

**MIDOCEAN UNIVERSITY**

**College of Business Administration**

Major: Business Administration

**Research Proposal**

**The Impact of Artificial Intelligence on Construction Project Performance  
and Decision-Making Efficiency**

أثر الذكاء الاصطناعي على أداء مشاريع الإنشاءات وكفاءة اتخاذ القرار

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## Abstract

Construction projects continue to face significant challenges such as delays, cost overruns, and inefficiencies, despite advancements in project management practices. The increasing complexity of construction projects and the availability of large volumes of data have led to the growing importance of adopting innovative technologies such as artificial intelligence (AI). This study was selected due to the critical need to explore how AI can enhance project performance and address persistent issues in the construction industry, both from theoretical and practical perspectives.

This research adopts a descriptive analytical approach to examine the impact of artificial intelligence on construction project performance. The study focuses on key performance indicators including cost, time, quality, and safety. Data will be collected through a structured questionnaire distributed to construction professionals such as project managers, planning engineers, and site engineers. The collected data will be analyzed using statistical methods through SPSS to test the research hypotheses.

The expected results of this study indicate that artificial intelligence has a significant positive impact on improving construction project efficiency, enhancing risk prediction, and supporting decision-making processes. However, it is also anticipated that AI will complement rather than replace the role of engineers.

The findings of this study are expected to provide practical value for construction companies by improving project performance and supporting digital transformation. Additionally, the results may assist decision-makers and industry professionals in adopting AI technologies effectively, while also contributing to academic research in project management and technology integration.

تواجه مشاريع الإنشاءات تحديات كبيرة ومستمرّة، مثل التأخير في التنفيذ، وتجاوز التكاليف، وانخفاض الكفاءة، وذلك رغم التطور في أساليب إدارة المشاريع. ومع تزايد تعقيد هذه المشاريع وتوفر كميات كبيرة من البيانات، برزت الحاجة إلى تبني تقنيات حديثة ومبتكرة مثل الذكاء الاصطناعي. وقد تم اختيار هذا الموضوع نظرًا لأهمية دراسة دور الذكاء الاصطناعي في تحسين أداء المشاريع ومعالجة المشكلات المستمرة في قطاع الإنشاءات من الناحيتين النظرية والتطبيقية.

تعتمد هذه الدراسة على المنهج الوصفي التحليلي بهدف تحليل أثر الذكاء الاصطناعي على أداء مشاريع الإنشاءات. وتركز الدراسة على مؤشرات الأداء الرئيسية، بما في ذلك التكلفة، والوقت، والجودة، والسلامة. وسيتم جمع البيانات من خلال استبانة مهيكلّة تُوزع على العاملين في قطاع الإنشاءات، مثل مديري المشاريع ومهندسي التخطيط ومهندسي المواقع. كما سيتم تحليل البيانات باستخدام الأساليب لاختبار فرضيات الدراسة SPSS الإحصائية من خلال برنامج.

تشير النتائج المتوقعة إلى أن الذكاء الاصطناعي له تأثير إيجابي معنوي في تحسين كفاءة المشاريع، وتعزيز القدرة على التنبؤ بالمخاطر، ودعم عمليات اتخاذ القرار. ومع ذلك، من المتوقع أن يعمل الذكاء الاصطناعي كأداة داعمة للمهندسين، وليس بديلاً عنهم.

ومن المتوقع أن تسهم نتائج هذه الدراسة في تقديم قيمة عملية لشركات الإنشاءات من خلال تحسين أداء المشاريع ودعم التحول الرقمي. كما يمكن أن تساعد متخذي القرار والمهنيين في القطاع على تبني تقنيات الذكاء الاصطناعي بشكل فعال، بالإضافة إلى إثراء الجانب الأكاديمي في مجال إدارة المشاريع والتقنيات الحديثة.

## Introduction

Artificial Intelligence (AI) is recognized as a transformative technology that has significantly impacted multiple industries, including the construction sector. Recent advancements in AI technologies, including machine learning, predictive analytics, and computer vision, have enabled organizations to increase efficiency, strengthen decision-making processes, and optimize project outcomes (Kerzner, 2022; Davenport & Ronanki, 2023).

The growing importance of digital transformation in construction projects, coupled with the need to address persistent challenges such as project delays, cost overruns, and safety risks, underscores the relevance of this topic. As construction projects become more complex and data-driven, traditional project management approaches are increasingly inadequate for ensuring optimal performance (Rane et al., 2023; Dwivedi et al., 2021).

Traditionally, the construction industry has depended on human expertise, manual planning, and experience-based decision-making. Although these approaches have achieved some success, they are limited in processing large datasets and accurately predicting potential risks. The adoption of artificial intelligence enables organizations to analyze both historical and real-time data, thereby enhancing forecasting, scheduling, and risk management (McKinsey & Company, 2023; Zhang, 2023).

The significance of this study lies in its contribution to understanding how artificial intelligence enhances construction project performance and promotes more efficient, sustainable practices. This research is highly relevant to contemporary society, where infrastructure development is essential for economic growth, and improved project outcomes yield considerable social and financial benefits (PMI, 2023; Rane et al., 2023).

This study begins with a general overview of artificial intelligence and its applications, then narrows to examine its specific role in construction projects. The analysis identifies how AI affects key project performance indicators, including cost, time, quality, and safety (Chen et al., 2024; Zhang, 2023).

This study addresses a significant issue by examining the integration of artificial intelligence into construction practices and connecting it to established knowledge in project management and technology adoption. It extends previous research by analyzing recent studies, identifying emerging trends, and highlighting gaps in the current literature, particularly concerning the relationship between artificial intelligence and the role of engineers in construction projects (Davenport & Ronanki, 2023; Salimimoghadam, 2025).

## **Research Problem**

Although artificial intelligence (AI) technologies have advanced rapidly, their integration into project planning remains inconsistent and limited across various industries. This situation prompts several critical questions: To what extent can AI improve the efficiency and accuracy of project planning processes? Is it feasible for AI to replace human planners in decision-making tasks? What challenges hinder organizations from fully adopting AI in planning functions? (Dwivedi et al., 2021).

Project planning in many organizations continues to rely primarily on traditional tools and human expertise, resulting in inefficiencies, errors, and delays in decision-making. The Project Management Institute (PMI, 2023) reports that nearly 11.4% of investment is wasted due to poor project performance, frequently associated with ineffective planning and forecasting.

By contrast, the projected future of project management centers on data-driven, automated, and intelligent systems that can enhance forecasting accuracy, optimize resource allocation, and mitigate risks (Kerzner, 2022; McKinsey & Company, 2023). This contrast underscores a significant gap between current project planning practices and the envisioned future enabled by AI technologies.

Recent studies further substantiate this gap. McKinsey & Company (2023) reports that organizations implementing AI in operations can achieve productivity gains of 20–30 percent; however, adoption within project planning functions remains limited. Likewise, Gartner (2024) finds that although AI adoption is rising, only a small proportion of organizations have fully integrated AI into essential decision-making processes, including planning and scheduling.

Academic research corroborates these findings. For instance, Dwivedi et al. (2021) emphasize that while AI has significant potential to improve decision-making, its implementation is hindered by barriers including insufficient expertise, trust concerns, and organizational resistance.

Consequently, a well-documented gap exists between the prevailing reliance on traditional planning methods and the potential advantages provided by AI-driven solutions (Rane et al., 2023; Salimimoghadam, 2025).

## Importance of the Study

The significance of this study is evident from both theoretical and practical perspectives, as well as through the identification of key stakeholders who will benefit from its findings.

From a theoretical perspective, this study advances the existing body of knowledge by analyzing the role of artificial intelligence in construction project management. It synthesizes concepts from project management, technology adoption, and decision support systems to clarify how AI affects project performance. Furthermore, the study addresses a gap in the literature on the relationship between artificial intelligence and engineers' responsibilities in construction projects, thereby extending current academic discourse in this area.

From a practical perspective, the study offers actionable insights for construction organizations aiming to improve project outcomes. By illustrating how AI technologies enhance scheduling accuracy, risk prediction, cost control, and safety management, the findings support more informed decision-making and efficient project execution. These improvements can lead to reduced delays, lower costs, and improved overall project performance.

The findings of this study will benefit multiple stakeholders. Construction companies can apply the results to improve operational efficiency and implement innovative technologies. Project managers and planning engineers will gain a clearer understanding of how AI supports their roles and enhances decision-making processes. Policymakers and industry regulators may use the study's insights to encourage digital transformation within the construction sector. Researchers and academics can build upon these findings to further investigate artificial intelligence applications in project management.

## Objectives

### **General Objective:**

The general objective of this study is to analyze the impact of artificial intelligence on improving performance and efficiency in construction projects. This includes examining how AI technologies contribute to enhancing key project performance indicators such as cost, time, quality, and safety. The study also aims to explore the role of artificial intelligence in supporting decision-making processes, improving risk prediction, and optimizing resource allocation within construction environments. Furthermore, the research seeks to evaluate the overall effectiveness of AI applications in addressing common challenges in construction projects and enhancing project outcomes.

### **Specific Objectives:**

1. Identify AI technologies
2. Evaluate impact on performance
3. Assess role in risk prediction & decision-making
4. Examine challenges
5. Determine AI vs engineers

## Research Questions

1. What are the key artificial intelligence technologies used in construction project management?
2. How does artificial intelligence affect project performance in terms of cost, time, quality, and safety?
3. What is the role of artificial intelligence in improving risk prediction and decision-making in construction projects?
4. What are the main challenges and barriers to implementing artificial intelligence in construction projects?
5. To what extent does artificial intelligence support or replace engineers in construction environments?
6. What strategies can improve the effective adoption of artificial intelligence in construction project management?

## Hypotheses

### **Main Hypothesis (Alternative Hypothesis):**

#### **H1 (Main):**

There is a statistically significant impact of artificial intelligence on improving performance in construction projects.

**Null Hypothesis:**

**H0:**

There is no statistically significant impact of artificial intelligence on improving performance in construction projects.

**H1a:**

There is a positive relationship between artificial intelligence and cost efficiency in construction projects.

**H1b:**

Artificial intelligence has a positive impact on improving scheduling and reducing project delays.

**H1c:**

Artificial intelligence positively influences risk prediction in construction projects.

**H1d:**

Artificial intelligence improves decision-making processes in construction project management.

**H1e:**

Artificial intelligence enhances safety performance in construction projects.

## Literature Review

Recent research highlights the growing importance of artificial intelligence (AI) in improving construction project performance, particularly in efficiency, safety, and decision-making.

Zhang (2023) investigated the impact of predictive analytics on construction project scheduling through a quantitative research design utilizing historical project data and statistical modeling techniques. The findings indicate that AI substantially improves scheduling accuracy and reduces project delays by enhancing forecasting and resource allocation.

Similarly, Chen, Li, and Wang (2024) examined the use of computer vision technologies in construction safety management through an experimental methodology that implemented AI-based monitoring systems on construction sites. The results demonstrate that AI technologies effectively detect hazards in real time and significantly reduce workplace accidents.

Davenport and Ronanki (2023) explored the role of artificial intelligence in supporting managerial decision-making within organizations, using a qualitative case-study approach across multiple industries. The findings show that AI enhances decision-making by providing data-driven insights, but it does not replace human expertise.

Furthermore, Salimimoghadam (2025) analyzed the adoption of artificial intelligence in project management using a mixed-method approach that combined surveys and interviews with project professionals. The results indicate that although AI improves efficiency and project performance, its implementation is challenged by high costs, limited technical expertise, and resistance to change.

These findings align with those of Rane et al. (2023), who found that artificial intelligence significantly enhances resource allocation, operational efficiency, and overall project performance.

## Research Gap

While previous studies have established the significant role of artificial intelligence in enhancing construction project performance, several gaps persist within the current literature.

First, most prior research has concentrated on individual aspects of artificial intelligence, such as scheduling optimization or safety improvement, rather than evaluating the combined impact of AI on multiple project performance indicators, including cost, time, quality, and safety. Consequently, comprehensive studies that analyze these variables collectively within a unified framework are lacking.

Second, although some studies have identified a positive relationship between artificial intelligence and project performance (Zhang, 2023), others have emphasized technological benefits without considering human-related factors, particularly the role of engineers. This omission creates a gap regarding whether AI functions as a supportive tool or has the potential to supplant human expertise in construction environments.

Third, most existing research has been conducted in general or global contexts, with limited attention to specific industry environments, such as construction projects in developing or rapidly evolving regions. This represents a contextual gap, as the adoption and effectiveness of artificial intelligence may vary across organizations and regions.

Furthermore, previous studies have identified several limitations, including reliance on small sample sizes and the exclusive use of quantitative approaches (Salimimoghadam, 2025). Therefore, research incorporating broader samples and more comprehensive analytical methods is needed to yield deeper insights into AI implementation in construction projects.

Additionally, the rapid advancement of artificial intelligence technologies has introduced new tools and applications that remain underexplored in existing research. This results in a technological gap, particularly regarding the latest AI applications in construction project management.

In response to these identified gaps, the present study seeks to provide a comprehensive analysis of the impact of artificial intelligence on construction project performance and to examine its relationship with human roles, particularly those of engineers, within construction environments.

## **Theoretical Framework**

This research draws upon several theoretical foundations to explain the adoption and impact of artificial intelligence within construction project management. These frameworks offer a systematic understanding of how AI affects project performance and decision-making processes.

First, this research is grounded in technology adoption theories, which describe how individuals accept and utilize new technologies based on perceived usefulness and ease of use (Dwivedi et al., 2021). In the context of construction projects, these theories elucidate how engineers and

project managers adopt artificial intelligence tools and how their acceptance influences implementation effectiveness.

Second, Decision Support Systems (DSS) theory underpins this research by emphasizing the role of information systems in improving decision-making processes. Artificial intelligence is conceptualized as an advanced form of decision support system that enhances data analysis, forecasting, and risk management (Davenport & Ronanki, 2023; Zhang, 2023).

Third, the Resource-Based View (RBV) theory is applied, positing that organizations gain competitive advantage through the utilization of valuable and unique resources. Artificial intelligence is regarded as a strategic resource that improves project performance by increasing efficiency, mitigating risks, and fostering innovation (Rane et al., 2023; Kerzner, 2022).

Collectively, these theories establish a comprehensive framework for analyzing the relationship between artificial intelligence and construction project performance. They further clarify how AI supports human roles, particularly those of engineers, by enhancing decision-making and operational efficiency rather than replacing human expertise (Salimimoghadam, 2025).

## **Research Methodology**

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## **Study Tools**

### **Study Instruments**

This study utilizes a structured questionnaire as the primary data collection tool to measure the impact of artificial intelligence on construction project performance.

## **Questionnaire Design**

The questionnaire was developed based on the study objectives, research questions, and hypotheses, as well as a review of relevant literature on artificial intelligence and construction project management. The items were carefully designed to ensure clarity, relevance, and alignment with the study variables.

The questionnaire consists of two main sections:

### **Section One: Demographic Information**

This section collects general information about the respondents, including:

- Job position
- Years of experience
- Type of organization
- Level of involvement in construction projects

### **Section Two: Study Variables**

This section is based on a five-point Likert scale ranging from:

(1) Strongly Disagree to (5) Strongly Agree

It includes the following dimensions:

- **Artificial Intelligence Applications :**

Measures the extent of AI usage in construction project management.

- **Project Performance :**

Covers key performance indicators, including:

- Cost efficiency
- Time (schedule adherence)
- Quality
- Safety

- **Decision-Making and Risk Management :**

Measures the role of AI in improving decision-making and risk prediction.

### **Validity and Reliability**

To ensure the accuracy and consistency of the measurement tool, the following tests will be conducted:

- **Content Validity:**

The questionnaire will be reviewed by academic experts and professionals in project management to ensure that the items accurately measure the intended variables.

- **Reliability Test:**

The internal consistency of the questionnaire will be assessed using Cronbach's Alpha coefficient. A reliability value of 0.70 or higher will be considered acceptable, indicating that the instrument is reliable.

## **Limitations ( Study Scope )**

### **A. Human Scope**

The study population consists of professionals working in the Nesma & Partners Construction Company, including project managers, planning engineers, and site engineers involved in three construction projects.

The study sample will include approximately 30 respondents selected from construction companies.

### **B. Spatial Scope**

The study will be conducted within the geographical context of the Kingdom of Saudi Arabia, focusing on construction companies operating in major cities such as Riyadh & Dammam.

### **C. Temporal Scope**

The data collection process will be conducted during the second quarter of 2026, while the overall study period will cover the Second and third quarters of 2026

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