate scheduling, predict risks, allocate resources, and generate strategic insights, enabling enhanced decision-making under uncertainty ([Bah Esseme et al., 2025](#); [Fan et al., 2025](#)).

1.9.2 Dependent Variable: Project Performance

Project performance is referred to which a project successfully meets its goals in terms of budget, schedule, quality, stakeholder satisfaction, and overall project effectiveness. Contemporary perspectives extend beyond the traditional Iron Triangle by incorporating factors such as adaptability, innovation, and stakeholder value creation. In the context of this study, project performance reflects the ability of software development projects to achieve successful outcomes through the effective utilization of AI-enabled capabilities ([Gabriel, 2026](#)).

1.9.3 Mediating Variable: Innovation Capability

Innovation capability is organization's ability to develop, adopt and implement novel concepts, technologies, procedures, or goods that enhance organizational performance is referred to as innovation capability.

It enables software development firms to effectively utilize technological knowledge, respond to changing customer needs, and adapt to emerging technologies such as Artificial Intelligence, machine learning (ML), and cloud computing. By facilitating continuous learning and adaptation, innovation capability enables organizations to respond effectively to evolving market demands and sustain their competitive advantage ([Battor and Battor, 2010](#); [Lawson and Samson, 2001](#)).

1.9.4 Moderating Variable: Managerial-AI skills

Managerial-AI skills refer to necessary skills managers should have to properly direct, oversee and capitalize on the artificial intelligence technologies in the organization setting. These are strategic and technical knowledge on how to find opportunities to utilize AI, managerial and communication skills that are needed to plan the adoption of AI into organizational operations and teams, and the analytical judgment ability to interpret and assess AI-generated insights in order to promote innovation and informed managerial decision-making.

These abilities will enable managers to successfully transform AI implementation to increased organizational innovation and better project results ([Giraud et al., 2023](#)).

1.10 Moderating Variable: Strategic Agility

Strategic agility refers to an organization's capability to rapidly sense environmental changes, respond to emerging opportunities and threats, and reconfigure resources and strategies to maintain competitive advantage ([de Diego Ruiz, 2023](#)). Within project-based organizations, strategic agility represents the capability of

the organization to continuously monitor environmental shifts and respond by rapidly reallocating project resources, scope, and objectives. This agility enables timely adjustments to project priorities and resource allocation while ensuring that such adjustments remain aligned with the organization's long-term strategic direction, thereby allowing projects to generate continuous strategic value.

Chapter 2

Literature Review

This chapter critically analyzes the research on artificial intelligence and project performance with managerial-AI skills and strategic agility as moderating variables and innovation capability as a mediating variable. The chapter shows the role of AI implementation in dynamic situations in enhancing project performance, where the organizational competencies are supportive. The review determines significant gaps in research and formulates a conceptual framework and hypotheses on empirical investigation through Dynamic Capabilities Theory.

2.1 Underpinning Theory Dynamic Capability Theory

This research is grounded in Dynamic Capability Theory (DCT), introduced by Teece et al. (1997), as it offers an extensive theoretical framework for explaining how organizations develop, integrate, and reorganize resources and capabilities to attain exceptional performance in rapidly evolving business environments. In contrast to theories that mainly highlight the ownership of valuable assets, like the Resource-Based View (RBV), Dynamic Capability Theory prioritizes an organization's capacity to continually adjust, innovate, and modify its current resources in response to technological and environmental shifts Teece (2007). This distinction is significant for the current research: a Resource-Based View (RBV) perspective

would suggest that companies with superior AI assets will inherently excel over those with lesser resources; however, empirical findings reveal significant variation in innovation results even among firms with similar AI investments [Sullivan and Wamba \(2024\)](#) a trend that dynamic capabilities theory (DCT) can elucidate more effectively, as it posits that resource ownership is essential but insufficient without the ability to perceive, capture, and adapt in relation to that resource. As software development companies continuously embrace artificial intelligence (AI) technologies, organizations require capabilities that allow them to not only deploy AI but also to proficiently leverage AI-generated insights to enhance project performance. Consequently, dynamic capability theory offers a suitable theoretical framework for analyzing the correlation between artificial intelligence adoption and project performance in software development SMEs.

Dynamic Capability Theory posits that organizations sustain competitive advantage via three interconnected capabilities: sensing, seizing, and transforming ([Teece, 2007](#)). Sensing is referring to an organization's capacity to identify opportunities, acknowledge emerging technologies, and observe alterations in both its internal and external landscapes. Seizing refers to the utilization of organizational assets to capitalize on recognized opportunities via innovation and strategic decision-making, whereas transforming refers to the ongoing reorganization of organizational resources, capabilities, and processes to sustain competitiveness in dynamic environments ([Teece, 2007](#)). This distinguishes them from the activities that can be separated and allocated to different organizational functions and instead focuses on how they are connected in a continuous cycle where every stage is informing and being shaped by the others a nuance these activities and their mapping as variables in this study will focus on, as opposed to each activity being seen as an isolated step that is exclusively related to one stage.

Artificial intelligence adoption is defined as the ability of software development companies to gather, process, and analyse large amounts of data concerning projects, detect potential risk, recognize new opportunities, and assist in data-driven decision-making ([Mikalef et al., 2023](#); [Yoshikuni et al., 2024](#)). This however is not enough to boost the performance of the organisation, or performance of

the project, as dynamic capability theory suggests, and the literature is largely in agreement that there is a gap between the identification of opportunities and the performance of the project: some authors believe the gap lies in the lack of technical integration ([Yoshikuni et al., 2024](#)), others in the managerial and organisational capability, not in technology ([Raisch and Krakowski, 2021](#)). This study adopts the different approach, viewing capability gaps rather than technological limitations as the binding constraint on AI-driven innovation. Organizations must therefore possess capabilities that enable them to transform AI-generated insights into innovative solutions, improved processes, and effective project practices.

From this perspective, innovation capability represents the organizational mechanism through which AI-enabled knowledge is translated into value-creating activities. Innovation capability is a capability that helps the organizations create new ideas, enhance existing processes and adopt innovative project solutions which improve project performance ([Eisenhardt and Martin, 2017](#)). Hence, the concept of innovation capability was considered as the mediator between artificial intelligence adoption and project performance in the research model. AI does not directly produce better project results; instead, the value lies in the ability of an organisation to use AI-powered knowledge in a way that enhances project performance and the learning of the organisation.

DCT also suggests that managerial skills and the capability of the organization to adjust to changes in the environment are also elements that influence organizational capabilities. In a project environment where AI is being used, the role of managers is critical for interpreting the results of the AI-generated insights, incorporating AI into the project activities, and ensuring that the AI initiatives are aligned with the organization's objectives. As a result, managers with higher managerial AI skills can more effectively support the use of AI technologies and have a higher potential capacity to build innovation capability ([Mikalef et al., 2023](#)). Likewise, strategic agility helps firms continuously adjust strategies, reconfigure resources and react quickly to changes in the technology and market, thus enhancing their capacity to harness innovation to increase project performance ([Ameen et al., 2024](#); [Doz and Kosonen, 2010](#)). Both these moderating abilities work at

different levels of analysis: managerial AI skills on the individual and managerial level and strategic agility on the organizational level; however, both take the same theoretical function within DCT's transforming stage, which is to support the capacity of the organization to effectively employ AI enabled capabilities in dynamic project situations, rather than creating project performance on their own ([Haider and Kayani, 2021](#)).

Dynamic capability theory is able to explain the relationship between artificial intelligence adoption and project performance in a coherent manner.

On the contrary, AI-generated knowledge is translated into innovative project practices through innovation capability, and managerial AI skills & strategic agility are enhanced to effectively develop and deploy these skills.

Hence, dynamic capability theory provides a robust theoretical foundation to explain the relationships of proposed variables of artificial intelligence adoption, innovation capability, managerial AI skills, strategic agility, and project performance in software development SMEs in Pakistan.

2.2 Artificial Intelligence Adoption and Project Performance

AI has increasingly become an inherent component of contemporary project management, with growing literature on its influence on decision-making, accuracy in project planning, and the general outcome of a project ([Dwivedi et al., 2021](#); [Wamba-Taguimdje et al., 2020](#)).

AI is no longer used to automate simple project-related tasks into complex predictive analytics and intelligent insights that can be used by project managers throughout the project life cycle ([Bahadori-Jahromi et al., 2025](#); [Teece, 2018](#)).

Repetitive and routine tasks, such as automated code generation, automated testing, automated documentation and so forth, are automated to reduce human error and accelerate development cycles, thereby improving the time and quality components of the classic so-called Iron Triangle ([Dohmke et al., 2023](#)). [Kozhakhmetova](#)

[et al. \(2024\)](#) reported that time spent on routine task is reduced by 30-40% due to AI adoption. This enables developers involved in the project to focus on complex problem-solving and strategic processes.

[Su and Ayob \(2025\)](#) further observe that AI significantly contributes to the completion of a project, particularly its optimisation in terms of anticipations, shorter delays, and reducing costs, with machine learning being the most frequently deployed form of AI in a project context. AI-powered allow preventing the emergence of risks in advance, reducing the number of project disruptions by 30-50 percent, and predicting issues with up to 70-80% accuracy rates in comparison with customary techniques ([Xu et al., 2025](#)).

Empirical evidence from the IT, construction, and manufacturing domains also confirms that AI-based applications, such as predictive models, natural language processors, and automated reporting tools, can be used to improve the accuracy of scheduling, improve communication, and enable risk detection beforehand ([Hossain et al., 2024](#); [Kozhakhmetova et al., 2024](#)). Research indicates that AI improves operational efficacy and managerial control, which boosts project performance ([Taboada et al., 2023](#)). Recent research emphasizes that AI not only enhances the outputs of the project by automating them but also enhances the overall organizational capabilities. [Diameh et al. \(2025\)](#) reported that AI would improve iterative decision-making and precision in the estimates, whereas [Joshi \(2024\)](#) points out the significance of AI in systematic planning, knowledge preservation, and performance monitoring. It signifies the change towards the vision of AI as a skill affecting not only traditional indicators (time, cost, quality) but also wider ones (adaptability, efficiency).

The dynamic capability theory, which postulates that the key to sustained project performance when operating in dynamic environments is the capacity to recognize opportunities and threats, seize opportunities by making wise decisions, and transform or restructure resources and processes ([Teece, 2007](#); [Teece et al., 1997](#)). Through risk anticipation, action planning, and predictive analytics, AI enhances seizing capabilities. [Su and Ayob \(2025\)](#) PRISMA-based review shows that AI-powered predictive and risk-modeling applications significantly enhance project

performance by improving scenario planning, facilitating early risk identification, and identifying hidden failure points. This improves managerial foresight, decision quality, and overall project resilience.

The AI-powered project management tools eliminate repetitive work, and the remaining managers can focus on strategic work (Hossain et al., 2024; Kozhakhmetova et al., 2024). AI also supports data-driven decision-making, neutral and effective scheduling, and intelligent resource allocation to seize capabilities. By transforming observed information into timely and appropriate project decisions, AI will assist enterprises in making better use of technological potential (Joshi, 2024).

Furthermore, through continuous learning, adaptive planning, and process reconfiguration, AI enables a project-based organization to adjust workflows and strategies as project requirements change (Kozhakhmetova et al., 2024).

Despite these advantages, some researchers warn that organizational preparedness and complementary skills will determine how AI affects performance. AI efficacy is frequently constrained by problems with data quality, difficulties integrating systems, financial limitations, and a lack of digital expertise (Saha, 2019; Srinivasan, 2025). Uncertainty about automated systems, resistance to change, and a lack of AI competence complicate the successful implementation of AI in projects (Nabeel, 2024). Organizations with strong learning orientations, adaptable cultures, and dedicated leadership are better positioned to convert AI investments into excellent project performance outcomes, according to dynamic capability theory (Kozhakhmetova et al., 2024). Uncertainty about automated systems, resistance to change, and a lack of AI competence complicate the successful implementation of AI in projects (Nabeel, 2024). Overall, literature shows that AI enhances predictive accuracy, decision quality, efficiency, and flexibility, all of which have a beneficial impact on the performance of projects. However, these advantages are mostly achieved when AI is integrated into organizational procedures as a dynamic capability rather than being viewed as a stand-alone technology, in line with DCT. The claim that AI improves project performance by facilitating sensing, seizing, and transforming mechanisms within project-based organizations is supported by

this theoretical viewpoint. Based on the above discussion, we propose the following hypothesis

H1: Artificial intelligence adoption has a positive impact on project performance.

2.3 Artificial Intelligence Adoption and Innovation Capability

Artificial Intelligence has turned into an influential power in improving the degree of innovativeness in companies, particularly in software development contexts where rapid product development and technological adaptation are necessary. AI can always improve the ability of a company to examine new ideas, accelerate the prototyping process, advance existing products, and exchange expertise between teams (Han et al., 2025). Wang et al. (2025), conceptualize two dimensions of AI: discovery-oriented AI fosters exploration and reduces uncertainty in the initial stages of innovation, and optimization-oriented AI enhances the refinement of the process by means of automated testing and A/B experimentation. Such processes enable the firms to identify new opportunities, validate innovative ideas in a better way, and reduce time-to-market.

Adoption of AI improves knowledge integration both within and across organizational boundaries, strengthening innovative capabilities. Ettinger (2025) find that AI adoption increases the innovation potential by enhancing knowledge integration, both internally and externally, mediating the improvement of the product development performance, particularly in the environments that are highly characterized by the R&D. This brings out the fact that the benefits of AI extend beyond automation and affect cognitive and collaborative factors that define the prospects of innovation.

AI transforms the research and development operations with routine tasks being automated, and engineers are able to focus on higher design and problem-solving

activities. According to [Gutiérrez \(2020\)](#) and [Alenezi and Akour \(2025\)](#), automated code generation, intelligent debugging, and predictive maintenance tools can allow teams to prototype faster and are more resource-efficient. AI-based methods of integration with lean startup strategies and short cycles of the prototyping process improve the process of idea testing, enabling managers to narrow down product concepts more precisely ([Wang et al., 2025](#)).

This view is supported by [Ying and Jin \(2024\)](#), who provide empirical data to support their ideas that the teams that apply AI to their work make more data-driven decisions and achieve higher levels of development performance due to improved knowledge exchanges.

These findings indicate that AI can help increase innovation capability, allowing the company to manage experimentation in an even more systematic way and reduce uncertainty in the preliminary exploration and final optimization phases.

Theoretically, DCT can be used to illustrate how artificial intelligence and innovation capability are interdependent. According to [Cimino et al. \(2025\)](#) and [Li et al. \(2025b\)](#) sustained innovation capabilities that an organization be able to recognize new opportunities, take advantage of those opportunities by making good use of resources, and adapt organizational processes and assets in response to environmental change.

AI strengthens the capacity for innovation by improving each of these movements. AI enables more thorough data analytics, trend detection, and probability recognition of large and heterogeneous data, its sensing skills are enhanced. By reducing uncertainty and improving the capacity to identify potential innovation directions, discovery-oriented AI supports early stages of research ([Wang et al., 2025](#)). Additionally, AI facilitates quick experimentation, automated testing, and optimization to help businesses turn prospects into profitable goods and services ([Ying and Jin, 2024](#)).

AI that encourages ongoing learning, architectural flexibility, and reconfiguration of innovative processes can also change the capabilities. [Costa and Almeida \(2024\)](#) emphasize that investments in digital technologies, AI process management, and cross-departmental integration are examples of dynamic capabilities that improve

the outcomes of innovation, particularly in small and medium-sized technology-driven businesses. Similarly, according to [Ettinger \(2025\)](#), one of the key dynamic characteristics that will enable the scalable and sustainable integration of generative AI is business architecture. AI becomes a sustainable innovation capability when data flows, governance structures, and model lifecycle management are included into organizational systems.

Beyond workflows and architecture, AI also changes the design and conceptualization strategies. [Batarseh et al. \(2020\)](#) note that AI-driven software engineering tools move routine activities to automated processes so that human designers could focus on defining problems, thinking creatively, and ethically, which are vital elements of the innovation capability.

Automation and human creativity interplay can enable businesses to develop more revolutionary ideas about new products, such as smart assistants or predictive platforms, as noted in a variety of theoretical and case-based studies ([Alenezi and Akour, 2025](#); [Gutiérrez, 2020](#); [Wang et al., 2025](#)).

Although AI can significantly expand the capacity of innovation, there are a number of impediments that prevent its full realization. Technical constraints, such as model reliability, integration complexity and challenges with maintaining machine learning pipeline (MLP) in continuous integration and continuous development (CI/CD) contexts are common barriers mentioned in reviews ([Batarseh et al., 2020](#); [Ghorbani, 2023](#); [Gutiérrez, 2020](#)). The lack of capacity of firms to transform AI implementation into tangible innovation outcomes is caused by organizational constraints, such as the absence of proper governance frameworks, insufficient interdepartmental cooperation, and not aligning it with innovation workflows ([Ettinger, 2025](#); [Wang et al., 2025](#)). The shortage of AI engineering and data science tools is something many companies are faced with to deploy AI in product development and architectural structures ([Alenezi and Akour, 2025](#); [Gutiérrez, 2020](#)). According to the dynamic capability theory, these limitations suggest that AI can only boost innovation when it is combined with other organizational capacities, learning systems, and adaptive systems. The hypothesis suggested is as follows based on the available literature.

H2: Artificial intelligence adoption has a positive impact on innovation capability.

2.4 Innovation Capability and Project Performance

The innovativeness is widely perceived as the important determinant of project performance that enables organizations to deal with uncertainty, generate new solutions, and improve the efficiency of performance. An organization's capability for innovation leads to improved project performance; organizations that are more adept at creating, assimilating, and utilizing new information are more likely to succeed ([Adanzounon et al., 2025](#)). According to [Chen \(2014\)](#), drivers of innovation such as technology management, the usage of resources and human factor facilitators significantly enhance innovation capability which in its turn explains 34.42% of the difference in the success of capital projects. Similarly, [Wang and Li \(2022\)](#) find out that the capability to collaborate in innovation directly improves the outcomes of a construction project because the stronger the focus on innovation in a team, the more benefits of improved coordination, knowledge sharing, and problem-solving.

Learning and absorptive capacity play a vital role in improving the relationship between project performance and innovation capability. [Hu et al. \(2023\)](#) prove that both organizational and individual learning contribute to the increase in the engineering innovation and the performance of hydropower project, with the focus on learning as a significant contributor to the innovative project activity. As explained by [Gonzalez \(2024\)](#) the realized absorptive capacity, which is the ability of an organization to absorb and exploit external knowledge, plays a very crucial role in project innovation and performance, particularly when it is supported by a strong learning culture. Combined with the above results, innovation capability can improve the outcome of the project by leading to a higher degree of proficiency of the organization in the interpretation, integration, and effective use of the new knowledge.

The dynamic capability theory can theoretically provide a clear explanation of the relationship between project performance and innovation capability.

This is due to DCT assumption that an organization's capability to perform in a dynamic and uncertain environment depends on its capacity to recognize opportunities, take advantage of them through efficient resource allocation and decision-making, and modify its operational procedures in order to stay competitive (Ma et al., 2021; Teece, 2018; Teece et al., 1997).

In the context of projects, one of the most basic manifestations of these dynamic capacities is an innovation capability. Throughout the project life cycle, the capacity to innovate improves the sensing capabilities that enable project teams to identify new risks, technical opportunities, and alternative solutions. Through improved experimentation and idea generation, organizations are better equipped to anticipate changes and respond proactively.

According to Wang and Li (2022) and Hu et al. (2023), innovation capability also facilitates seizing capacities by enhancing the quick deployment of new information, tools, and methodologies to realize the efficiency of project planning, coordination, and execution.

Additionally, innovation capability contributes to the transformation of capabilities by allowing businesses to adjust project procedures, workflows, and governance mechanisms in response to project requirements and environmental uncertainties.

Similar to DCT, research suggests that the innovation capability typically acts as a transitional mechanism that transforms organizational resources and capabilities into high-performing initiatives (Migdadi, 2021).

Chen (2014) indicate that the stimulating factors impact on the performance of the project primarily through the innovation capability rather than direct pathways, which underscores the importance of innovation in the value creation processes. Saeed et al. (2022) also demonstrate that the concept of innovation capability mediates between the impact of organizational flexibility on project portfolio performance, and the tendency of this mediating role is greater in an environment of high uncertainty. Kusumawijaya and Astuti (2025) illustrate in the construction

sector that dynamic capabilities and knowledge management enhance the success of projects through the innovation process, which promotes the idea that innovation capability is the channel through which organizational strengths become the performance advantages.

The broader relevance of this mediating process is also supported through the research of [Zare Khafri et al. \(2023\)](#), who prove that the ability to innovate indirectly improves the performance of the SMEs through lean-agile project-office structures.

Research proves the performance of innovation capabilities and its mediating roles with respect to learning, absorptive capacity, flexibility, knowledge management and dynamic capabilities ([Chen, 2014](#); [Gonzalez, 2024](#); [Hu et al., 2023](#); [Saeed et al., 2022](#); [Wang and Li, 2022](#); [Zare Khafri et al., 2023](#)).

In line with dynamic capability theory, the results demonstrate that the innovation ability can facilitate organizations to constantly change, re-model project procedures, and harness knowledge assets, hence, boosting project performance in dynamic environment. Considering the arguments outlined above, we suggest the following hypotheses.

H3: Innovation capability has a positive impact on project performance.

2.5 Mediating Role of Innovation Capability

The capability to innovate has gained greater recognition as one of the primary aspects through which artificial intelligence enhances the projects performance, particularly in technology-driven and knowledge-intensive environments. In the context of software development, the rapid development of AI-based tools, such as predictive analytics or automatic code generation platforms, present businesses with new opportunities to improve their processes, products, and project flows. However, the benefits of AI performance do not emerge immediately, but they depend on the ability of an organization to assimilate, combine, and act upon AI-based insights, a competence that has generally been perceived as innovation capability ([Teece, 2007](#)).

According to the dynamic capability theory (Teece, 2007; Teece et al., 1997), performance benefits are maintained when businesses are able to develop the capacity to sense opportunities, seize technological opportunities, and alter organizational routines in response to environmental change.

Innovation capability is a dynamic capability that allows businesses to incorporate AI-driven insights into practical project upgrades in the context of AI-driven project ecosystems, hence mediating the relationship between AI adoption and project performance.

The literature defines innovation capability as a complicated organizational ability that encompasses creativity, technological experimentation, integration of knowledge, and development and execution of new ideas (Batista et al., 2025).

In situations where organizations use AI tools, such systems generate a vast number of informational products, such as predictive models, automated solutions, optimization insights, but it is the ability to innovate that enables teams to transform these outputs into useful improvements.

Research show that AI enhances exploratory learning, increases the problem-solving process, and gives the knowledge a better integration, and these factors contribute to innovation in software project processes and products (Cohen and Levinthal, 1990; Sahoo et al., 2024). Companies with the strong innovation capability will be much more adept at identifying the new project risks, optimizing the work processes, and embracing AI-based enhancements that directly affect efficiency, quality, and responsiveness.

The mediator role of innovation capability in the correlation between AI and project performance is increasingly supported using empirical evidence. It has been shown that even though the direct impact of AI adoption is the increase in productivity, its highest impact is achieved when it stimulates innovative working practices, encourages experimentation, and allows continuous process improvement (Sebrek et al., 2024). Gama and Magistretti (2025) found that those companies that had improved innovation capability were better able to incorporate AI-derived knowledge in project management workflows, which resulted in better schedules, outstanding quality outcomes, and customer satisfaction. Similarly,

Siddiqui (2024) observed that software companies that integrated AI into the innovative process, such as prototyping, testing, and knowledge sharing, experienced an increase in the flexibility of their projects and a reduction in the time to deliver them. These findings indicate that AI improves behaviour led by innovation, which in turn changes project practices, making innovation capability a key mediating resource.

Innovation capability is a crucial component that makes it easier to seize and transform mechanisms, according to the dynamic capability theory. While AI improves sensing abilities by providing real-time insights, predictive analytics, and early danger identification, the capacity to innovate is what enables project teams to take advantage of these opportunities by coming up with fresh ideas and altering project procedures (Gama and Magistretti, 2025). Teams with high levels of creativity will be more likely to include AI tools into the project process, reorganize processes, and redistribute tasks, all of which will improve project performance (Elumalai, 2025). As a result, the innovativeness is not only a beneficial organizational trait; it is a strategic instrument of change that bridges the connection between the AI and project performance.

At the same time, some research acknowledges that the relationship does not exist in all organizations in the same manner. The firms that have limited innovation capability often cannot translate AI investments into meaningful performance improvement because of their technological culture, attitude to learning, or absorptive capacity to implement AI-derived insights into existing projects (Tushman and O'Reilly III, 1996). The mediating effect is reduced by limited digital maturity, conservative settings, and rigid structures, leading to underutilization or inappropriateness of AI towards project needs. This difference supports the contingency assumptions of DCT its benefits are dependent on complementary abilities such as knowledge sharing, collaboration, and experimentation.

Overall, the literature concludes that innovation capability is important as a mediating factor in change as a medium of intervention. AI adoption into an investment beyond technology into a driver of better project performance. The AI enhances sensing capabilities, offering predictive, analytical, and diagnostic data, but it is

the innovative potential, which enables the organizations to utilize them, redesign the procedures, and achieve improved timelines, cost efficiency, and quality outcomes.

The representation of this interaction implies the main principles of the dynamic capability theory and justifies the constant performance of AI-based organizations with high innovation capability out of the performance of organizations with low innovation capabilities.

The hypothesis is based on the discussion above as follows.

H4: Innovation capability mediates the relationship between artificial intelligence adoption and project performance.

2.6 Moderating Role of Managerial-AI Skills

Organizations increasingly recognize that artificial intelligence adoption alone do not guarantee innovation or enhance organizational performance. Instead, the potential of AI to generate value will be largely dependent on managers' ability to make sense of the insights that AI can provide, connect AI with organizational processes, and correlate the capabilities of AI with strategic goals.

As AI becomes embedded in project management and software development activities, managers play a pivotal role in transforming AI-enabled knowledge into innovative products, services, and processes (Mikalef et al., 2023; Raisch and Krakowski, 2021).

In recent years, there has been an increasing focus on the connection between innovation capability and the adoption of artificial intelligence. The existing research has consistently shown that AI technologies enhance innovation by improving data analysis capabilities, accelerating decision-making processes, facilitating in knowledge integration, and enabling organizations to better identify opportunities for innovation (Dai, 2024; Liu et al., 2024; Nafizah et al., 2024). Automation and analytics driven by AI can boost experimentation, increase process effectiveness, and aid in the creation of new products and services. However, empirical findings

also indicate that the innovation benefits derived from AI adoption vary considerably across organizations, suggesting that additional organizational and managerial conditions influence whether AI translates into stronger innovation capability (Sullivan and Wamba, 2024).

While AI can generate extensive amounts of data, predictions, and recommendations, this does not guarantee that it results in organizational innovation; managers need to assess the information's significance, understanding its strategic implications, and deciding how to respond. This variation in outcomes is the point at which managerial AI skills become theoretically important.

In this regard, Dynamic Capability Theory (DCT) is a strong argument that competitive advantage is not only derived from the possession of valuable technologies but also from the ability of the organization to sense the opportunities, to seize them by making the right decisions, and continually to transform the resources and processes of the organization (Teece, 2007; Teece et al., 1997).

From an AI adoption perspective, AI technologies enhance the value and potential of the organization in terms of identifying opportunities and generating insights, whereas managerial capabilities influence how these are translated by the organization into action and value an issue that reflects the automation-augmentation paradox, which suggests that AI is valuable to an organization only when properly harnessed and balanced with, not replaced by, managerial judgment (Raisch and Krakowski, 2021). This boundary condition acts in three different ways. One interpretive mechanism: managers with high managerial AI skills can interpret and contextually understand the AI-generated insights, mitigating the chances of valuable information being misjudged or lost in the sensing process. Second, a decision and resource mechanism: these managers assess AI recommendations in relation to strategic priorities and allocate organizational resources to AI-supported projects faster and with increased trust, enhancing the seizing stage. Thirdly, a coordination-reconfiguration mechanism: managerial AI skill that is required to restructure workflows, cross-functional collaboration, and organizational routines that integrate the use of AI into continuous innovation processes, which is the transforming stage. All three mechanisms are linked together and it is because of

these three mechanisms that managerial AI skills are a boundary condition: if they are missing, each phase of the sensing-seizing-transforming sequence is disrupted, and the innovation potential of the artificial intelligence adoption remains unused.

Recent empirical findings support this theoretical approach, especially with regard to managerial skills and organizational readiness. [Jöhnk et al. \(2021\)](#) identified managerial capability, along with other organizational readiness factors, such as technological and commitment-related resources as determinants of the success of AI adoption within a company.

According to [Giraud et al. \(2023\)](#) AI is more likely to augment managerial skills such as decision-making, judgment, and coordination than to replace them outright, with only narrow, routine tasks such as basic information-gathering being adaptable to complete automation.

This evidence indicates that managerial AI skills, not only AI adoption, affect innovation outcomes by indicating that managers who actively learn AI-related abilities are better positioned to capture value from AI systems rather than be displaced by them.

In software development SMEs, the moderating influence of managerial AI skills is especially significant, as resource shortages, the fast pace of technological advancements, and the complexity of projects boost the necessity for managerial decision-making.

In these settings, product managers may be intimately engaged with the choice of AI tools, focus on innovation projects, and integrate AI into project processes. Good managerial AI skills can then help make the use of AI more effective by helping to integrate the insights gained from AI into actionable innovation activities.

On the other hand, despite comparable levels of AI adoption, companies with less managerial AI experience could underuse AI technology, leading to poorer innovation outcomes ([Costa and Almeida, 2024](#); [Toth et al., 2025](#)).

Few empirical studies have specifically looked at managerial AI skills as a moderating mechanism that strengthens the relationship between artificial intelligence

adoption and innovation capability, especially within software development SMEs operating in developing economies like Pakistan, despite prior research acknowledging the significance of managerial capabilities in AI implementation and organizational innovation.

Most existing studies have examined the direct effects of AI adoption or managerial capabilities independently, while the interactive role of managerial AI skills in enhancing AI-driven innovation remains underexplored.

This gap could be filled by a better understanding of the circumstances in which the use of AI is likely to enhance the innovation capability and this would be a benefit to both theory and practice. In light of the above discussion, the following hypothesis is proposed:

H5: Managerial AI skills positively moderate the relationship between artificial intelligence adoption and innovation capability, such that the impact of AI adoption on innovation capability is stronger when managerial AI skills are high.

2.7 Moderating Role of Strategic Agility

Strategic agility has been the focus of an increasing scholarly attention because of the swift progress in technologies, environmental ambiguity, and the complexity of project-based work. Strategic agility enables businesses to identify a change in the environment, seize emerging opportunities, and internal competencies should react to technological and market changes ([Sajid et al., 2025](#)). Within recent years, the term strategic agility has been defined not only as an operational tool but as a key dynamic capability that is required to achieve outstanding performance in projects, especially in those cases when digital transformation and innovation-driven competition are evident ([Pandey et al., 2025](#)).

Empirical studies indicate that strategic agility enhances project performance by enabling faster decision-making, greater responsiveness, and more effective adaptation to technological innovations. [Sarwar and Rehman \(2024\)](#) argue that agile organizations are better equipped to manage uncertainty and complexity in projects,

resulting in improved efficiency, quality, and stakeholder satisfaction. These benefits become especially salient in environments characterized by rapid technological change, where static strategies are insufficient to sustain project performance.

While innovation capability plays a significant role in project performance, existing research suggests that innovation alone does not guarantee superior outcomes unless it is supported by organizational responsiveness (Yusof et al., 2023). Sajid et al. (2025) emphasize that strategic agility will help to increase the absorptive capacity of organizations, which will enable them to integrate technological innovation into their project workflows more efficiently.

According to Saeed et al. (2021), organizational flexibility, which has a close relationship with strategic agility, enhances the ability of the firm to introduce innovations across the projects that it undertakes, particularly when it faces a highly transformative environment.

Similarly, the research on SMEs indicates that the innovation capability has a positive impact on strategic agility, which allows organizations to overcome resource constraints and convert the innovative potential into a practical increase in performance (Alfarajat, 2023). These findings suggest that strategic agility and innovation capability cooperate to enhance project performance.

Besides innovation capability, artificial intelligence (AI) integration into project environments has emerged as a groundbreaking factor. AI tools increase the accuracy of prediction, make it easier to make real-time decisions, and are highly reliant on the flexibility of an organization when it comes to effectiveness. Nikolić and Bjelica (2025) emphasize that AI is capable of improving or slowing down the project performance, depending on the agility of the organization. The introduction of AI may lead to a lack of agility, misalignment, or other technological issues in companies that are not agile; whereas agile companies tend to be better at interpreting the insights gained through AI and taking steps based on data-driven recommendations, as well as to reshape project processes. Mariani et al. (2025) confirm this idea and show that organizational agility modulates the impact of strategic resources on performance in organizations based on projects, which is an important role of agility in enhancing the achievements of AI-based projects.

According to the dynamic capability theory, strategic agility is an essential dynamic capability that enables businesses to effectively translate inventive and technological resources into high-quality project performance.

To create sustained competitive advantage and performance, DCT states that the company must be able to identify opportunities and threats, seize opportunities with prompt strategic response, and reorganize organizational resources and processes in response to environmental change (Teece, 2007; Teece et al., 1997).

In project-based contexts, the mechanisms of strategic agility are operationalized through quick detection of technological advancements, seizing possibilities presented by AI and innovations, and continually reorganizing project structures and procedures.

Strategic agility increases the coordination and flexibility of an organization. According to Sarwar and Rehman (2024), agility enhances the competitiveness of organizations in terms of the ability to manage resources in a flexible way, especially in high-tech. According to DCT principles, strategic agility is a boundary condition that either permits or prohibits the transformation of AI adoption and innovation capability into successful project performance.

Strategic agility is considered a greater capability that enables sensing, seizing, and reconfiguring processes that are critical to transforming technological investments, including innovation and AI, into improved project results (Pandey et al., 2025).

In turn, strategic agility becomes an important factor to evaluate the ability of project teams to use innovative tools, data analysis, and technological advances.

Also, innovation capability and AI adoption on the performance of projects increases in situations where there is a high level of uncertainty and volatility. Saeed et al. (2021) demonstrate that absorptive capacity and organizational flexibility have stronger impacts on performance when working in dynamic situations, which is why strategic agility is so important in uncertain environments.

Similar outcomes can be observed in the studies of SMEs, where agility counterbalances the limited resources and enables the company to implement innovations more efficiently (Alfarajat, 2023). Under such circumstances, strategic agility is

used as a regulator that helps to strengthen the relationship between the critical organizational skills and project performance.

Overall, research repeatedly indicates that the effects of AI and innovation capability on project performance are reinforced by strategic agility. The agile organizations are better placed to adopt new technology, absorb knowledge through innovations, and effectively adapt to the changing project needs.

Strategic agility can be vital in converting AI integration and creative aptitude into long-term increases in project efficiency and quality, project flexibility, and stakeholder satisfaction in the face of technical complexity and environmental instability.

Based on the discussion, the following hypotheses is proposed:

H6: Strategic agility positively moderates the relationship between adoption of artificial intelligence and project performance, such that the impact of AI on project performance is stronger when strategic agility is high.

H7: Strategic agility positively moderates the relationship between innovation capability and project performance, such that the impact of innovation capability on project performance is stronger when strategic agility is high.

2.8 Conceptual Research Framework and Summary

The theoretical framework is a multi-path model in which Artificial Intelligence (AI) is applied as an independent variable (IV), and it directly and indirectly influences the Project Performance (DV) through Innovation Capability (mediator). The framework also identifies other moderators, such as Strategic Agility, which creates the relationship between innovation capability and project performance, and Managerial-AI Skills, which strengthen the association between AI and innovation capability. The ownership does not always result in the generation of

rent. The Dynamic Capabilities Theory (DCT) fills this gap by offering information about how organizations are responsive to turbulent environment through sensing, capturing and restructuring resources (Teece et al., 1997). In this regard, strategic agility manages the dynamical mobilization of the innovation activities, which leads to stronger and more adaptive performances of the projects. The integrated framework hence forecasts the project performance with a mediated system, the more innovative the AI and a moderated system where the stronger the linkage. It does not underline the existence of assets but its active coordination, which describes the complexity of AI-based innovation within the existing project environments.

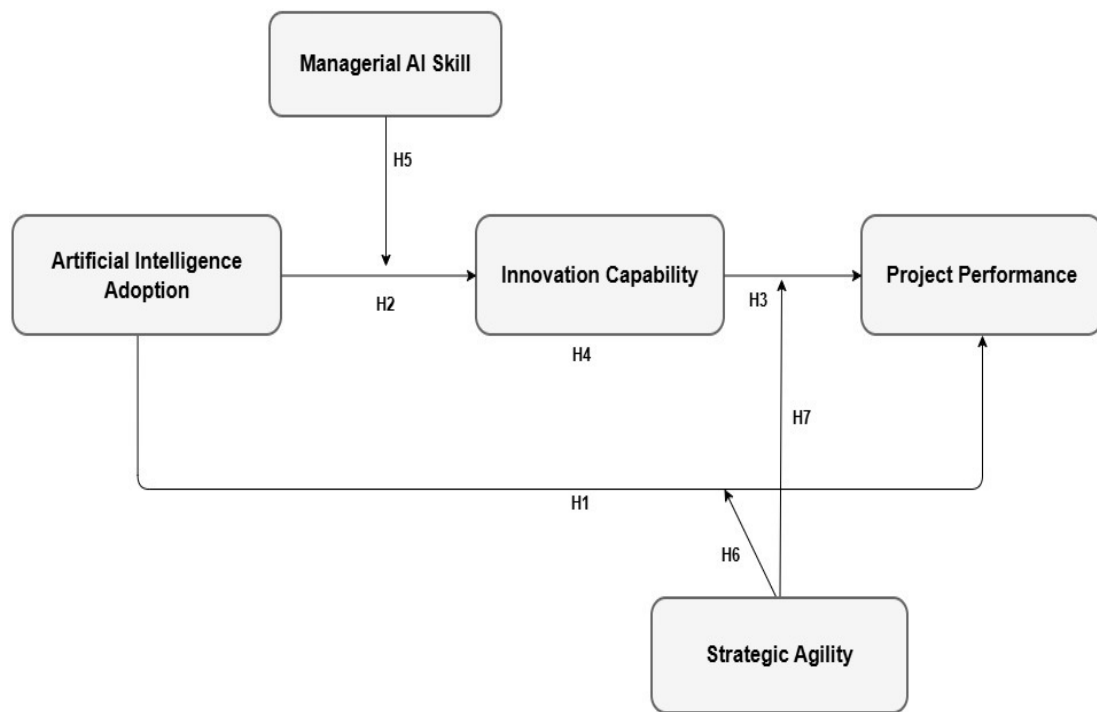


FIGURE 2.1: Conceptual Framework

Chapter 3

Research Methodology

3.1 Introduction

This chapter explains the research methodologies employed for the research, methods to collect data, address the research questions, and achieve the objectives of the research. It describes the demographic and sample selected, the data collection methods and the research methodology. The section also describes the analytical techniques employed to ensure the validity and dependability of the results.

3.2 Research Design

[Al Humdan et al. \(2024\)](#) described that research design refers to how the methodology of searching and acquiring the necessary information to resolve the questions set in the research, the type, setting, and time of the research. The research is based on a hypothetico-deductive paradigm and a quantitative approach to examine the relationships between the AI adoption and project performance of software development companies at the SME level, mediating by the innovation capability and moderated by managerial-AI skills and strategic agility. The research process involved the formulation of hypotheses on the basis of the dynamic capability theory, the collection of data using pre-designed instruments to measure the constructs of AI adoption, project performance, innovation capability, managerial AI

skills and strategic agility, and the analysis of the data based on the use of the statistical procedures of regression, mediation, and moderation to test empirically the hypothesized relationships.

3.2.1 Philosophy Positivism

The research is based on the positivist philosophical approach, which is based on the fundamental assumption that reality can be seen, measured and quantified with the help of objective facts and systematic assessment (Ali, 2024; Park et al., 2020). This philosophy is particularly appropriate because the research aims at analyzing pre-defined hypotheses, which relate to cause-and-effect relationships that are more specific, namely, the impact of AI-driven innovation capabilities on project performance. Positivist view demands that rigorous statistical methodological and validated measures are followed ensuring that the empirical measurement and validation of the hypotheses are formatted, repeatable and valid to the norms of empirical management research.

3.3 Population and Sample

A population is a set of objects and individuals that are relevant to the focus that the researcher is required to study (Willie, 2024). The collection of data representing the entire population is usually not possible, and to ensure the validity of the research and to represent the population, it is necessary to select a representative sample (Creswell and Creswell, 2017; Kumar et al., 2025). The participants of this study are project managers; team leads and product managers from software development companies in Islamabad and Rawalpindi (SME) in Pakistan. These individuals are directly involved in the planning of the project, the implementation, as well as integration of the artificial intelligence tools and approaches. The population sample will consist of the participants who are employed at the SME level in a software development company and has at least six months of experience in their present role (such as project manager, team lead, or product manager),

they are eligible for inclusion. This minimal experience requirement guarantees that participants have enough exposure to the project procedures of their company to offer knowledgeable insights about the adoption of AI and project performance.

Since, it is not feasible to reach all the professionals working in software development companies, a convenience sampling technique is employed. Respondents are selected based on their accessibility and willingness to participate in the study.

This approach is appropriate because collecting data from every eligible professional is impractical due to the time and resource constraints of the study.

3.4 Population Sampling

A population is a collection of items, such as individuals or groups, that are associated with the researcher and their field of study ([Willie, 2024](#)).

However, researchers often cannot collect data representing the entire population ([Goundar, 2012](#)). According to Praveen Kumar et al. (2025) it's important to choose a sample that is representative of the target population so it's credible and the data it provides accurately reflects the target population. The research is based on software development SMEs of Islamabad and Rawalpindi, Pakistan.

The target population includes project managers, product managers, and team leads of SME software development firms in AI-powered software development projects. The respondents have the necessary professional experience to offer information about the artificial intelligence adoption, innovation capability, managerial AI skills, strategic agility, and project performance.

The G*Power 3.1.9.4 software, which would estimate a sample size regardless of the number of predictors that would be included in the research model rather than studying the full population, was used to determine an appropriate sample size. The statistical power of a research involving the social sciences and behavior is frequently ascertained using G*Power ([Faul et al., 2009](#)). A minimum sample size of 85 participants is needed in the current investigation, which uses a four-predictor model, in order to attain a 0.80 statistical power with a medium effect

size. Figure 3.1 shows the G*Power of the obtained sample size and the minimum sample size.

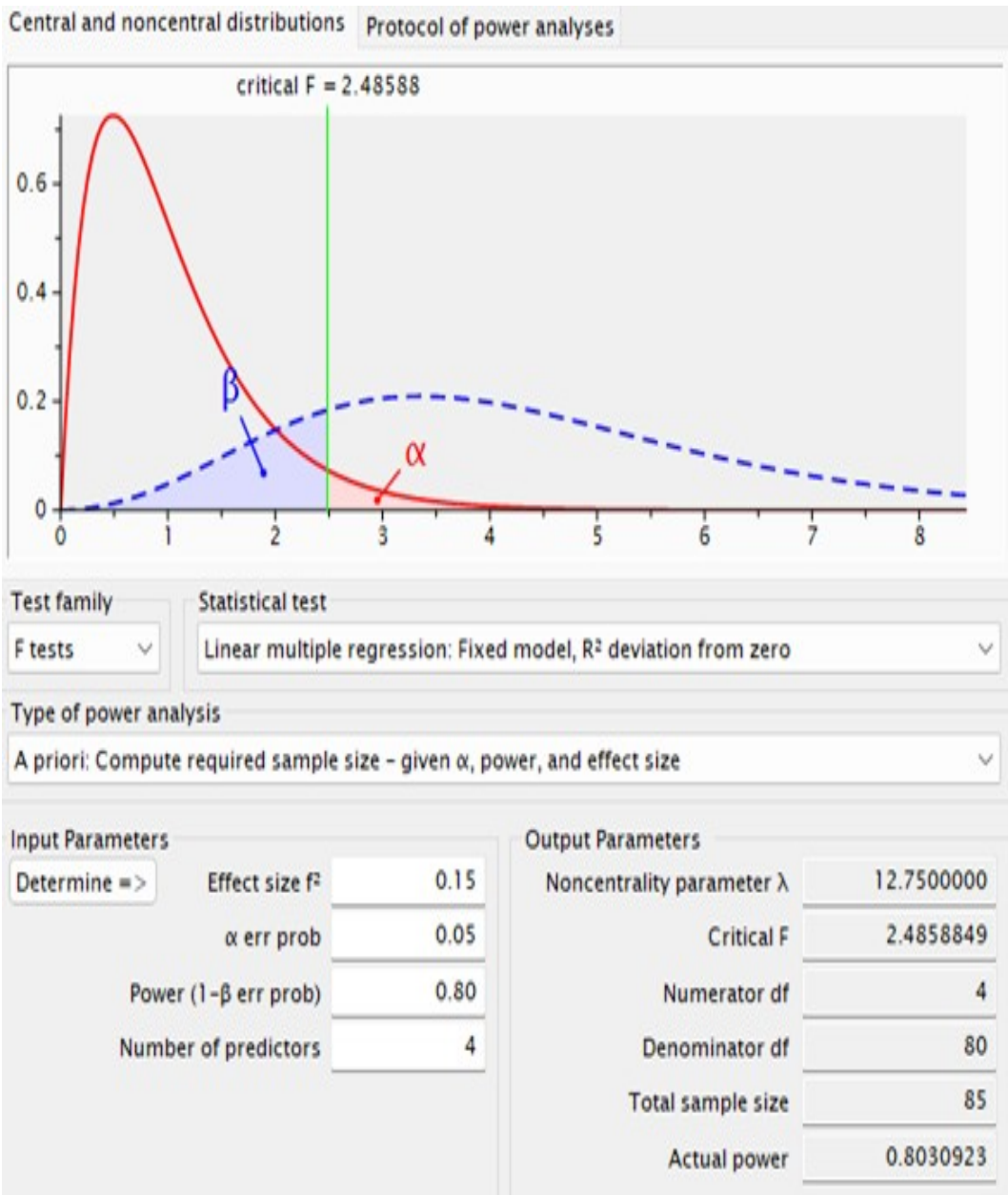


FIGURE 3.1: G*Power (with power = 80%)

In order to further demonstrate sample adequacy, Figure 3.2 shows the G*Power analysis, which shows that while 85 respondents are sufficient to reach the minimal power requirement of 80%, a sample size of 129 participants is needed to attain a higher statistical power of 0.95. About 300 experts who work in software development businesses will be contacted for data collecting in order to improve the findings' dependability and generalizability.

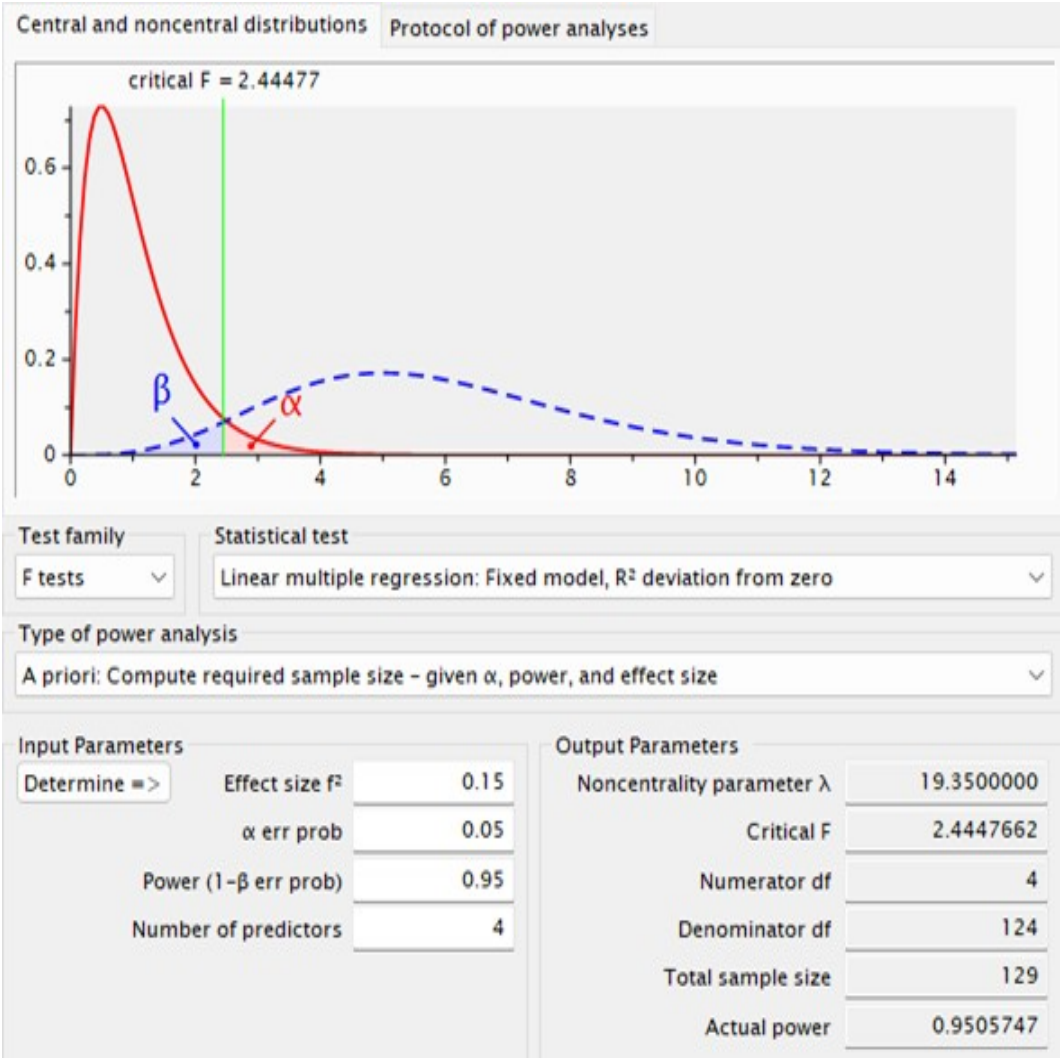


FIGURE 3.2: G*Power (with power = 95%)

3.5 Sample and Sampling Technique

The sample represents the target population of the research area, using two common sampling methods: probability and non-probability sampling (Shamsudin et al., 2024). The non-probability method is used to collect information from a representative segment of the population. The method applied to collect data in this research is convenience sampling technique which is sampling technique that uses respondents who are easily accessible and willing to participate in the research. The respondents are project managers, team leads, Product managers of

the SME software development companies engaged in AI-based projects. These respondents offer the information needed to analyse the impact of the use of artificial intelligence adoption on project performance.

3.6 Time Horizon

One month, April 6, 2026 – May 4, 2026, were used to gather data for this study. A cross-sectional time frame was used because the study was not time-lagged.

3.7 Ethical Issues

Throughout this research conduct, research ethics remained a top priority. Prior to data collection, the following crucial actions were performed to address ethical concerns:

1. The Capital University of Science and Technology granted ethical permission (Ref: CUST/FMSS/REC/2026-5) following the submission of the necessary checklist, questionnaire, and relevant study materials to the committee for evaluation.
2. The study's academic goal was explained to the participants, and their involvement was entirely voluntary. The respondents' privacy and confidentiality were protected, and the information gathered was used only for study.
3. Appendices I and II contain the research instrument, the ethics approval letter, and questioner required for this research.

3.8 Unit of Analysis

[Nowakowska-Siuta \(2024\)](#), described that the unit of analysis is determined by the objective of the research and the methodological strategy selected. Individuals, teams, companies, or projects may constitute the foundation for an analysis. The unit of analysis for this research is the project level. Project managers, product managers, and team lead involved in AI-driven software development projects

provide information because they have relevant perspectives on the adoption of AI during project development and its impact on project performance.

3.9 Data Collection

A structured questionnaire was used to collect data from respondents regarding artificial intelligence adoption, innovation capability, managerial AI skills, strategic agility, and project performance.

The study employed a cross-sectional research design, as data were collected from respondents at a single point in time.

The questionnaire consisted of closed-ended questions measured using a five-point Likert scale, enabling the quantitative assessment of the study variables. To facilitate data collection and improve accessibility for respondents, the questionnaire was administered through Google Forms.

3.10 Sample Characteristics

For this study total number of responses was 400. Demographics include for this survey includes, gender, age, education, position, work experience, experience with AI and project team size.

The following tables display the characteristics of the respondents whose data was collected.

3.10.1 Gender

Gender was recorded in order to learn more about the participants' backgrounds in the survey. 58.8% of the respondents were male, and the 41.2% respondents were female. This displays the overall gender distribution of the workforce in Rawalpindi and Islamabad-based IT project-based organizations.

TABLE 3.1: Gender

Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Male	231	58.6	58.6	58.6
Female	163	41.4	41.4	100.0
Total	394	100.0	100.0	

3.10.2 Age

Another significant demographic is age to better understand the background and work experience of the participants. The majority of the respondents were between the ages of 21 to 30 years, making up 39.2%. The age group of 31- 40 years had the second-highest percentage (31.5%) while 23.3% of people were between the ages of 41 - 50 years. Just 6% of people were over 51years.

TABLE 3.2: Age

Age	Frequency	Percent	Valid Percent	Cumulative Percent
21-30	153	38.8	38.8	38.8
31-40	124	31.5	31.5	70.3
41-50	93	23.6	23.6	93.9
51 above	24	6.1	6.1	100.0
Total	394	100.0	100.0	

3.10.3 Education

Like age and gender, education level is an important demographic characteristic because it gives workers the chance to improve their knowledge, abilities, and methods so they can compete on a global scale. For every country to succeed, education is essential. In order to gather educational information, the questionnaire made reference to three different degree classifications. 53.3% had a bachelor's degree, 32.0% of respondents had a master's degree and 14.7% had a PhD. The percentage of people with bachelor's degrees has gone up.

TABLE 3.3: Education

Education	Frequency	Percent	Valid Percent	Cumulative Percent
Bachelor	213	54.1	54.1	54.1
Masters	122	31.0	31.0	31.0
PhD	59	15.0	15.0	100.0
Total	394	100.0	100.0	

3.10.4 Position

In order to better understand the roles of members in their organizations, respondents were also asked to define their position. 41.1% of respondents were positioned as Team lead, 31.3% of respondents were positioned as Product manager and 27.4% respondents were positioned as project manager. A broad view is provided by this arrangement of positions how various roles in IT-based organizations in Rawalpindi and Islamabad see project management, leadership, and innovation.

TABLE 3.4: Position

Position	Frequency	Percent	Valid Percent	Cumulative Percent
Project Manager	108	27.4	27.4	27.4
Product Manager	124	31.5	31.5	58.9
Team Lead	162	41.1	41.1	100.0
Total	394	100.0	100.0	

3.10.5 Work Experience

According to [Ayanwale et al. \(2024\)](#), work experience is a significant component of demography since it improves individual capacities and inventiveness. to compile data regarding the experiences of the respondents. The collection was done in four different ranges. These years are suitable for representatives to select work experience pertinent to their particular industries, according to employee tenure data.

30.5% of respondent have fewer than three years of work experience, 22.8% have between three and five years, 30.3% have between six and ten years, and 16.5% have more than ten years. This suggests that a sizable percentage of responders had less than three years of work experience.

TABLE 3.5: Work Experience

Work Experience	Frequency	Percent Valid	Percent Cumulative	Percent
Less than 3 years	117	29.7	29.7	29.7
3 to 5 years	91	23.1	23.1	52.8
6 to 10 years	120	30.5	30.5	83.2
10 years and above	66	16.8	16.8	100.0
Total	394	100.0	100.0	

3.10.6 Experience with AI Tools

To collect data regarding respondents' experiences with the AI tools four distinct ranges were used for collection. 25.7% of respondents had less than one years of experience, while 22.2% had one to two years, 34.9% had experience between three to five years, and 17.0% had worked for more than five years experience working AI tools. This indicates that a sizable portion of respondents had experience with AI tools for three to five years.

TABLE 3.6: Experience with AI Tools

Experience With AI Tools	Frequency	Percent Valid	Percent Cumulative	Percent
Less than 1 year	101	25.6	25.6	25.6
1 to 2 years	85	21.6	21.6	47.2
3 to 5 years	140	35.5	35.5	82.7
5 years and above	68	17.3	17.3	100.0
Total	394	100.0	100.0	

3.10.7 Project Team Size

The distribution of project team sizes in the sample is diverse, with a fair representation of small, middle, and large teams. 31.2% of respondents work in groups of less than five individuals, 20.4% of respondents work in group of five to ten members, 29.7% of respondents work in group of eleven to twenty members and 18.5% of respondents work in group of more than 21 members. This indicates that a sizable portion of respondents had worked in project team size of less than 5 members.

TABLE 3.7: Project Team

Project Team Size	Frequency	Percent Valid	Percent	Cumulative Percent
Less than 5 members	123	31.2	31.2	31.2
5 to 10 members	78	19.8	19.8	51.0
11 to 20 members	119	30.2	30.2	81.2
20 members and above	74	18.8	18.8	100.0
Total	394	100.0	100.0	

3.11 Research Instruments

For data collection, a structured questionnaire was adapted to collect data from respondents regarding artificial intelligence adoption, innovation capability, managerial AI skills, strategic agility, and project performance. Closed-ended questions on a five-point Likert scale were used in the study to provide quantitative measurement of the variables. The questionnaire was used in Google Forms to ensure easily accessible and efficient data collection. 394 questionnaires were sent to the project managers, team lead and product managers of the SME software firm of Islamabad and Rawalpindi, Pakistan. All 394 questionnaires were returned and were suitable for analysis.

3.11.1 Independent Variable: Artificial Intelligence Adoption

For Artificial intelligence adoption, 5-item scale of [Shaban et al. \(2026\)](#) was adopted to evaluate impact of artificial intelligence adoption as the independent variable with Cronbach's alpha reliability recorded at 0.773.

3.11.2 Dependent Variable: Project Performance

For project performance, 5-item and 5-point Likert scale (5 = strongly agree and 1 = strongly disagree) of ([Kim, 2018](#)) was adopted to evaluate project performance as dependent variable, having Cronbach's alpha reliability recorded at 0.767.

3.11.3 Mediating Variable: Innovation Capability

A 6-item, 5-point Likert scale (5 Strongly Agree, 1 Strongly Disagree) based on ([Akman and Yilmaz, 2008](#)) is adopted to measure innovation capability as mediating variable with Cronbach's alpha reliability recorded at 0.861.

3.11.4 Moderating Variable: Managerial-AI skills

7 items, 5 Point Likert scale (5 strongly agree and 1 strongly disagree) by ([An et al., 2024](#)) are used to assess the influence of managerial-AI skills as moderating variable having Cronbach's alpha reliability recorded at 0.927.

3.11.5 Moderating Variable: Strategic Agility

[Queiroz et al. \(2018\)](#) and [Tallon and Pinsonneault \(2011\)](#) 8 item scale was used for measuring strategic agility as the moderator variable. Cronbach's alpha reliability was found to be 0.937 for the sample items are 8 and 5-point Likert scale (5 strongly agree and 1 strongly disagree).

TABLE 3.8: Research Instrument

Variables	Items	Sources
Artificial Intelligence Adoption	5	Shaban et al. (2026)
Project Performance	5	Kim (2018)
Innovation Capability	6	Akman and Yilmaz (2008)
Managerial AI skills	7	An et al. (2024)
Strategic Agility	9	Queiroz et al. (2018) Tallon and Pinsonneault (2011)

Chapter 4

Data Analysis and Results

In this chapter, Section 4.1 discusses the data screening procedure. By evaluating the measurement model and structural model, Section 4.2 expands on the results of the data analysis. Lastly in the section 4.3 the results of hypothesis that was investigated in this study are compiled.

4.1 Data Screening

Data screening is a process which is required to ensure the validity and reliability of measurements as well as to evaluate the data's completeness, distribution, and quality ([Riskin et al., 2025](#)). Data screening is the process of checking the data on outliers, value gaps, and problems with normality ([Sun and Xia, 2024](#)). By carefully examining the data, researchers can reduce errors that could significantly affect the results. This will establish a solid basis for significant and reliable study findings ([Ojoboh and Igben, 2024](#)).

4.1.1 Data Cleaning

Data cleaning improves accuracy of the data by fixing errors, filling in missing values, and removing unnecessary information. It is used to produce points, removes any inaccurate data, and enhances the dataset's quality ([Ahuja et al., 2024](#)). Researchers encourage the use of data analytics to evaluate normality distribution,

assure the quality and accuracy of results, improve the integrity of findings, and obtain more reliable results by filtering the data (Imjai et al., 2024).

4.1.2 Missing Values and Outliers

The validity and accuracy of the results may be significantly impacted by the presence of any missing values when no data value is captured. According to Zhou et al. (2024), this happens when respondents intentionally or unintentionally fail to provide a response. Data collection improves the overall analysis and provides a more accurate interpretation of study outcomes (Little & Rubin, 2019). To minimize the possibility of missing data, all questionnaire items in the Google Form were set as mandatory (required) fields, ensuring that respondents completed every question before submitting the questionnaire. Consequently, the data used in this research had neither outliers nor missing values.

4.2 Results

Using Smart PLS Version 4 (Sarstedt et al., 2024), partial least squares structural equation modelling (PLS-SEM) has been carried out in two stages: measurement model evaluation and structural model evaluation. The structural model, also known as the inner model, shows the relationships between the constructs (Cheung et al., 2024), whereas the measurement model, also known as the outer model, shows the connections between constructs and their indicators (Huda and Risman, 2024). Additionally, Harman's Single-Factor Test and One-Way ANOVA were performed using IBM SPSS Statistics to evaluate common technique bias and investigate group differences, respectively.

4.2.1 Harman's Single Factor Test

Harman's single-factor test is conducted using IBM SPSS in order to evaluate the possibility of common method bias in the gathered data. The first factor recovered explained 34.396% of the total variation, according to the results shown in Table

4.1. The results indicate that common technique bias is not a major concern in the current study because this value is below the suggested threshold of 50%. The results indicate that the data are adequate for further analysis because the measures appear to be highly reliable, revealing the presence of separate constructs within each measure.

TABLE 4.1: Harman's Single Factor Test

Test	First factor variance	Threshold	Result
Harman's single factor test	36.25%	<50%	No common Method Bias

4.2.2 Covariates

In the current study, a One-Way ANOVA test was performed using IBM SPSS to look at the effects of the various demographic variables on the outcome variable. The purpose of this analysis was to determine whether there were statistically significant differences between each of the respondent groups on the various project performance outcomes identified in the literature and reported in this paper that are related to demographic factors. The demographic variables that were used to measure were Gender, Age, Education, Position, Work Experience, Experience with AI Tools and Project Team Size. The results, presented in Table 4.2 show that all of the demographic variables are statistically significant predictors of Project performance. Notably, Gender ($F = 11.118$, $p < 0.001$), Age ($F = 19.78$, $p < 0.001$), Education ($F = 4.600$, $p = 0.011$), Position ($F = 19.866$, $p < 0.001$), Work Experience ($F = 20.645$, $p < 0.001$), Experience with AI Tools ($F = 20.039$, $p < 0.001$), and Project Team Size ($F = 24.809$, $p < 0.001$) all reveal significant differences in project performance. Control variables are variables that are included in statistical analysis to account for their potential influence on the dependent variable, allowing the relationships between the main study variables to be examined more accurately (Hair Jr et al., 2021). Variables that show a significant relationship with the dependent variable may be included as control variables

to reduce the effects of extraneous factors. Therefore, the following demographic factors are considered as control variables in the present study.

TABLE 4.2: Covariates

Covariate	Mean square	F value	P value
Gender	2.973	11.118	<0.001
Age	4.726	19.78	<0.001
Education	1.239	4.600	0.011
Position	4.972	19.866	<0.001
Work Experience	4.924	20.645	<0.001
Experience with AI Tools	4.799	20.039	<0.001
Project Team Size	5.758	24.809	<0.001

4.2.3 Measurement Model Assessment

The reliability and validity of the scale items to all variables were assessed on construct reliability and construct validity. Cronbachs alpha (CA) reliability and composite reliability (CR) were tested in order to determine construct reliability. Construct validity was measured by analyzing average variance extracted (AVE) and outer loadings. Average variance extracted shows how much variance has been extracted by latent variables or constructs using its indicators. The dependencies of individual variable items were determined using the outer loadings.

4.2.3.1 Construct Reliability and Convergent Validity

As demonstrated in Table 4.3 below, the CA readings are above 0.7 in all the constructs and the values of AVE are more than the minimum acceptable level of 0.5 (Cheung et al., 2024). This means that all the variable items were converging to indicate their underlying constructs.

TABLE 4.3: Construct Reliability and Convergent Validity

Constructs	CA	CR (rho-a)	CR (rho-c)	AVE
AI Adoption	0.773	0.781	0.845	0.523
IC	0.864	0.877	0.897	0.594
MAIS	0.927	0.942	0.941	0.696
PP	0.765	0.770	0.840	0.514
SA	0.938	0.939	0.948	0.670

Abbreviations: Cronbach Alpha (CA), Composite Reliability (CR), Average Variance Extracted (AVE)

4.2.3.2 Outer loadings

Outer loadings were assessed to evaluate the indicator reliability of the measurement model. According to (Hair et al., 2016), outer loading values of 0.70 or above indicate satisfactory indicator reliability. However, indicators with loadings between 0.40 and 0.70 should not be removed automatically. Hair Jr et al. (2021) recommend that such indicators should only be considered for removal if their deletion improves the Composite Reliability (CR) and Average Variance Extracted (AVE) of the respective construct. In the present study, four indicators had outer loadings between 0.40 and 0.70; however, these indicators were retained because the constructs continued to satisfy the recommended threshold values for CR and AVE. Therefore, the results presented in Table 4.4 confirm adequate convergent validity of the measurement model.

TABLE 4.4: Outer loadings

Variable	Item	OL	Variable	Item	OL
AI	AI1	0.638	PP	PP1	0.777
	AI2	0.74		PP2	0.735
	AI3	0.755		PP3	0.688
	AI4	0.762		PP4	0.736
	AI5	0.714		PP5	0.642

Table 4.4 continued from previous page

Variable	Item	OL	Variable	Item	OL
IC	IC1	0.756	MAIS	MAIS1	0.731
	IC2	0.758		MAIS2	0.782
	IC3	0.779		MAIS3	0.818
	IC4	0.801		MAIS4	0.901
	IC5	0.832		MAIS5	0.873
	IC6	0.692		MAIS6	0.869
SA	SA1	0.796		MAIS7	0.852
	SA2	0.857			
	SA3	0.826			
	SA4	0.837			
	SA5	0.859			
	SA6	0.813			
	SA7	0.824			
	SA8	0.84			
	SA9	0.706			

4.2.3.3 Discriminant Validity

Discriminant validity was assessed to determine whether the constructs in the measurement model were empirically distinct from one another (Kamis et al., 2020). In the present study, the Fornell–Larcker criterion and the Heterotrait–Monotrait Ratio (HTMT) were used to assess discriminant validity. The Fornell–Larcker criteria is a widely used method for assessing the discriminant validity of measurement models (Rane et al., 2024). The Fornell–Larcker criterion assesses whether each construct’s square root of the Average Variance Extracted (AVE) is higher than its correlations with the other constructs (Hilkenmeier et al., 2020). The square root of the AVE is represented by the diagonal values 0.723 (AI), 0.771 (IC), 0.834 (MAIS), 0.717 (PP), and 0.816 (SA), as shown in Table 4.5. The Fornell–Larcker

criterion verifies that adequate discriminant validity has been established because these values are higher than the equivalent inter-construct correlations. Table 4.5 below illustrates discriminant validity through Fornell-Larcker Criterion.

TABLE 4.5: Discriminant Validity through Fornell-Larcker

	AI	IC	MAIS	PP	SA
AI	0.723				
IC	0.366	0.771			
MAIS	0.357	0.418	0.834		
PP	0.698	0.502	0.476	0.717	
SA	0.447	0.523	0.405	0.631	0.819

In addition to the Fornell–Larcker criterion, discriminant validity was further assessed using the Heterotrait–Monotrait Ratio (HTMT) proposed by (Henseler et al., 2015). To establish discriminant validity, HTMT values should be below 0.90, depending on the conceptual similarity of the constructs. Values exceeding these thresholds indicate insufficient discriminant validity (Hair Jr et al., 2021; Henseler et al., 2015). As presented in Table 4.6, the HTMT values range from 0.416 to 0.877. Although the highest HTMT value between artificial intelligence adoption and project performance is 0.877, it remains below the recommended threshold of 0.90. Therefore, the HTMT results confirm that all constructs demonstrate adequate discriminant validity, indicating that the constructs are empirically distinct and suitable for further structural model analysis.

TABLE 4.6: Discriminant Validity through HTMT

	AI	IC	MAIS	PP	SA
AI					
IC	0.424				
MAIS	0.416	0.440			
PP	0.877	0.601	0.583		
SA	0.501	0.584	0.426	0.724	

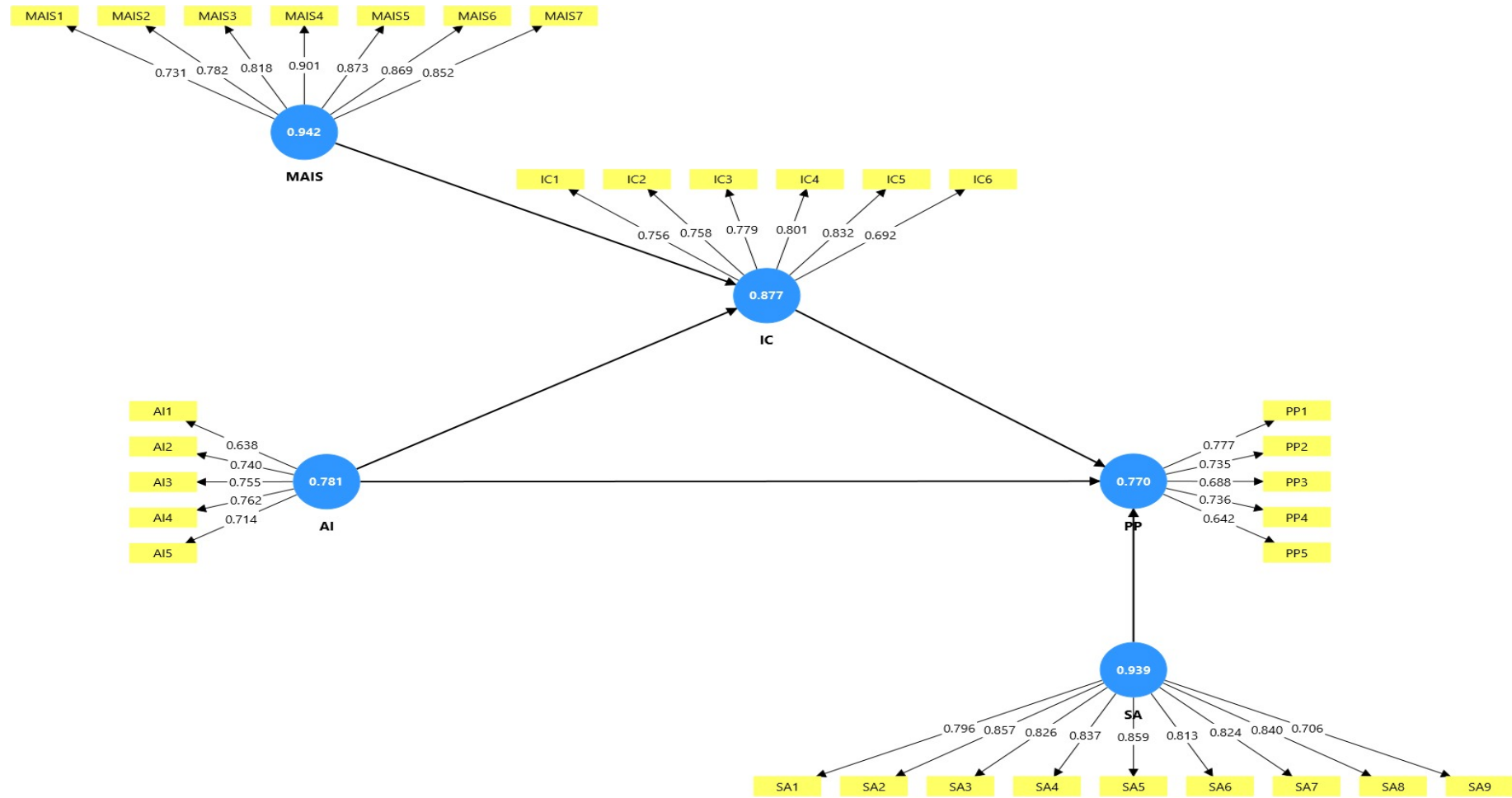


FIGURE 4.1: Measurement Model Analysis

4.2.4 Structural Model Assessment

The second step of PLS-SEM was carried out in order to assess the inner model in compliance with the criteria set by [Bido et al. \(2014\)](#), with the goal of examining the moderating influence of the managerial AI skill and strategic agility, and the mediating effects of innovation capability. The coefficient of determination (R^2), predictive relevance (Q^2), and the significance of path coefficients [Hair Jr et al. \(2021\)](#).

4.2.4.1 Model Fit Assessment

The Standardized Root Mean Square Residual (SRMR) was used to evaluate the model's fit. According to Hu and Bentler (1999), a good model fit is indicated by an SRMR value less than 0.08, while PLS-SEM values less than 0.10 are deemed acceptable ([Hair Jr et al., 2021](#)). Table 4.7, the estimated model produced an SRMR value of 0.107, whereas the saturated model provided an SRMR score of 0.089. While the estimated model somewhat surpasses the suggested threshold of 0.10, the saturated model shows an adequate match. However, the structural model was further assessed using path coefficients, coefficient of determination (R^2), predictive relevance (Q^2), and hypothesis testing because PLS-SEM primarily concentrates on prediction rather than overall model fit.

TABLE 4.7: Model Fit Assessment

	Saturated Model	Estimated Model
SRMR	0.089	0.107

4.2.4.2 Coefficient of Determination and Predictive Usefulness

The model's predictive usefulness (Q^2) and coefficient of determination (R^2) were evacuated. R^2 statistics show how much the dependent variable has changed as a result of one or more independent variables, as well as the variation in the dependent variable attributable to the independent variable ([Hair Jr et al., 2021](#)).

TABLE 4.8: Direct Relationship

H	Relationship	β	Mean	STDEV	T values	P Values	2.5% LLCI	97.5% ULCI	Remarks
H1	AI ->PP	0.482	0.483	0.044	11.023	0.000	0.397	0.569	Supported
H2	AI ->IC	0.289	0.294	0.044	6.541	0.000	0.214	0.388	Supported
H3	IC ->PP	0.318	0.320	0.047	6.811	0.000	0.232	0.415	Supported

TABLE 4.9: Mediation Analysis

H	Relationship	β	Mean	STDEV	T values	P Values	2.5% LLCI	97.5% ULCI	Remarks
Indirect effect									
H4	AI ->IC ->PP	0.092	0.094	0.019	4.751	0.000	0.060	0.135	Supported

TABLE 4.10: Moderation Analysis

H	Relationship	β	Mean	STDEV	T values	P Values	2.5% LLCI	97.5% ULCI	Remarks
H5	MAIS x AI ->IC	0.146	0.146	0.041	3.571	0.000	0.053	0.215	Supported
H6	SA x AI ->PP	-0.078	-0.085	0.036	2.168	0.030	-0.169	-0.013	Not Supported
H7	SA x IC ->PP	0.139	0.138	0.023	5.967	0.000	0.092	0.183	Supported

R² values for dependent variables are classified as considerable (0.26), moderate (0.13), and weak (0.02) by [Cohen \(2013\)](#). The R² values for project performance (0.682) and innovation capability (0.256) (% variation) are shown in Table 4.7, both of which are significant. The structural model's predictive significance was then evaluated using Q² values, which, if more than zero (Q² > 0), indicate successful value reconstruction and show the model's predictive relevance ([Shmueli et al., 2019](#)). The results of using PLS-Predict, which are displayed in Table 4.3, reveal that the dependent variables' Q² values were more than zero, indicating predictive relevance.

TABLE 4.11: Coefficient of Determination

	R-square	R-square adjusted	Q ² predict
IC	0.228	0.224	0.231
PP	0.629	0.626	0.629

4.2.4.3 Direct Relationship Analysis

A bootstrapping analysis with 5,000 subsamples was used to determine the significance and t-values of the path coefficients. Table 4.8 results suggest that adoption of artificial intelligence has a strong positive impact on project performance (PP) ($\beta = 0.397$, $t = 8.150$, $p < 0.00$), thus supporting the first hypothesis (H1). Additionally, the findings support the second hypothesis (H2) by showing a positive relationship between adoption of artificial intelligence and innovation capability ($\beta = 0.291$, $t = 6.473$, $p < 0.00$). Furthermore, the performance of projects is strongly positively correlated with innovation capabilities ($\beta = 0.312$, $t = 6.745$, $p < 0.00$), supporting the third hypothesis (H3).

4.2.4.4 Mediation Analysis

The mediation analysis was conducted using the bootstrapping approach with 5,000 subsamples in order to examine the indirect effect of innovation capability

on the relationship between artificial intelligence adoption and project performance. As presented in Table 4.10, the indirect effect of AI on PP through IC is positive and statistically significant ($\beta = 0.092$, $t = 4.751$, $p < 0.00$). The indirect effect is significant because the confidence interval does not include zero. Additionally, the direct impact of AI on PP is still statistically significant and positive ($\beta = 0.482$, $p < 0.001$). According to Zhao et al. (2010), when both the direct and indirect effects are significant and point in the same direction, the mediation is classified as complementary partial mediation. Therefore, Innovation Capability partially mediates the relationship between artificial intelligence adoption and project performance while the direct effect remains significant. Thus, hypothesis H4 is supported.

4.2.4.5 Moderation Analysis

The moderating effects of managerial AI skills and strategic agility were examined using the bootstrapping procedure in SmartPLS with 5,000 bootstrap subsamples. Three interaction effects were assessed; the moderating effect of MAIS on the relationship between artificial intelligence adoption and innovation capability, the moderating effect of SA on the relationship between AI adoption and project performance (PP), and the moderating effect of SA on the relationship between IC and PP.

The results presented in Table 4.11 shows that the interaction terms of managerial AI skills exert a positive and significant impact between the relationship of artificial intelligence adoption and innovation capability ($\beta = 0.146$, $t = 3.571$, $p < 0.001$). This suggests that high moderation effect of managerial AI skills enhance the relationship between AI adoption and innovation capability.

This means that the ability of managers to leverage AI adoption for improved innovation capability is greater in organizations where managers have more knowledge and competencies related to AI. Thus, it is concluded that H5 supports. Conversely, the interaction term of Strategic agility has a negative and significant impact between the relationship of artificial adoption and project performance ($\beta = -0.078$, $t = 2.168$, $p = 0.030$).

This result indicate that high moderation effect of strategic agility weakens the relationship between AI adoption and project performance. The fact that strategically agile firms regularly reorganize resources, change priorities, and modify procedures in response to shifting environmental conditions could be one cause. Such flexibility improves organizational responsiveness, but because resources and attention are simultaneously devoted to ongoing adaptation efforts, it may lessen the initial performance gains from AI adoption.

Organizations constantly recognize, take advantage of, and change possibilities, according to Dynamic Capability Theory; nevertheless, an overemphasis on strategy reconfiguration may momentarily reduce the direct impact of AI adoption on project performance.

As a result, even though strategic agility is still a useful organizational skill, larger levels of it may reduce the immediate benefits of AI adoption on software development project performance. So, the hypothesized positive moderating effect is not confirmed and H6 is rejected.

Additionally, the Strategic agility has a positive and significant impact between the relationship of innovation capability and project performance ($\beta = 0.139$, $t = 5.967$, $p = 0.000$). This implies that strategic agility has a positive and strengthening influence on project performance when combined with innovation capability. Companies that are more strategic agile can pivot resources, processes and strategic decisions quickly to align with changing project environments and thus, are better able to turn innovative capabilities into better project results. Hence, the hypothesis H7 is supported.

In order to have a better understanding of the nature of the moderating effect, Figure 4.2 present the slope analysis to demonstrate the interaction between managerial AI skills and artificial intelligence adoption on innovation capability.

The positive association between AI adoption and innovation capability becomes stronger as managerial AI skills increases, as evidenced by the steeper slope for high managerial AI skills (+1 SD) compared to the mean and low levels of managerial AI skills. On the other hand, the link is relatively weaker when management AI skills are low (-1 SD).

TABLE 4.12: Conditional Direct Effect of MAIS on IC

	AI ->IC
MAIS at +1 SD	0.435
MAIS at -1 SD	0.143
MAIS at Mean	0.289

This shows as the higher the managerial AI skills, the stronger the relationship between AI adoption and innovation capability; and the lower the managerial AI skills, the lower the relationship between AI adoption and innovation capability. Table 4.12 shows the conditional direct effect of managerial AI skills.

TABLE 4.13: Conditional Indirect Effect

	AI ->IC ->PP
MAIS at +1 SD	0.138
MAIS at -1 SD	0.045
MAIS at Mean	0.092

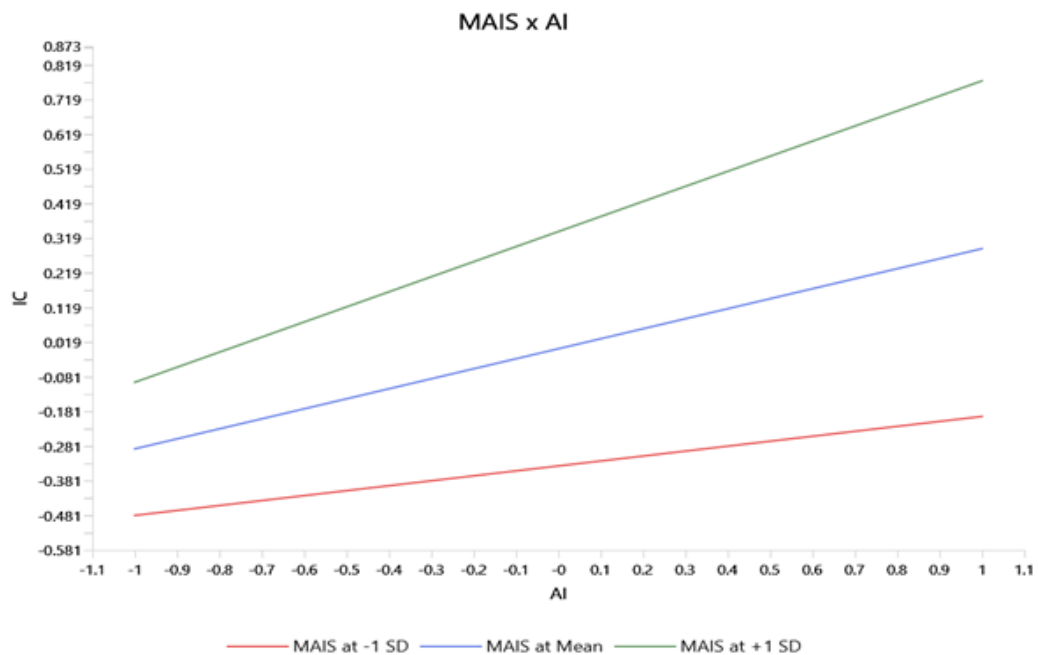


FIGURE 4.2: Moderation Analysis of MAIS Between AI and IC

The moderating effect of strategic agility on the relationship between artificial intelligence adoption and project performance is shown in Figure 4.3. The upward-sloping lines indicate that AI adoption has a positive relationship with project performance at low, mean, and high levels of strategic agility. However, the slope of the relationship is steeper at low strategic agility (-1 SD) and becomes flatter as strategic agility increases. This pattern is consistent with the significant negative interaction effect ($\beta = -0.078$, $p = 0.030$), indicating that higher strategic agility weakens the positive effect of AI adoption on project performance. Thus, although AI adoption contributes positively to project performance across all levels of strategic agility, its positive effect is relatively stronger when strategic agility is low and weaker when strategic agility is high.

TABLE 4.14: Conditional Direct Effect of SA on IC and PP

	AI ->PP	IC ->PP
SA at +1 SD	0.312	0.457
SA at -1 SD	0.468	0.180
SA at Mean	0.390	0.318

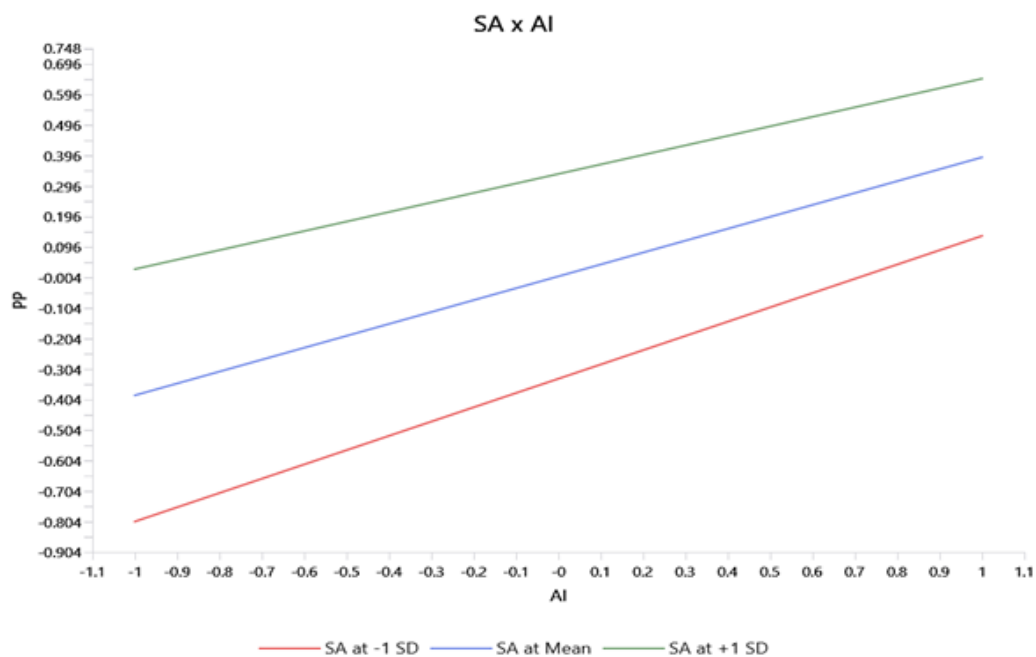


FIGURE 4.3: Moderation Analysis of SA

TABLE 4.15: Conditional Indirect Effect

	AI ->IC ->PP
SA at +1 SD	0.131
SA at -1 SD	0.052
SA at Mean	0.092

Figure 4.4 shows the moderating effect of Strategic Agility on the relationship between Innovation Capability and Project Performance. The red slope, which represents strategic agility (SA) at -1 SD, is lower as compared to other slopes. The green slope representing high strategic agility (+1 SD) is the steepest among the three lines, indicating that organizations with higher strategic agility gain greater project performance benefits from innovation capability.

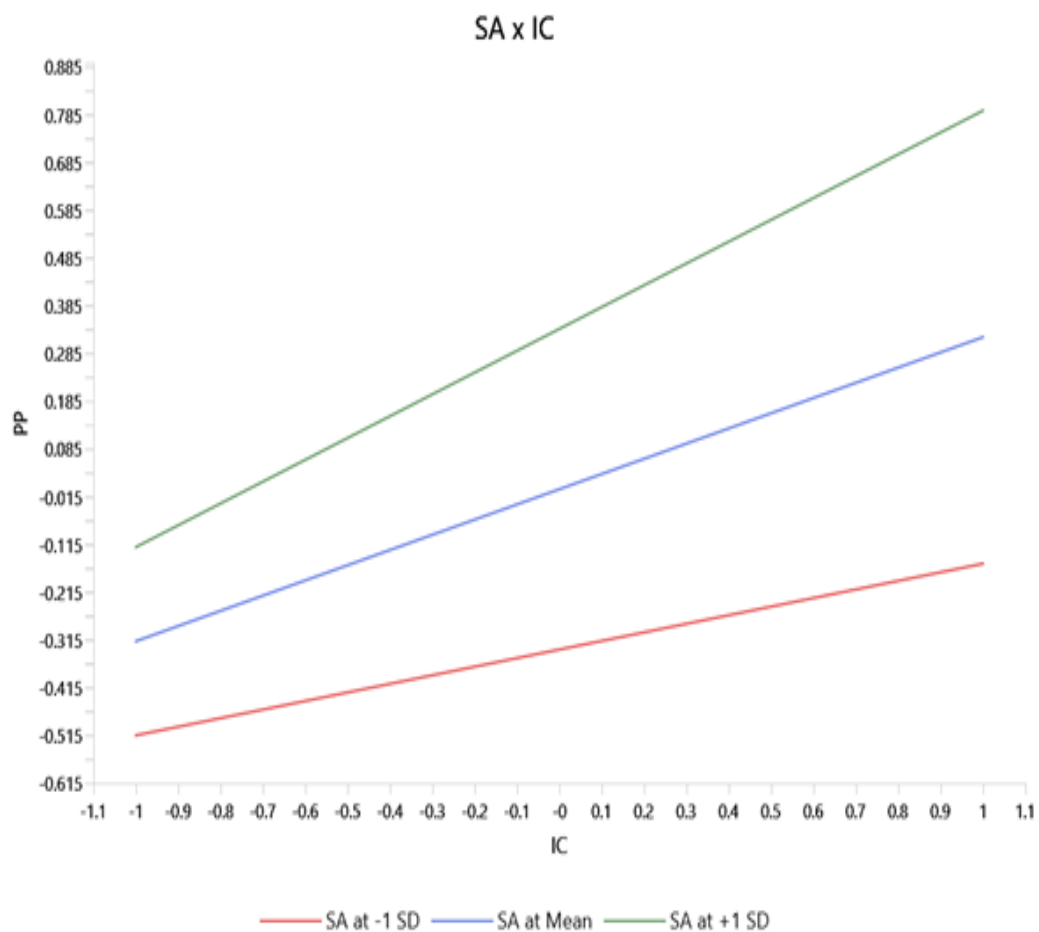


FIGURE 4.4: Moderation analysis of SA

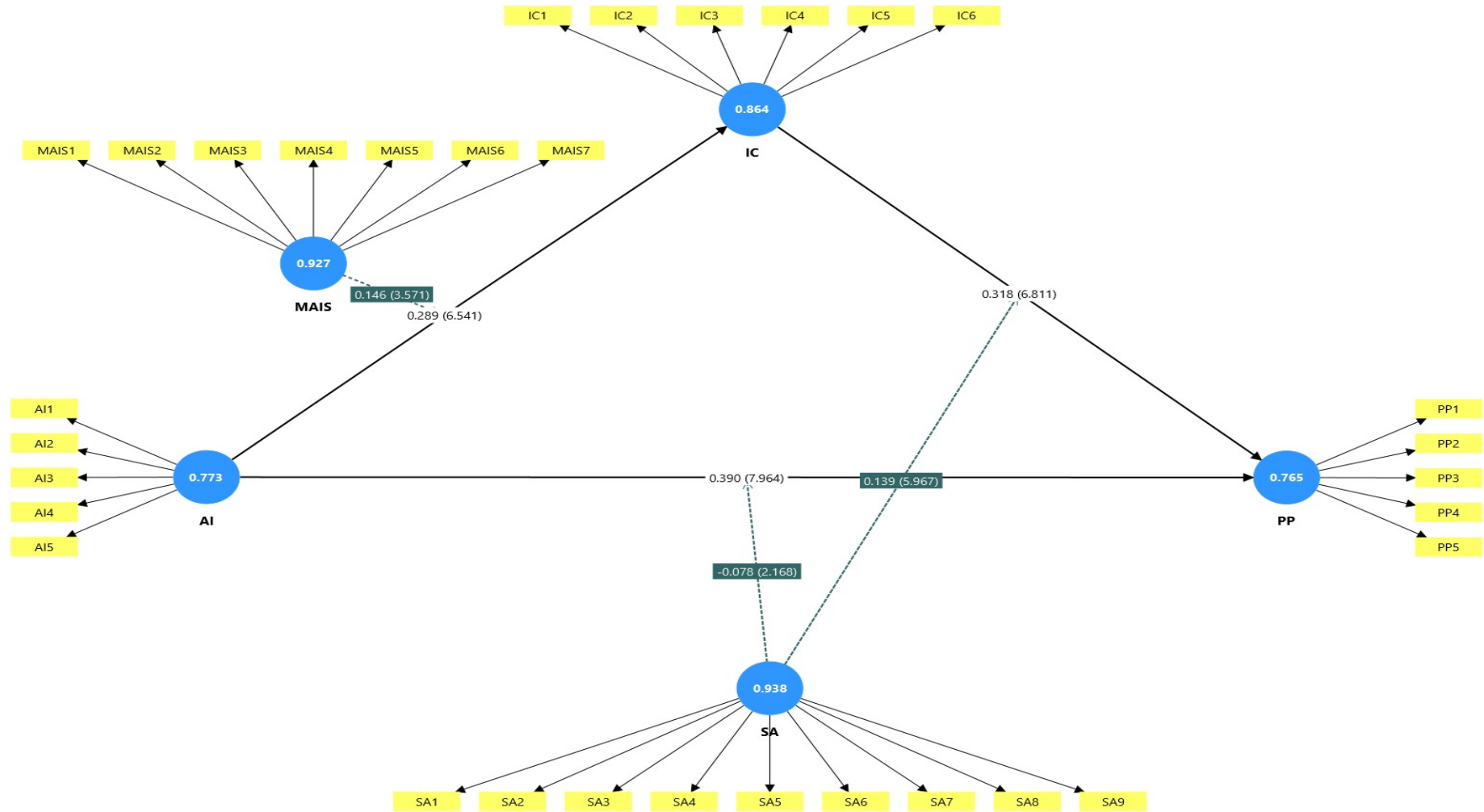


FIGURE 4.5: Structural Model Analysis

4.3 Hypothesis Result Summary

TABLE 4.16: Hypothesis Result Summary

Hypothesis	Statement	Result Decision
H1	Artificial intelligence adoption has a positive impact on project performance.	Supported
H2	Artificial intelligence adoption has a positive impact on innovation capability	Supported
H3	Innovation capability has a positive impact on project performance	Supported
H4	Innovation capability mediates the relationship between artificial intelligence adoption and project performance.	Supported
H5	Managerial AI skills positively moderate the relationship between artificial intelligence adoption and innovation capability, such that the impact of AI adoption on innovation capability is stronger when managerial AI skills are high.	Supported
H6	Strategic agility positively moderates the relationship between artificial intelligence adoption and project performance	Not Supported
H7	Strategic agility positively moderates the relationship between innovation capability and project performance	Supported

Chapter 5

Discussion and Conclusion

5.1 Introduction

This chapter include the discussion and interpretations of the results and findings reported in Chapter 4 of this study and also discusses the implications of results in relation to the existing literature, research objectives and proposed hypotheses. This study aims to investigate the impact of the artificial intelligence (AI) adoption on the project performance in the IT industry in Pakistan. The study has also investigated the mediating effect of innovation capability and the moderating effects of managerial AI skills and strategic agility. The findings of the study carried out using the Smart PLS-4 program offer insightful information and partially validate the suggested conceptual model; all hypotheses, with the exception of H6, have statistical support. The findings of the study are presented in the following sections, which are based on the hypothesis-by-hypothesis results and with some inputs from the literature.

5.2 Hypothesis Discussion

5.2.1 Artificial Intelligence has a Positive Impact on Project Performance

The relationship between AI adoption and project performance has now become a topic of discussion in the IT industry, particularly in developing nations where project delays, cost overruns, and inefficiencies are common. Findings of this research confirm the significant and positive relationship between AI adoption and project performance ($\beta = 0.482$, $t = 11.023$, $p < 0.05$). This implies that adoption of AI will allow achieving a higher level of efficiency, accuracy, and data-based decision-making, which will in turn result in better project performance.

Project performance is widely recognized as a key factor of organizational success and the use of artificial intelligence have a significant impact on the performance and efficiency of a project. AI technologies enhance project performance by facilitating data analysis, automation, and informed decision-making (Zhang et al., 2021). Empirical studies indicate that AI can significantly improve project performance by boosting worker productivity, automating tedious tasks, and improving decision-making by adoption AI (Kassa and Worku, 2025). According to Cheng et al. (2012) AI methods, such as neural networks, fuzzy logic, and optimization algorithms, can be used effectively to manage uncertainty and enhance the accuracy of the project performance. Gabsi (2024) also emphasize that AI improves productivity by automating complex routine tasks and boosting human capacity by providing superior data insights and predictive analytics. This two-fold purpose of AI not only decreases the costs of operation, but also enhances the quality and speed of decision-making, which results in improved project performance (Kassa and Worku, 2025). Moreover, AI-powered systems can facilitate real-time tracking and forecasting, enabling project managers to actively respond to risks and uncertainties, which is essential to the enhancing the performance of project (Reznikov, 2025).

The significance of artificial intelligence is even more serious in the framework of the IT industry because of the extremely high level of complexity, fluidity of needs, and the rapidity of projects. AI technologies can help IT organizations handle vast amounts of data, enhance the accuracy of forecasts, and make decisions in real-time ([Su and Ayob, 2025](#)).

This becomes especially crucial in developing nations such as Pakistan where IT projects are usually limited in resources and have uncertainty. By assisting organizations to become more efficient in their operations, more adaptive, and assisting with better project execution, AI helps organizations to overcome such challenges. Theoretically, this relationship is greatly advocated by Dynamic Capability Theory that focuses on the capacity of an organization to integrate, develop, and restructure internal and external competencies in fast changing environments ([Teece, 2018](#)).

The artificial intelligence could be considered as a strategic dynamic capability which would increase the capacity of organization to sensitize opportunities and capitalize on them with the help of data-driven decisions and modify project processes based on them. Through AI, organizations will be able to keep changing their project management processes and enhancing their innovation potential as well as reacting to the environmental uncertainty ([Kenny, 2003](#)).

In addition, recent research indicates that those organizations implementing AI-based methods can attain more agile and resilient project environments. The use of AI in predictive analytics, intelligent automation, and real-time monitoring improves the efficiency and effectiveness of projects because it allows continuously assessing and modifying project activities ([Reznikov, 2025](#)).

The capabilities are especially useful in IT projects, which are characterized by the fast pace of technological development and the changes in the needs of different stakeholders, which require flexibility and responsiveness. In the IT industry where projects are characterized by high complexity, uncertainty and constant innovation. Artificial intelligence is a strategic enabler that can be used in such environments to improve organizational agility and enhance the project performance. As a result, AI is viewed as one of the key elements influencing a project's

performance, enabling businesses to achieve increased productivity, adaptability, and competitive advantage in modern IT project environments.

5.2.2 Artificial Intelligence Adoption has a Positive Impact on Innovation Capability

The second hypothesis has also been supported, with results indicating a strong positive relationship between artificial intelligence and innovation capability ($\beta=0.289$, $t = 6.541$, $p < 0.05$). This indicates that the adoption of AI is a major booster of innovation capability in organizations, at least in the IT sector as AI-powered technologies help companies to develop new ideas, enhance the development process, and provide innovative solutions more effectively. The results that support H2 are in line with other studies that emphasize AI and innovation capability as a major force behind change in the IT industry. The adoption of AI boosts teamwork, enhances the speed of developmental processes and increases product quality, which establishes a robust basis of innovation in software organizations (Ettinger, 2025).

Based on the available literature, organizations need a combination of enabling capabilities related to technological, organizational, and environmental settings to successfully use AI (Bessen et al., 2022). Incorporating AI into organizational processes is enabled by these capabilities, such as functional competence, cybersecurity management, knowledge recombination, and effective governance of digital projects (Agarwal et al., 2021; Boyson et al., 2022). Moreover, the regulatory awareness and partner agility are the environmental aspects that facilitate the capabilities of firms to use AI even more (Liu et al., 2020; Olan et al., 2021). On top of adoption, AI does not only create value, but also increases the innovation capability of firms, changing the way innovation activities are performed (Browder et al., 2022; Garbuio and Lin, 2019). Specifically, AI enhances innovation processes and makes them more flexible and scalable, allowing companies to react better to changing environments (Gupta et al., 2020). According to Hoornaert et al. (2017), AI-based features like augmented decision-making, process

optimization, and improved problem-solving can contribute to the organizational innovation performance to a significant extent.

These results are also supported by recent research, which underlines the positive direct effect of AI use on innovation potential. According to [Siddiqui \(2024\)](#), that AI boosts the innovation capability because it increases the processing of knowledge, generates insights based on data, and is more efficient in using resources. On the same note, [Zhong and Song \(2025\)](#) emphasize that AI allows companies to explore new technological prospects and effectively utilize available knowledge, thus reinforcing the innovation performance. [Gao et al. \(2025\)](#) also indicate that AI improves organizational sensing, learning, and transformation process that is crucial to maintaining innovation. [Moreira et al. \(2024\)](#) also note the existence of knowledge integration, technological capability, and organizational learning as dimensions of innovation capability, which are considerably enhanced by the adoption of AI. All of this evidence supports the thesis that AI is a vital facilitator of innovation capability, which will eventually increase the innovativeness of firms overall.

Artificial intelligence is essential to the IT industry's capability for innovation as AI adoption enhances teamwork, real-time decision-making, and agile development all of which are critical for fostering creativity in extremely dynamic technological environments ([Joshi, 2025](#)). Additionally, AI-based systems can offer automated testing, smarter debugging, and quicker prototyping all of which help to accelerate and improve innovation ([Alenezi and Akour, 2025](#)). Theoretically, these results can be greatly explained by the Dynamic Capability Theory, which assumes that organizations gain sustainable competitive advantage because of their capabilities to detect opportunities, capture them, and re-align the resources ([Teece, 2007](#)). Artificial intelligence enhances these dynamic capabilities by allowing organizations to quickly adapt to changes in the environment, incorporate new knowledge, and change the way operations are conducted. The dynamic capabilities view also indicates that AI can improve the capability of innovation by increasing organization learning, flexibility, and responsiveness, thus allowing companies to keep innovating in competitive markets ([Ettinger, 2025](#); [Gao et al., 2025](#)).

Furthermore, AI facilitates the process of strategic innovation by helping to make wise judgments and investigate novel business models, in addition to increasing operational efficiency.

Even though AI offers many benefits, there are also obstacles to its adoption, such as difficulty integrating it, a lack of expertise, and resistance to change, particularly in IT organizations transitioning to AI-based systems.

Therefore, it can be concluded that artificial intelligence is one of the main sources of innovation in the IT sector since it enables businesses to continuously develop, learn, and adapt, which ultimately leads to improved innovation outcomes and long-term competitive advantage.

5.2.3 Innovation Capability has a Positive Impact on Project Performance

Hypothesis 3 has been validated through a positive and significant relationship between Innovation capability and project performance ($\beta = 0.312$, $t = 6.745$, $p < 0.05$). This confirms that innovative capabilities lead to improved performance of project specially at SMEs level organization. This suggests that organizations which have innovation capability are able to create new concepts, improve procedures, and generate excellent project performance. It's common knowledge that an organization's ability to innovate is crucial to its project performance because it boosts project execution effectiveness and efficiency.

Empirical studies emphasize that innovation capability helps firms to create, embrace and execute new ideas, processes, and technologies that can be used to improve project performance. Innovation capability can be defined as the capability of an organization to mobilize resources efficiently, integrate knowledge and to constantly introduce improvements, which are vital in promoting high performance (Yusof et al., 2023). According to (Gonzalez, 2024), innovation is closely linked to the processes of information acquisition and learning, where organizations learn, integrate, and synthesize knowledge to develop creative solutions that improve project performance. Organizational learning and absorptive capacity usually aid

this process and enhance the capacity of a firm to innovate and work well. Moreover [Biedenbach and Müller \(2012\)](#) also prove that innovative capabilities can lead to short-term and long-term project performance by allowing organizations to perfect the current processes (incremental innovation) and create completely new solutions (radical innovation), thus enhancing efficiency, effectiveness, and competitive positioning.

The ability to innovate is particularly important in the IT sector because projects there are technologically advanced and fast-paced, requiring ongoing innovation because of system integrations, ongoing updates, and shifting customer demands. Businesses with strong innovation are better able to leverage new technologies, improve system development cycles, and respond quickly to changes in the market and in technology.

As a result, they are better at completing projects that meet stakeholder expectations and are of high quality. The Dynamic Capability Theory, which holds that organizations perform better by developing capabilities that allow them to adapt to quickly changing contexts, is the theoretical foundation for this connection ([Teece, 2018](#)).

In this context, innovation capability is regarded as one of the most important dynamic qualities that enables businesses to recognize new technological opportunities, seize them with creative solutions, and adapt their resources and procedures to them ([Terziovski and Samson, 2007](#)). As a result, companies with high potential for innovation are more adaptable, resilient, and better equipped to manage challenging IT projects and produce improved project performance by delivering high quality outcomes.

Therefore, the innovation capability is important for improving a project's performance by fostering creativity and adaptability and providing a chance for ongoing improvement. In the IT industry, innovation capability is a strategic enabler due to the complexity and constant change of projects, as well as the ability to maintain agility and competitiveness inside organizations. In turn, as it would enable businesses to produce excellent results and guarantee their long-term success, project performance can be characterized as a significant driver of innovative capabilities.

5.2.4 Innovation Capability Mediates the Relationship between Artificial Intelligence and Project Performance

To analyze, the mediation analysis has revealed that innovation capability mediates the relationship between the adoption of AI and project performance ($\beta = 0.092$, $t = 4.751$, $p < 0.00$), providing significant empirical support for H4. This highlights that AI adoption leads to performance improvement; its effects become more pronounced as companies become more effective in their innovation. Innovation capabilities enable firms to better integrate, adapt, and leverage AI-driven insights within project processes. Thus, innovation capability not only strengthens the direct effects of AI adoption but also acts as an essential pathway that enhances overall project performance by fostering a more adaptive and innovation-driven environment.

The results support the mediating factor of innovation capability in the relationship between project performance and AI adoption well. As emphasized in previous research, the implementation of AI involves a combination of enabling capabilities that include functional competence, cybersecurity management, knowledge recombination, and governance structures that make it possible to successfully integrate AI into an organization ([Agarwal et al., 2021](#); [Bessen et al., 2022](#)). When integrated, AI increases the power of innovation by increasing flexibility, scalability, and responsiveness in the innovation processes ([Bag et al., 2021](#)). In addition, AI-based features like ambidexterity, augmented decision-making, process optimization, and advanced problem-solving have a significant impact on increasing the capabilities of the organization to create and adopt innovative solutions ([Dicuonzo et al., 2023](#); [Lou and Wu, 2021](#)).

These results are aligned with the existing literature, which highlights that the ability to innovate is the most important mediating variable between AI adoption and project performance. Investments in technology are not enough to fuel performance unless they are converted to innovation capabilities ([Lang et al., 2012](#);

Thornhill, 2006). In this aspect, AI becomes more effective in knowledge processing, organizational learning, and resource integration that are crucial in developing innovation capability (Li et al., 2025a). Moreover, AI enhances sensing, seizing, and transforming features, allowing companies to translate technological potential into innovative products (Gao et al., 2015). The capability of innovation, in its turn, allows firms to convert knowledge and ideas into new products, services and processes, which eventually results in better performance of the project. Its multi-dimensional character, i.e. capability to learn, conduct research and development, and allocate resources, further lends credence to the fact that it is a major mechanism that connects technological inputs with performance outputs (Duan et al., 2020).

Thus, in line with the dynamic capabilities theory (Helfat and Peteraf, 2003), the results prove that AI generates value indirectly by enhancing innovation capability, which is a key intervening factor in the conversion of AI adoption to improved project performance. The outcome of this research indicate that innovation capability is a critical mediator in the association between artificial intelligence and project performance. The IT sector requires organizations to embrace AI technologies, as well as establish robust innovation capabilities to maximize the performance benefits and attain sustainable competitive advantage.

5.2.5 Managerial AI Skills Positively Moderate the Relationship between Artificial Intelligence Adoption and Innovation Capability, such that the Impact of AI Adoption on Innovation Capability is Stronger when Managerial AI Skills are High

The study found that managerial AI skill moderates the relationship between artificial intelligence adoption and innovation capability ($\beta = 0.146$, $t = 3.751$, $p < 0.05$). Innovation capability is strongly enhanced with increasing managerial skills with AI as a facilitating condition, suggesting the positive impact of adoption of the technology increases with the managerial skill. This means that merely having

AI technology in an organization is not enough, firms need AI managers who can use and understand the tools.

This result support previous literature by [Alekseeva et al. \(2024\)](#) that the use of AI transforms the position of managers and drives their need to have cognitive skills and analytical abilities, which underscores the significance of managerial skills in exploiting AI technologies. [Yang et al. \(2024\)](#) have pointed out that AI integration has been found to boost the managerial decision-making skills, which subsequently boosts planning, organization, and organizational performance in general. These results indicate that managers with good AI-related skills would be in a better position to turn AI adoption to meaningful innovative outcomes.

Additionally, [Dorn \(2025\)](#) highlight that AI-enhanced situations and managers' tasks are becoming less administrative and more strategic and innovation-focused. The demand for managers to spearhead the digital transition, foster a culture of innovation and lifelong learning, and encourage human-AI teamwork is growing. Because these abilities enable enterprises to fully utilize the innovative potential of AI technologies, this shift also validates the moderating importance of management AI capabilities.

Furthermore, empirical evidence indicates that a key element of human AI skills that significantly impact innovation is managerial AI skills. Companies that invest in building such skills can better redesign operations, maximize resources, and encourage creativity, which are critical in the innovation process. This support the idea that managerial AI skills are important to technological innovation in technology-driven environments rather than merely supporting it. The Dynamic Capability Theory, which holds that companies must build, integrate, and reconfigure internal competences in order to effectively respond to the rapidly changing environment, provides theoretical justification for this conclusion ([Gao et al., 2025](#)). Managerial AI skills are one of the important dynamic capabilities in the context of AI adoption to allow firms to feel the technological opportunities, capture the potential of innovations, and remodel operational processes ([Olan et al., 2022](#)). In the IT industry in particular, where the constant innovation is a key factor to competitive advantage, managerial AI skill improves the possibility

of the firm to be agile and innovate as it is able to make good use of AI technologies (Tupsakhare, 2022).

These results of this research demonstrate that managerial AI skills significantly enhance the positive relationship between AI adoption and innovation capability, demonstrating that the likelihood of converting AI investments into sustainable innovative performance increases with an organization's managerial competencies.

5.2.6 Strategic Agility Positively Moderates the Relationship Between Artificial Intelligence Adoption and Project Performance, such that the Impact of AI Adoption on Project Performance is Stronger when Strategic Agility is High

The findings revealed that strategic agility has a significant negative moderating effect on the relationship between AI adoption and project performance ($\beta = -0.078$, $t = 2.168$, $p < 0.05$), which is counter to the hypothesized positive moderation. In particular, the positive impact of AI adoption on project performance decreases with strategic agility. H6 is therefore rejected, not because the concept of strategic agility is irrelevant, but because the role of strategic agility is not what was proposed. Although Dynamic Capability Theory provides the rationale for the importance of strategic agility for performance, there is no negative interaction in the theory's usual formulation and rather than a breakdown of the dimension, the result indicates a more specific mechanism within the dynamic one.

The surprising discovery could indicate that the impact of AI on project performance is less significant in highly agile organizations. According to Khraim (2022), technological innovative capabilities and firm performance in IT sector firms in Jordan, strategic agility was not a significant moderator that would amplify the relationships between technological innovative capabilities and firm performance, implying that the hypothesized role of strategic agility as an amplifier of the relationships between technological innovative capabilities and firm performance is

not always observed in practice. This is consistent with the current study's result that strategic agility does not provide a further boost to the performance effect of AI and that this effect is somewhat reduced. The literature has previously shown that strategic agility is crucial for AI adoption. A high exploration tendency trait which is characteristic of companies that seem to be strategically agile reduces the performance enhancing benefits of AI adoption because of the instability in AI implementation stemming from too many experiments. Likewise, AI's positive impact was also dampened by high exploitation tendencies, which limited its transformative power due to its dependence on the existing processes (Hong et al., 2026). This evidence indicated that strategic orientations that are tied to agility do not necessarily magnify the positive impacts of AI, but in certain situations, they actually reduce its impact. Further, a study on the success of digital products revealed that the combination of AI and project management did not directly impact the product outcome and importantly, the findings indicated that AI negatively moderated the relationship between open innovation networks and product outcome, suggesting that AI can, under certain conditions, decrease the value of existing organizational capabilities rather than complement them (Nikolić and Bjelica, 2025). This reinforces the idea that AI is not just about amplifying organizational capabilities, but rather a dynamic and multifaceted partnership. The unexpected negative moderation might be a sign that firm strategic agility may have a negative impact because they already have effective mechanisms in place to adapt, flexible decision-making, and fast response. In these settings, AI systems can bring some added value to the project performance which could be partially replaced by the tried and tested agility practices within the organization. According to Balzano and Bortoluzzi (2024) agile organizations are always testing processes out and get used to uncertainty, this can reduce their need for outside technological assistance to make decisions, including AI tools. According to Dynamic Capability Theory, firms must combine, build and flex their internal and external capabilities in order to cope with dynamic environments (Teece, 2018). Though strategic agility is known to be a key dynamic capability that facilitates this adaptation, the following findings indicate that in contexts of already highly developed agility, it might be able to partially replace not complement AI-driven decision support.

Research on AI and organizational resilience also shows that using AI doesn't necessarily lead to improved performance; instead, performance is dependent on how AI is integrated into the work and organizational functions. This is consistent with the notion that AI could provide decreasing marginal benefits in the most agile organizations. In addition, a study on the role of management commitment and AI adoption revealed that in environments that use AI, the moderating effect of management and organizational factors decreases as AI-driven routines become institutionalized, indicating that established organizational capabilities can take over or cancel out the expected moderating effects of contextual variables (Aldosary et al., 2026). Similarly, if strategic agility is already at a high level, it can also help to offset the contribution of AI to project performance. Based on the results of this study, it can be concluded that strategic agility has statistically significant but negative moderating effect on the relationship between the adoption of AI and project performance. This means that for organizations with high strategic agility, the value to project performance from using AI systems may be less. Therefore, as an extension to the proposed hypothesis, there is a slight weakening relationship between the AI-project relationship when strategic agility is added to the equation of this study. Future research should examine the conditions around the use of strategic agility as an alternative or supplement to the adoption of AI, taking into account additional contextual factors such as industry type, organization size, and the maturity of AI deployment.

5.2.7 Strategic Agility Positively Moderates the Relationship Between Innovation Capability and Project Performance, such that the Impact of Innovation Capability on Project Performance is Stronger when Strategic Agility is High

The findings indicate that the relationship between innovation capability and project performance is significantly and positively moderated by strategic agility ($\beta = 0.139$, $t = 5.967$, $p < 0.05$), with the effect of innovation capability on

project performance increasing with strategic agility. That is, there is a positive relationship between innovation capability and project performance, but it is also improved when they can quickly adapt and effectively apply the new ideas created. literature supports this finding by indicating that innovation capability is a major driver of project and organizational performance since it helps firms to create, integrate and deploy new knowledge and technologies to enhance performance (Biedenbach and Müller, 2012). According to Zongyuan and Jiale (2025) the connection between innovation and performance is not always direct, and it may require contextual conditions, including the agility of the organization. The result is also supported by previous literature by Dunlop-Hinkler et al. (2011) that capability of an organization to quickly adapt to changes in the environment and realign resources, is one of the factors that significantly contribute to improved performance outcomes.

Consistent with research that highlights that strategic awareness, coherent leadership, and flexibility, which help organizations to match the work on innovation with the evolving market needs and enhance the overall performance of the project (Weill et al., 2003). Moreover, empirical data also proves that strategic agility plays an important role in boosting performance and is even more effective when interacting with technological and innovation capabilities (Ashrafi et al., 2019; Queiroz et al., 2018). Khraim (2022) have pointed out that strategic agility reinforces the impact of technologically innovative capabilities on the performance of firms by facilitating quick decision-making and the ability to allocate resources flexibly.

In the IT industry this moderating effect is especially critical as the projects are dynamic, uncertain, and technology-based. IT organizations have to be innovative and at the same time keep up with the changing fast paced technology and changing demands of clients. Although the innovation capability enables the firms in developing new solutions and refining the processes, strategic agility assures that the innovations are implemented and aligned with the environmental demands effectively. Present research confirms strategic agility is crucial for businesses because it facilitates change adoption, allows them to take advantage of

new opportunities, and improves project performance.

Strategic agility is thus a key element that can be used to increase the effectiveness of innovation capability within project settings. It allows organizations to react swiftly to changes, align innovation strategies with market requirements and help organizations get the full value of innovative efforts. When innovativeness and strategic responsiveness are critical in an industry like IT, the ability to be innovative and have strategic agility is a powerful source of achieving high project performance. As a result, the strategic agility may be regarded as a moderating factor that enhances the positive correlation between the innovation capability and project performance towards achievement of better results and long-term competitive advantage

5.3 Confirmation of Hypothesis

TABLE 5.1: Confirmation of Hypothesis

Hypothesis	Statement	Result
H1	$AI \rightarrow PP$	Supported
H2	$AI \rightarrow IC$	Supported
H3	$IC \rightarrow PP$	Supported
H4	$AI \rightarrow IC \rightarrow PP$ (Mediating)	Supported
H5	$MAIS \times AI \rightarrow IC$ (Moderating)	Supported
H6	$SA \times AI \rightarrow PP$ (Moderating)	Not Supported
H7	$SA \times IC \rightarrow PP$ (Moderating)	Supported

5.4 Implications

5.4.1 Theoretical Implication

This study is theoretically grounded in Dynamic Capability Theory (DCT) proposed by Teece et al. (1997) which suggests that the organizational performance

is built on three aspects: sensing, seizing, and reconfirming, meaning that the organization is capable of sensing new opportunities, seizing them by coordinating its resources, and reconfirming its organizational routines to respond to changes in the environment. The present research model maps these three dimensions onto the constructs of the model: the sensing dimension is operationalized by AI adoption, as project teams depend on AI tools for their patterns and predictions; the seizing dimension is operationalized by managerial AI skills, and is the domain of the manager who is tasked to translate insights created by the AI into action for the project; the reconfiguring dimension is operationalized by innovation capability, which is the capacity of the organization to transform its processes and workflows over time as a result of the use of AI. This study offers a theoretically precise and empirically testable extension of the theory into the domain of using AI in software project management by placing each construct in a different DCT dimension.

The positive relationship between project performance and adoption of AI supports the resource-based dimension of DCT (specifically, that technologically superior resources lead to competitive advantage), with empirical evidence. This discovery aligns with earlier empirical research that found the adoption of AI can improve operational efficiency, decision-making accuracy, and productivity in knowledge-based sectors. In theory this result shows that AI adoption becomes a first order dynamic capability, essentially one through which software organizations can directly benefit their project scheduling, resource allocation, and quality assurance of their software. This extends the scope of the concept of DCT beyond the manufacturing and strategy environments to the project management of IT project, thus enriching the empirical foundation of the concept. The most important theoretical finding of this study is the confirmation of innovation capability as a mediator between the adoption of AI and the project performance. The findings in this study operationalize the reconfiguration pillar of DCT, which posits that organizations must continuously reconfigure their assets in order to maintain their competitive advantage; specifically, the adoption of AI. According to the mediation result, important reconfiguration of organizational routines, in what (Teece,

2007) calls reconfiguration, is the way in which AI generates superior project performance, and not mechanical superiority in the product, process or outcome. This discovery builds on previous research on innovation capability (Lawson and Samson, 2001) by defining it as the key link between technological investment and project performance in AI-based software development projects. It suggests that the dimension of reconfiguration of the DCT should be modelled, rather than assumed, theoretically, as it is an important aspect of AI-driven performance.

Managerial AI skills have a strong influence on the seizing dimension of DCT, hence the moderator effect of these skills. The results indicate that the relationship between the use of AI and innovation capabilities is positive and significant when the project managers have high competencies in the area of AI, highlighting that innovation capability depends on a competent seizing agent in addition to the sensing capability. The finding broadens the theories and knowledge of managerial skills in AI-enabled contexts – mere implementation of AI tools is not sufficient; managerial skills should include understanding the gained insights from the AI; managing AI tools within project processes; developing an attitude of openness toward introducing AI tools in the workplace. The current results call this into question by specifying managerial AI skills as the competency for effective seizing in AI-intensive project performance. On the other hand, the non-significant moderation effect of strategic agility narrows the boundaries of DCT, suggesting that once the seizing and reconfiguring dimensions are suitably operationalized at the managerial level, in terms of managerial skills and innovation capability, the effect is not moderated by broader organizational agility, which begs further theorizing about the level of analysis at which agility is relevant.

The study also provides methodologically added value to the theoretical development of this field by using the Partial Least Squares Structural Equation Modelling (PLS-SEM) method which simultaneously tests direct, mediation and moderation effects in an integrated model. For theory building research in a newly emerging field where the constructs are being newly developed and sample size is moderate and in the case of research on AI adoption in Pakistan's software industry, it is suitable. The reliability of the model helps to validate the theoretical findings,

and the model used in this research can be replicated in future research with longitudinal design or qualitative comparative analysis and various moderators like organizational culture, leadership style and technological readiness.

In conclusion, this study extends Dynamic Capability Theory by developing and empirically testing a context-specific model based on the dynamic capabilities of an integrated system comprising AI use, innovation capabilities and managers' AI skills to enhance software project performance. The model extends DCT's previous formulation, which was mostly abstract and organization-level, by articulating the mechanisms (innovation capability as mediator) and boundary conditions (managerial AI skills as a significant moderator; strategic agility as a non-significant moderator) that shape the effects of AI at the project level. The study's main theoretical contribution is the granular nature of the theorisations of DCT at the level of mechanisms, particularly in AI intensive software environments, and this can serve as the basis for future research in the field of DCT.

5.4.2 Practical Implication

On the practical side, the findings of this research are relevant for project managers, product managers, and team lead of software development industry in Pakistan, especially for small and medium sized software enterprises where large-scale technological investment is often limited due to limited resources. The positive effect of using AI tools on project performance underscores the importance of strategic implementation of AI in the project's core functions, such as requirements estimation, progress monitoring, sprint planning, and defect detection. Project managers should take a step-by-step, evidence-based approach to adoption, starting with high friction project processes and scale adoption as concrete results are realized while also helping SMEs to tangibly and measurably gain performance benefits without taking on excessive financial and operational risk.

Second, the powerful mediation effect of innovation capability indicates that the use of AI tools is not enough to produce better project results. The project manager, product manager and team lead should therefore establish organizational

practices that take the insights gleaned from AI into innovative practice, such as regular retrospectives, joint logs of what's learned, and dedicated innovation sprints. These mechanisms can be especially useful for SMEs, where R&D teams are, if they exist, quite limited in size, and where the way project and product teams work, informally, everyday, is crucial to the process of making AI-generated knowledge relevant for innovation.

Third, the strong positive moderating effect of managerial AI skills highlights the importance of developing project managers, product managers and team leads with technical knowledge and authority to transform AI-drawn insights into actionable decisions. Managers are not only to use the AI tools as end-users but also as strategic enablers who will interpret the output of AI, align it with project and product goals and coordinate its implementation across functions. In SMEs with limited resources, it's likely that investments in managerial AI competence will be more likely to pay off than investments in AI infrastructure, managerial competence, and not the complexity of the technology, is the key factor in whether or not AI is translated into innovation and performance.

Last, but not least, the dual role of strategic agility has a more subtle implication. The direct link between AI adoption and project performance was significantly weaker after the addition of strategic agility, indicating that when the organization is too busy re-prioritizing, it hampers the smooth processes that allow AI-driven improvements to become more stable and effective. At the same time, it significantly reinforced the link between innovation capability and project performance, suggesting that when the AI-generated insight is turned into innovation, agility becomes relevant to the ability to make the innovation pay off in tangible project results. The principle of agility should therefore be used judiciously: AI's use should be a stable process, but the innovative output should be flexible in its application and action implementation.

This study is also able to provide a wider concept of enhancing the practices of project and product management using AI techniques in software SMEs of developing economy like Pakistan. It is imperative for project managers, product managers, and team leads to support creating structured, low-cost solutions that

help foster AI literacy, cross-functional coordination, and innovation practice on a continuous basis rather than on an ad hoc basis. The validated intervening role of innovation capability further strengthens the notion that embedding practice of innovation in the day-to-day project cycles is crucial and that AI utilization is an organizational skill set to be developed, not a one-off technology acquisition.

In this regard, software companies and SME leadership are urged to dedicate resources to affordable AI-literacy training, knowledge-sharing structures, and simple AI-backed decision-making tools that maximize the value of adopting AI without the financial investments associated with enterprise-scale transformations.

Examples of practical actions might involve creating peer-led AI champion initiatives, AI-driven sprint planning and defect prediction tools, and integrating AI workflows into structured onboarding programs for new team members. Also, strategic agility is more useful when it is used on the right segment of the AI-to-performance continuum, so it's important that software companies not view "more agile" as always being a good thing.

The resources are best spent on strengthening the stable, well-defined routines and managerial AI competence for the AI adoption process, while being flexible at the level of innovation capacity and project results, enabling firms to benefit from agility where it brings value without jeopardizing the routines that lead to the achievement of the innovation.

5.5 Limitations and Future Research Directions

The findings of this study are valuable to understand how the adoption of AI impacts project performance and innovation capability; however, several limitations should be noted: Although this study offers insights into the connection between AI adoption, innovation capability, and project performance, it has some limitations: The cross-sectional design, which involved collecting data at one specific point in time, also made it difficult to see how adopting AI affects the innovation capability and project performance at various stages of the project. The causal relationships of identified relationships should be interpreted with caution

as the potential impact of AI adoption can change as organizations become more experienced.

Secondly, the study focused only on a few Software Development Companies (SDC) at the SME level in Islamabad and Rawalpindi, which may not be representative of other parts of the country or larger companies with different resources, infrastructure and priorities. Third, self-reported data can suffer from biases, including common method bias and social desirability, which can differ from actual behaviors and results in organizations.

Given these constraints, a few areas of future research are proposed. Longitudinal studies would be especially useful for drawing inferences about the trend of impact of AI adoption on innovation capability and project performance, which would help to reach causal conclusions. Further, the moderating effect of strategic agility was not found to be supported; future research should investigate whether it has a moderating effect on performance via some other organizational path or via the path of innovation capability. Additional comparative analysis by organization size, sector and geography would also help to identify how context influences outcomes of AI uptake and provide policy advice on this. Additionally, the addition of other factors like organizational culture, leadership style, and technological readiness for future model would give a more comprehensive picture of the factors influencing the AI's successful implementation. Last, but not least, the framework of this study could be applied to other industries and cultures to further develop a more general knowledge regarding the effect of AI in organizational innovation and performance.

5.6 Conclusion

The purpose of this research was to explore the impact of the adoption of AI on project performance in software development SMEs, considering the mediation effect of innovation capability and the moderation effects of managerial AI skills and strategic agility. The study's results offer robust empirical evidence of the positive impact of the use of AI on project performance when it comes to software

development organizations. The findings underscore how AI tools can improve the efficiency, decision-making process, and project performance. Furthermore, innovation capability was identified as a significant mediator between AI and project performance, highlighting how AI can enhance project performance by fostering innovative solution generation, adaptation, and implementation.

Additionally, managerial AI skills were found to be an essential moderating variable, enhancing the relationship between AI adoption and innovation capability. This suggests that companies with greater management skills in AI have more capacity to use AI technologies to support innovation and to enhance performance results. While the moderating effect of strategic agility on the AI adoption and project performance relationship was not substantiated, it provides pathways for further studies and organizational exploration of the interaction between strategic agility and AI for project transformation in dynamic project contexts. Moreover, the study contributes to the academic debate on the role of AI in driving innovation and project management in the technology industry and offers a wealth of practical advice to technology companies, project managers and policymakers seeking to achieve the highest possible level of project performance with the right approach to AI adoption, a culture of innovation and leadership that is AI literate.

Overall, this study enhances the understanding of the potential of AI in driving innovation and project performance, offering a comprehensive framework that combines technological, organizational, and managerial aspects. The study provides useful knowledge for both the academia and the practice, in that organizations have to (not only) adopt the technologies of AI and also have to build the innovation capability and managerial knowledge to reap the benefits of performance. The results offer valuable insights for IT organizations, project managers, and policy makers aiming to improve project performance with intelligent use of AI and innovation approaches.

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Appendix-A



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Ref: CUST/FMSS/REC/2026-5

Date: 6th April, 2026

RESEARCH ETHICS COMMITTEE CERTIFICATE OF REVIEW AND SUPPORT

This is to certify that Project titled: *"Impact of artificial intelligence adoption on IT Project Performance: A Moderated Mediation model"* submitted by MS scholar *Nudrat Niaz*, and/ supervised by: *Dr. Syed Arsalan Haider* reviewed by the Research Ethics Committee of Faculty of Management and Social Science, meets the requirements of the American Psychological Association's Ethical guidelines for Human Research and is **REVIEWED** and **APPROVED** by Research Ethics Committee of Faculty of Management and Social Sciences.

It is the Scholar's responsibility to ensure that all researchers associated with this project are aware of the conditions of approval and which documents have been approved.

The Scholar is required to notify the Research Ethics Committee in case of any amendment in the project, specifically:

- Any significant change to the project and the reason for that change, including an indication of ethical implications (if any)
- Serious adverse effects on participants and the actions taken to address those effects
- Any other unforeseen events or unexpected developments that merit notification
- The inability of the Principal Investigator to continue in that role, or any other change in research personnel involved in the project
- A delay of more than 12 months in the commencement of the project
- Termination or closure of the project.


Dr. Zunnoorain Khan

Convener, Research Ethics Committee
Faculty of Management and Social Sciences
Capital University of Science and Technology
Islamabad



CAPITAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

Department of Management Sciences

Dear Respondent,

I am a student of the graduate programme in Project Management at Capital University of Science and Technology. I am conducting an academic research study for my Master's thesis on "Impact of Artificial Intelligence Adoption on IT Project Performance: A Moderated Mediation Model."

This survey is part of an academic research study conducted for a Master's thesis in Project Management. It will take approximately 5–7 minutes to complete. The purpose of this questionnaire is to examine how the adoption of advanced technologies can improve the performance of IT projects by strengthening innovation capabilities. It also seeks to examine the role of managerial AI skills and strategic agility in maximizing the benefits of such technologies.

Your responses will be kept strictly confidential and will be used only for research purposes. There are no right or wrong answers; please respond honestly based on your experience.

For additional questions, send an email to nudrat.96@gmail.com. Thank you so much for taking the time to complete this survey. Thank you in advance for your help and support.

Regards,

Nudrat Niaz

Demographic Information

Please tick (✓) the relevant box.

Gender	Male	Female
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Age	18–30 years	31–42 years	43–54 years	55 years and above
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Education	Bachelor	Master	PhD
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Position	Project Manager	Product Manager	Team Lead
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Work Experience	Less than 3 years	3–5 years	6–10 years	10 years and above
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Experience with AI Tools	Less than 1 year	1–2 years	3–5 years	5 years and above
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Project Team Size	Less than 5 members	5–10 members	11–20 members	20+ members
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Keeping in view your software development project, please indicate the extent of your agreement or disagreement by selecting the appropriate option:

1 = Strongly Disagree 2 = Disagree 3 = Neutral 4 = Agree 5 =
Strongly Agree

(Please respond with your answers considering AI-enabled software development projects and their impact on project performance.)

Artificial Intelligence

Sr.	Statement	1	2	3	4	5
1	We deploy advanced technologies such as artificial intelligence in software project development.					
2	We adopt artificial intelligence at firm level for taking right strategic and project related decision making.					
3	We extensively use artificial intelligence in our company to design, develop and improve software products and services.					
4	Our company has continuous process in place to adopt next generation technologies to improve software project performance.					
5	Our firm is also ready to embrace tested technologies like artificial intelligence in order to facilitate innovation in the software development projects.					

Project Performance

Sr.	Statement	1	2	3	4	5
1	The software project results, or deliverables, are in line with client objectives.					
2	The software development project is operating within the pre-estimated budget.					
3	The software development project was completed within the planned schedule.					
4	The stakeholders have been pleased with the result of the software development project.					
5	The quality of the software project and the quality of the deliverables meet the standard.					

Innovation Capability

Sr.	Statement	1	2	3	4	5
1	We have a culture and management process in our software development organization that actively promotes and encourages innovation in projects.					
2	Our team is also able to utilize knowledge both internal and external (e.g. documentation, industry trends) to perform software development work efficiently and quickly.					
3	Our organization is fast in adapting our software products and development processes to changes in market conditions, like what the customers want or what the competitors offer.					
4	The project team members and software developers should be motivated to share their ideas and engage in projects like feature development, process improvement, and innovation projects.					
5	The market, customers, or partners continue to test new ideas that are assessed and implemented in software development and project activities.					
6	We can easily modify and enhance products or processes in response to environmental or technological change by having our software development teams modify rapidly.					

Managerial AI Skills

Sr.	Statement	1	2	3	4	5
1	Our managers are able to understand software development and business challenges and to direct AI adoption to solve them.					
2	Our managers are able to work with developers, data scientists, and clients to find the opportunities where AI can help to improve software development processes and products.					
3	Our managers have a good sense of where to adopt AI during software project development.					
4	The manager, who leads AI initiatives in our company, is a strong leader in introducing AI-driven projects.					
5	Our managers are able to understand the needs of clients and projects ahead and promote AI-based solutions to address them.					
6	Our managers are able to coordinate AI-related operations both in the development teams and stakeholders in supporting the success of the project.					
7	We have strong leadership to support AI initiatives and managers demonstrate ownership of and commitment to AI projects.					

Strategic Agility

Sr.	Statement	1	2	3	4	5
1	Our project team responds quickly to changing customer requirements for the software project.					
2	In application development, we customize software features or services to meet individual client needs.					
3	We respond immediately to the launch or the upgrade of new software products by our competitors in the software development market.					
4	In the case of our software development services, we change pricing models or subscription plans depending on changes in the market.					
5	We can expand the software solution into new markets efficiently.					
6	We adjust the range of software features or modules available in the project based on demand.					
7	We adopt AI-based technologies to enhance the efficiency and output of the software project.					
8	We switch software development tools, frameworks, or vendors to improve quality, cost, or delivery timelines.					
9	We replace software components when we can find quality or cost improvements.					