

Thesis Title:
**Factors Influencing AI-Based Project Management
and Its Outcomes in Industrial Engineering Projects**
“Design and Consultancy Engineering Projects”

PART-3 of the Thesis
Rev.01

by
MAJID TALEB ALFLFEL
Saudi Arabia

2025 - 1447

**Submitted to Midocean University in partial fulfillment of the requirements
for the degree of Doctor of Philosophy**

in

Faculty of Management

2026

MAJID TALEB ALFLFEL



Table of Contents

1	Methodological Framework of the Research:	5
2	Theoretical Framework (Related Literature Review)	5
3	Research Methods and Procedures (Methodology)	5
3.1	Research Methodology (Approach)	5
3.2	Study Population and Sampling:	6
3.2.1	Study Population:	6
3.2.2	Quantitative Study Sample:	6
3.2.3	Qualitative Study Sample:	8
3.3	Construction of Data Collection Instruments:	8
3.3.1	Instrument Overview	8
3.3.2	Quantitative Instrument (Questionnaire Structure)	9
3.3.3	Qualitative Instrument (Expert Interview Guide)	10
3.3.4	Instrument Validation and Reliability	10
3.4	Identification of Study Variables	11
3.5	Implementation Procedures	13
3.6	Research Design and Statistical Processing	15
4	References	17
4.1	Arabic References:	17
4.2	English References:	17

List of Shortcuts:

AI	Artificial Intelligence
ANN	Artificial Neural Network
CV	Computer Vision
DL	Deep Learning
LLMs	Large Language Models
ML	Machine Learning
NLP	Natural Language Processing
NSDAI	National Strategy for Data and Artificial Intelligence
PMBOK	Project Management Body Of Knowledge
PMI	Project Management Institute
PMIS	Project Management Information System
RL	Reinforcement Learning
SDAIA	Saudi Data and Artificial Intelligence Authority
CEO	Chief Executive Officer

1 Methodological Framework of the Research:

2 Theoretical Framework (Related Literature Review)

3 Research Methods and Procedures (Methodology)

3.1 Research Methodology (Approach)

This study employs a mixed-method research design, integrating quantitative survey data with qualitative insights from expert interviews. This approach is justified by the need to explore both the factors influencing the utilization of AI-based project management and the measurable outcomes resulting from its integration in design and consultancy engineering projects. The quantitative phase provides statistically validated evidence on the relationships among influencing factors, AI utilization, and project outcomes. Meanwhile, the qualitative phase adds depth by capturing real-world insights, challenges, and enablers from industry experts. Together, these methods ensure a comprehensive and empirically grounded understanding of the dynamics shaping AI-based project management in the Saudi consultancy and design

Justification of Methodology Choice:

This research applies a mixed-method approach, integrating both quantitative and qualitative data collection and analysis. The rationale behind this choice stems from the complex nature of the research objectives, which aim to identify factors influencing AI utilization, measure its effect on project outcomes, and analyze the mediating role of AI-based project management in design and consultancy engineering projects.

Furthermore, the mixed-method approach is chosen to bridge the gap between theoretical insights and practical applications in AI-based project management. This dual approach ensures that the study captures both perceptions and measurable effects, offering a holistic analysis.

The quantitative component involves the distribution of structured questionnaires to a wide sample of professionals in Saudi Arabia's engineering consultancy sector. This allows the collection of statistically analyzable data on the relationship between the identified variables.

The qualitative component is based on semi-structured interviews with subject-matter experts and decision-makers in AI-Based project management. This provides in-depth insight into contextual factors, real-world challenges, and practical strategies, supporting a deeper understanding of the adoption process and interpretation of survey results.

This dual approach ensures that the findings are both statistically valid and contextually grounded, enhancing the reliability and relevance of the research conclusions.

This methodology is justified based on the need to:

- Address "what" the influencing factors are and "how" they statistically affect outcomes (quantitative),
- And understand "why" such factors exist and how they are experienced by practitioners in real scenarios (qualitative).

This research employs a mixed-method design in which structured quantitative data forms the basis for hypothesis testing, while qualitative interviews offer contextual support and interpretation. The study makes a theoretical contribution by proposing and validating a model that links influencing factors, AI-based project management practices, and project outcomes through mediation analysis. On the practical level, it delivers actionable recommendations tailored to the specific context of Saudi Arabia's design and consultancy engineering sector

3.2 Study Population and Sampling:

3.2.1 Study Population:

The design & consultancy engineering firms in Saudi Arabia, in total 1,123 companies according to the statistics of the Saudi Council of Engineers as of April 2024.

The study population consists of professionals involved in design and consultancy engineering firms in Saudi Arabia, which form the core environment where AI adoption in project management is emerging. According to data from the Saudi Council of Engineers (April 2024), there are 1,123 registered firms operating within this sector, ranging in size and specialization.

These firms typically include project directors, managers, engineers, and department leaders who are either decision-makers or directly engaged in utilization of AI-based project management tools.

3.2.2 Quantitative Study Sample:

Participants will be selected from design & consultancy engineering firms in Saudi Arabia, including project directors, managers, engineers, department leaders and decision-makers with direct AI utilization experience. To ensure that the research reflects diverse organizational perspectives, a structured and balanced sampling approach will be used.

The criteria include:

- Firm size: (small, medium, large)
- AI maturity levels: (early adopters, in-progress adopters, advanced users)

- Sector specialization: (architecture, engineering consultancy, project supervision, etc.)

Participants will be selected from the key managerial and operational roles, including but not limited to:

- Project Directors
- Project Managers
- Project Engineers
- Engineering Leads
- Departments Leads
- Decision-Makers

Additionally, the questionnaire will include a dedicated section to capture the demographic characteristics of the participants, allowing for a deeper analysis of how factors such as experience level, job role, and organizational background influence utilization of AI-Based project management and its outcomes.

The sample size was calculated using the formula by Steven K. Thompson (2012), as follows:

$$n = \frac{N \times p(1-p)}{\left[\left[N-1 \times \left(d^2 \div z^2 \right) \right] + p(1-p) \right]}$$

where:

- n = required sample size
- N = population size (1,123)
- p = expected proportion of the characteristic present (e.g., 0.5 to maximize the sample size)
- d = acceptable margin of error (e.g., 0.05)

Assuming an expected proportion **p = 0.5** and a margin of error **d = 0.05**, the sample size is calculated as follows:

$$n = \frac{1123 \cdot 0.5 \cdot (1-0.5)}{(1123-1) \cdot 0.05^2 + 0.5 \cdot (1-0.5)}$$

Let's compute the sample size using these values:

$$n = \frac{1123 \cdot 0.5 \cdot 0.5}{1122 \cdot 0.0025 + 0.25}$$

$$n = \frac{280.75}{2.805 + 0.25}$$

$$n = \frac{280.75}{3.055}$$

$$n \approx 91.86$$

To ensure accurate data, the sample size can be rounded to **92** firms.

If it is necessary to ensure good representation and avoid potential errors, the sample size may be increased based on the study's needs and potential data collection challenges.

The minimum required sample size ($n = 92$) was determined using Thompson's formula to ensure statistical validity. However, given the requirements of Structural Equation Modeling (SEM), which demands a larger dataset for reliable model estimation, the actual data collection will exceed this threshold to support robust analysis and improve generalizability.

3.2.3 Qualitative Study Sample:

For the qualitative component, a purposive sampling method will be used to select 8–12 expert interviewees from the same population. These will include:

- Organization CEO
- Senior Project Managers
- AI expert and Decision-maker

These interviews will help interpret statistical findings, enrich the discussion, and provide real-world illustrations.

3.3 Construction of Data Collection Instruments

3.3.1 Instrument Overview

To achieve the research objectives and test the proposed hypotheses, this study apply a mixed-method approach, utilizing both a structured questionnaire and a semi-structured interview guide as the primary data collection instruments.

- The structured questionnaire represents the quantitative tool, capturing measurable data across the three core variable groups: factors influencing AI utilization (independent variables), AI-based project management practices (mediating variable), and project management outcomes (dependent variables).
- The semi-structured interviews serve as the qualitative instrument, providing rich contextual insight into the challenges, benefits, and strategic considerations involved in AI-based project management.

This dual-instrument design ensures a comprehensive analysis that includes both empirical validation and in-depth exploration of real-world experiences.

3.3.2 Quantitative Instrument (Questionnaire Structure)

The questionnaire is designed using closed-ended questions on a 5-point Likert scale to assess agreement, frequency, or impact perception. Additionally, a small section of open-ended questions is included to enrich the quantitative data with narrative insights aligned with key research objectives.

The Questionnaire Comprises Five Sections:

1. **Demographic and Organizational Information:**

Captures participants' roles, experience, company size, AI familiarity, and current AI usage in project management.

2. **Independent Variables (Influencing Factors):**

Measures the extent to which the following six factors influence the utilization of AI-based project management in design and consultancy engineering projects:

- Data Privacy and Security
- Resistance to Change
- Cost of AI Implementation
- Compatibility with Existing Infrastructure
- Workforce Development
- Ethical Considerations

3. **Mediating Variable (AI-Based Project Management):**

Evaluates the extent to which AI tools are utilized in core project management tasks such as scheduling, reporting, risk handling, collaboration, and coordination.

4. **Dependent Variables (Project Management Outcomes):**

Evaluates the perceived outcomes of AI utilization: Assesses the perceived outcomes of AI-based project management, including:

- Decision-making
- Project quality
- Data collection accuracy
- Data analysis and insight generation
- Risk identification
- Time efficiency
- Collaboration and communication

5. Open-Ended Questions:

Support deeper qualitative understanding and explore contextual insights, including barriers, enablers, perceived benefits, and strategic recommendations for enhancing the utilization of AI-based project management practices.

3.3.3 Qualitative Instrument (Expert Interview Guide)

To supplement the quantitative findings and provide contextual depth, a semi-structured interview guide is developed based on the conceptual model and research objectives. This tool will enable a deeper understanding of:

- Perceptions of AI Utilization in project management practices
- Challenges and factors related to data security, workforce capability, and ethical concerns
- Organizational readiness and infrastructure compatibility
- Decision-making dynamics and time efficiency linked to AI
- Real examples from practice in design and consultancy engineering projects
- Industry-specific reflections, especially within the Saudi firms.

Interviews will be conducted in person or virtually, depending on participant availability and logistical feasibility. Participants will include experienced project managers, engineers, and decision-makers from Saudi Arabia's leading design and consultancy firms.

3.3.4 Instrument Validation and Reliability

The questionnaire will be reviewed by academic experts and industry practitioners to ensure content validity. To ensure methodological rigor and the credibility of findings, both the structured questionnaire and the semi-structured interview guide will undergo rigorous validation and reliability procedures.

- **Questionnaire (Quantitative Instrument)**

The questionnaire will be reviewed by an academic scholars and industry professionals to establish content validity, ensuring that the items appropriately reflect the study's independent, mediating, and dependent variables.

A pilot study will be conducted with a small representative sample of participants from the target population. The pilot aims to test:

- Clarity of wording,
- Logical flow,
- Response time,
- consistency,
- Content validity (via expert feedback).

The reliability of the questionnaire will be evaluated using Cronbach's Alpha. A threshold of 0.70 or higher will be considered acceptable, indicating a strong degree of internal consistency across each construct.

This validation process ensures that the questionnaire produces statistically sound and meaningful data for hypothesis testing.

- **Interview Guide (Qualitative Instrument)**

The semi-structured interview guide will be validated through expert review to ensure relevance, neutrality, and clarity of the open-ended questions. It will be pilot-tested with a small number of participants to verify:

- Interview flow and timing
- Comprehension and interpretation of questions
- Thematic alignment with the study's objectives and conceptual framework

Following the pilot, minor revisions may be applied to enhance integrity before full deployment.

To ensure rigor in the qualitative phase, the interview structure will undergo expert validation and pilot testing. Credibility will be reinforced through member checking, while thematic coding - if needed - will follow a systematic and transparent process aligned with the study's conceptual framework.

3.4 Identification of Study Variables

This section defines the key variables that constitute the foundation of the research model. The study framework is structured around three main types of variables:

- **Independent Variables (IVs):** Factors influencing the utilization of AI tools in project management.
- **Mediating Variable (MV):** AI-based project management.
- **Dependent Variables (DVs):** Project management outcomes.

3.4.1.1 Independent Variables (IVs): Factors Influencing the utilization of AI Tools

These variables reflect organizational, technical, and ethical dimensions that influence the utilization of AI-based project management practices in design and consultancy engineering projects. The six independent variables identified are:

1. Data Privacy and Security
2. Resistance to Change
3. Cost of AI Implementation
4. Compatibility with Existing Infrastructure
5. Workforce Development (Training and Skills)
6. Ethical Considerations

Each of these variables is operationalized using multiple items on a five-point Likert scale. These independent variables form the foundation for understanding the drivers and barriers that influence the extent to which AI can be effectively utilized in project management processes.

3.4.1.2 Mediating Variable (MV): AI-Based Project Management

This variable captures the transformation of project management practices through the integration of AI tools. It acts as a bridge between the influencing factors (IVs) and the outcomes (DVs), and reflects the degree to which AI has been embedded in core project management functions such as:

- Planning and scheduling
- Documentation and progress reporting
- Resource forecasting and allocation
- Risk analysis and decision support
- Team collaboration and information sharing

These functions were selected based on established literature on AI applications in project management and are reflected across the study's data collection tools to ensure construct alignment.

This variable is critical in understanding how AI reshapes management workflows and mediates the influence of external factors on performance outcomes. The mediating role of this variable will be statistically tested using mediation analysis techniques.

3.4.1.3 Dependent Variables (DVs): Project Management Outcomes

These variables represent the results and benefits associated with the utilization of AI-based project management. They focus on performance, efficiency, quality, and collaboration outcomes achieved through AI integration. The seven dependent variables are:

1. Decision-Making
2. Project Quality
3. Data Collection Accuracy
4. Data Analysis
5. Risk Identification Accuracy
6. Saving Time for Project Managers
7. Effective Collaboration and Communication

Each variable is measured through structured items designed to evaluate how the utilization of AI-based project management influences key project performance indicators. The data is gathered via the quantitative questionnaire and supported by qualitative insights obtained through expert interviews.

3.5 Implementation Procedures

This section details the practical steps followed to carry out the study from instrument development to data collection and validation. This procedure ensures compliance with ethical research principles and academic integrity.

3.5.1.1 Instrument Development

- **Questionnaire Design (Quantitative Tool)**

The structured questionnaire was developed to measure the three main variable sets defined in the conceptual framework; independent variables, the mediating variable, and dependent variables through dedicated sections and supporting demographic and qualitative items.

1. **Demographic Information** (e.g., position, experience, company size, familiarity with AI).
2. **Independent Variables** – Items measuring data privacy, cost concerns, Resistance to Change, etc.
3. **Mediating Variable** – Items exploring how AI is embedded in project management.
4. **Dependent Variables** – Items measuring project outcomes influenced by AI.
5. **Open-Ended Questions** – Designed to capture deeper qualitative insights that may not emerge from fixed-response questions.

A 5-point Likert scale is used for consistency and statistical reliability. A five-point Likert scale was used for all closed-ended items to ensure clarity, comparability, and statistical validity.

- **Semi-Structured Interview Guide (Qualitative Tool)**

To complement the quantitative data, a semi-structured interview guide was designed. It includes open-ended questions aligned with each of the three variable types:

- Challenges related to each **independent variable**
- Reflections on **AI-based project management practices**
- Perceptions of the resulting **project outcomes**

This qualitative instrument enables deeper exploration of emerging themes and provides context for interpreting quantitative findings.

3.5.1.2 Pilot Testing

Prior to full deployment, the structured questionnaire underwent pilot testing with a small sample ($n = 15$) of professionals working in Saudi design and consultancy firms. The pilot aimed to assess:

- Clarity of wording,

- Logical flow,
- Response time,
- consistency,
- Content validity (via expert feedback).

The interview guide was also reviewed and refined in consultation with academic and industry experts to ensure clarity, neutrality, and relevance.

3.5.1.3 Ethical Considerations

This research strictly adheres to ethical guidelines approved by the university. The following measures were implemented:

- Participants will be fully informed of the study's purpose, scope, and voluntary nature.
- Informed consent will be obtained prior to participation.
- Anonymity and confidentiality were assured; no identifying personal or organizational data was collected.
- Interview participants were granted the option to decline recording.

3.5.1.4 Questionnaire Distribution and Data Collection

Quantitative Data Collection (Questionnaire):

- To be distributed electronically via email and professional platforms (e.g., LinkedIn and Whats'app).
- Target participants will include engineers, project managers, and senior staff from Saudi design and consultancy engineering firms.
- The data collection period will last six weeks, with bi-weekly follow-ups to increase response rates.

Qualitative Data Collection (Interviews):

- Semi-structured interviews will be conducted either in-person or virtually based on participant availability.
- Participants will be selected purposefully to ensure diversity in roles, company size, and AI maturity levels.
- Interviews will be audio-recorded with permission and transcribed for analysis.

3.5.1.5 Data Analysis Procedure

- Quantitative Analysis: Will be Conducted using SPSS for descriptive statistics (e.g., frequencies, means) and inferential testing (e.g., correlation, regression, and SEM for mediation analysis).
- Qualitative Analysis: Thematic analysis using manual coding, organized according to pre-defined codes aligned with the study variables (IVs, MV, and DVs).

3.6 Research Design and Statistical Processing

This section details the overall research design structure and the statistical methods to be employed in analyzing both quantitative and qualitative data. These procedures are selected to ensure methodological rigor and alignment with the study's objectives, research questions, and hypotheses.

3.6.1.1 Research Design

This study adopts a sequential explanatory mixed-method research design, incorporating both statistical analysis and qualitative interpretation.

- **Quantitative Phase:**

A structured questionnaire is distributed to professionals in Saudi design and consultancy engineering firms to collect data on the influencing factors (independent variables), the utilization of AI-based project management (mediating variable), and project outcomes (dependent variables).

- **Qualitative Phase:**

Semi-structured interviews are conducted with a select group of industry experts to capture deeper contextual understanding, clarify survey trends, and provide interpretive insights.

This sequential explanatory design is employed to:

- Identify and evaluate the key factors influencing the utilization of AI tools in project management within design and consultancy engineering projects
- Analyze how AI-based project management mediates the relationship between influencing factors and project outcomes
- Examine the direct influence of these factors on the outcomes of AI-based project management.
- Assess variations in AI utilization and outcomes across different organizational types, sizes, and participant demographics.
- Propose practical recommendations by combining statistical trends with real-world expert insights

The research design follows a correlational approach, with mediation analysis techniques applied through SEM. This enables the analysis of both direct and indirect relationships among variables, while qualitative findings offer deeper interpretive support.

3.6.1.2 Quantitative Data Analysis

To ensure rigorous quantitative analysis, data collected from the questionnaire will be processed using the following statistical techniques:

1. **Descriptive Statistics**

- Frequency, percentage, mean, and standard deviation to describe demographic characteristics and general response trends.
- 2. **Reliability Testing**
 - Cronbach's Alpha will assess the internal consistency of each construct. A threshold of ≥ 0.70 will be used to confirm acceptable reliability.
- 3. **Exploratory Factor Analysis (EFA)**
 - Used to verify dimensionality and identify factor loadings, ensuring items align well with their intended constructs.
- 4. **Confirmatory Factor Analysis (CFA)**
 - Conducted to validate the measurement model and assess model fit indices.
- 5. **Structural Equation Modeling (SEM)**
 - SEM will be the primary technique for testing hypotheses related to:
 - Direct relationships (e.g., IVs $\rightarrow$ DVs)
 - Indirect relationships through mediation (IVs $\rightarrow$ MV $\rightarrow$ DVs)
- 6. **Open-Ended Questionnaire Responses**
 - Thematic analysis will be used to extract meaningful patterns from open-ended survey responses, further enriching interpretation of statistical findings.

3.6.1.3 Qualitative Data Analysis

Data from the semi-structured expert interviews will be analyzed through thematic coding, following this process:

- Transcripts will be coded according to predefined themes aligned with the three variable sets:
 - **Independent Variables** (e.g., cost, ethics, infrastructure)
 - **Mediating Variable** (AI-based project management)
 - **Dependent Variables** (e.g., decision-making, project efficiency)
- Emergent sub-themes will also be noted to enhance interpretation of quantitative results and provide real-world insight into contextual challenges and enablers.

To ensure qualitative rigor, interview protocols will be validated through expert review and pilot testing. Credibility is strengthened through member checking, and thematic coding will follow a structured, traceable approach aligned with the study's conceptual model.

3.6.1.4 Methodology summary

In summary, this study applies a robust mixed-method research design, combining structured quantitative data collection with in-depth qualitative interviews. This methodology aligns with the study's aim of examining the factors influencing the utilization of AI-based project management, the mediating role of AI in transforming project management practices, and the resulting project outcomes in design and consultancy engineering projects. The structured questionnaire enables the collection of statistically measurable insights into the relationships between influencing factors, AI-based practices, and outcomes.

In parallel, the interviews provide rich contextual perspectives and professional judgments from experts in the field. Together, these methods enhance the study's validity, reliability, and contextual relevance, ensuring that both empirical evidence and real-world experience shape the research findings and final recommendations.

The insights gained from qualitative interviews will be integrated with the quantitative findings to validate emerging patterns, clarify unexpected results, and deepen the understanding of observed statistical relationships. This integration enhances both the methodological robustness and the contextual relevance of the study.

4 References

4.1 Arabic References:

- الشهري خالد، ياسويد خلود، غروي محمد، سليمان وليد. (2023) واقع الذكاء الاصطناعي على إدارة المشاريع في القطاع الحكومي في المملكة العربية السعودية. مجلة الفنون والأدب وعلوم الإنسانيات والاجتماع. ع 94.
- الغامدي سلوى & ضرمان فالح. (2022) عمليات إدارة المعرفة القائمة على الذكاء الاصطناعي في المشاريع الإنشائية دراسة تطبيقية في المملكة العربية السعودية. مجلة ابن خلدون للدراسات والأبحاث. مج 2. ع 10.
- الغامدي عبد السلام . (2019) أهمية علاقة إدارة المعرفة بإدارة المشاريع: تكامل العمليات ونجاح المشروع. شبكة المؤتمرات العربية.
- القططاني عايض. (2022). دور الذكاء الاصطناعي في تحقيق التنمية المستدامة في إطار رؤية المملكة العربية السعودية 2030، المجلة العربية للمعلوماتية وأمن المعلومات. المؤسسة العربية للتربية والعلوم والآداب، مصر، مج 3، ع (9)، ص 97 – 130.
- علي رزق (2022). استخدام تقنيات الذكاء الاصطناعي وتحليل البيانات في الكشف عن الجرائم. مجلة الدراسات القانونية والاقتصادية.
- المكاوي إسماعيل. (2023). نحو ميثاق أخلاقي لاستخدام الذكاء الاصطناعي في البحث التربوي. المجلة التربوية.
- عبدالله فارس & صالح أحمد (2019). دور تقنية الذكاء الاصطناعي في إدارة ومواجهة الأزمات دراسة تحليلية في معمل البان الجزيرة / الموصل. مجلة العلوم الإدارية العراقية.

4.2 English References:

- A. Foster, "Artificial Intelligence In Project Management", Cost Engineering, vol. 30, no. 6, 1988.]".
- Aladağ, H. Assessing the Accuracy of ChatGPT Use for Risk Management in Construction Projects. Sustainability 2023, 15, 16071. <https://doi.org/10.3390/su152216071>
- Atteya G. & Messallam A. (2021). Organizational and Individual Determinants of Employees' Intrapreneurship Behavior in Private Egyptian Organizations. Journal of Alexandria University for Administrative Sciences
- Allal-Chérif et al., (2021). Intelligent Purchasing: How artificial intelligence can redefine the purchasing function.
- Bah Esseme AC, Faniyan AA, Farayola GF, et al. AI in Project Management: Enhancing Efficiency, Decision Making and Risk Management. J Artif Intell Mach Learn & Data Sci 2025, 3(1), 2107-2114. DOI: doi.org/10.51219/JAIMLD/Alain-Claude-Bah-Esseme/462

- Bilal M., Oyedele L., Kusimo H., Owolabi H., Akanbi L., Ajayi A., Akinade O., Delgado J. (2019). Investigating profitability performance of construction projects using bigdata: A project analytics approach. *Journal of Building Engineering*
- BELHARET A., BHARATHAN U., DZINGINA B., MADHAVAN N., MATHUR2 C., Toty Y. (2020). Report on the Impact of Artificial Intelligence on Project Management. *Management of Technology and Information Systems*.
- Binder, J. (2007). *Global Project Management Communication Collaboration and management across Borders*. 10,1108/sd.
- Bharati A., Sandbrink C. (2024). The Implementation of Artificial Intelligence in Project Management. *REAL CORP 2024 Proceedings/Tagungsband*. 15-17 April 2024 – <https://www.corp.at>
- BODEA, C., MITEA. C., STANCIU. O. (2020). Artificial Intelligence Adoption in Project Management
- Bento, S., Pereira, L., Gonçalves, R., Dias, Á. and Lopes da Costa, R. (2022) ‘Artificial intelligence in project management: a systematic literature review’, *Int. J. Technology Intelligence and Planning*, 13, (2), pp.143–163.
- Campi A., Hernandez M., Mikhaylov S., Esteve M., (2020). VERCOMING THE CHALLENGES OF COLLABORATIVELY ADOPTING ARTIFICIAL INTELLIGENCE IN THE PUBLIC SECTOR
- Cubric M., (2020). Drivers, Barriers and Social Considerations for AI Adoption in Business and Management: a Tertiary Study. *Business School*
- Dacre N., Kockum F. (2022). Artificial intelligence in project management. *APM research Fund Series*
- Davahli M., (2020). The Last State of Artificial Intelligence in Project Management.
- Dwivedi D, Hughes L., Ismagilova E., Coombs C., Crick T., Duan Y., Dwivedi R., Edwards J., Eirug A., Galanos V., Ilavarasan P., Janssen M., Jones P., Kar A., Kizgin H., Kronemann B., Lal B., Lucini B., Medaglia R., Meunier-FitzHugh K., Meunier-FitzHugh L. Misra S., Mogaji E., Sharma S., Singh J., Raghavan V., Raman R., Rana N., Samothrakakis S., Spencer J., Tamilmani K., Tubadji A., Walton P., Williams M. (2021). Artificial Intelligence (AI) multidisciplinary perspectives on emerging challenges, opportunities, and agenda for research, practice policy. *International Journal of Information Management*
- El Khatib, M., & Al Falasi, A. (2021). Effects of Artificial Intelligence on Decision Making in Project Management. *American Journal of Industrial and Business Management*, 11, 251-260.
- Elmousalami H., (2020). Comparison of Artificial Intelligence Techniques for Project Conceptual Cost Prediction. *ResearchGate*
- Güray T. (2023). Investigating AI Applications in Construction Industry: A Systematic Review. *ResearchGate*.
- Hassi S., (2024). Utilization of Artificial Intelligence in Project Management. *International Business Management YAMK*
- K Aneesha & M K Haridharan (2017). Ranking the Project Management Success Factors for Construction Project in South India. *Earth and Environmental Science*
- Kelepouris P., (2023). Implementation of Artificial Intelligence in Project Management and effect in working personnel. *KTH Royal Institute of Technology*

- Khayyat M. & Alshaikhi A. (2021). An investigation into the Impact of Artificial Intelligence on the Future of Project Management. Research Gate.
- Kork P., R G., Shewale M., Khartode B., (2023). An investigation into the Impact of Artificial Intelligence on the Future of Project Management. ICSTCE
- Kozhakhmetova A., Mamyrbayev A., Zhidebekkyzy A., Bilan S. (2025). Assessing the impact of artificial intelligence on project efficiency enhancement. Knowledge and Performance Management, 8(2), 109-126. doi:10.21511/kpm.08(2).2024.09
- Lasse Wrobel, Christian Dietzmann, Rainer Alt. (2025). An Analysis of AI Project Management Frameworks. Hawaii International Conference on System Sciences
- Lishner, I.; Shtub, A. Using an Artificial Neural Network for Improving the Prediction of Project Duration. Mathematics 2022, 10, 4189. <https://doi.org/10.3390/math10224189>
- Mahmood A., Al Marzooqi A., El khatib M., AlAmeemi H., (2023). How Artificial Intelligence can Leverage Project Management Information System (PMIS) and Data Driven Decision Making in Project Management. International Journal of Business Analytics and Security (IJBAS).
- Maphosa V., Maphosa V., (2022). Artificial Intelligence in Project Management; Bibliometric Analysis. Journal of Theoretical and Applied Information Technology.
- Müller R. et al. (2024). Artificial Intelligence and Project Management: Empirical Overview, State of the Art, and Guidelines for Future Research. Project Management Journal.
- Nagireddy S., (2023). AI and Its Impacts on Project Management. Faculty of the Graduate School
- ODEH M., (2023). The Role of Artificial Intelligence in Project Management. IEEE Engineering Management Review
- Ong S. & Uddin S., (2020). Data Science and Artificial Intelligence in project Management, The past, Present and Future. Journal Modern Project Management
- Opeyemi Abayomi Odejide & Tolulope Esther Edunjobi, (2024), AI IN PROJECT MANAGEMENT: EXPLORING THEORETICAL MODELS FOR DECISION-MAKING AND RISK MANAGEMENT. Engineering Science & Technology Journal
- PAULO S. (2021). THE CURRENT STATE AND TRENDS OF ARTIFICIAL INTELLIGENCE IN PROJECT MANAGEMENT Bibliometric Analysis
- Prekh R. & Mitchell O. (2024), Utilization of artificial Intelligence in project management. International Journal of Science and Research Archive
- PIORKOWSKI D., PARK S., WANG A., WANG D., MULLER M., PORTNOY F., (2021). How AI Developers Overcome Communication Challenges in a multidisciplinary Team: A Case Study
- Reznikov R. (2025). Enhancing Project Management Success through Artificial Intelligence. International Journal of Multidisciplinary Research and Growth Evaluation
- Riesenera M., Kuhna M., Keupera A., and Schuh G. (2023). A literature analysis on success factors and their corresponding scientific approaches in multi-project management. Elsevier
- Ruiz, J., & Torres, J., & Crespo, R. (2020). The Application of Artificial Intelligence in Project Management Research; A Review. International Journal of Interactive multimedia and Artificial Intelligence. Vol. 6, P.61

- Saudi Council of Engineers, (2024, March 16). Intelligence Reports. Retrieved on 2024, March 16, from <https://www.saudieng.sa>
- Salvagno M., Taccone F. & Gerli A. (2023). Can AI help for scientific writing. *Critical Care*
- Savio, R. & Ali, J. (2023). Artificial Intelligence in Project Management & Its Future. *Saudi Journal of Engineering and Technology*.
- Savio, R. & Ali, J. (2023). Artificial Intelligence in Project Management & Its Future. *Saudi J Eng Technol*, 8(10): 244-248
- Sahadevan, S. (2023). Project Management in the Era of Artificial Intelligence. *European Journal of Theoretical and Applied Sciences*, 1(3), 349-359.
- Sheoraj, Y.& Sungku, R. (2022). Using AI to develop a framework to prevent employees from missing project deadlines in software projects - a case study of a global human capital management (HCM) software company. *Advances in Engineering Software*. 170, 103143.
- Seventh Edition of the PMBOK® Guide, (2021). Project Management Institute (PMI).
- Sogaxa A., Simpeh E. and Fapohunda J., (2021). Effective quality management strategies for enhancing the success rate of indigenous construction SMEs in construction project delivery. *Earth and Environmental Science*
- Taboada, I.; Daneshpajouh, A.; Toledo, N.; de Vass, T. (2023). Artificial Intelligence Enabled Project Management: A Systematic Literature Review. *Appl. Sci.*, 13, 5014. 6 & 15.
- T B Venczel, L Berényi and K Hriczó. (2021). Project Management Success Factors. *Journal of Physics*
- Todorovic. (2021). An investigation into the Impact of Artificial Intelligence on the Future of Project Management. *Information Management School*.
- Tubman A., (2022). The Use of Artificial Intelligence in International Decision-Making Processes in Project Management. *ResearchGate*.
- Waqar, A., & Andri, & Qureshi, A., & Almujibah, H., & Tanjung, L., & Utami, C. (2023). "Evaluation of success factors of utilizing AI in digital transformation of health and safety management systems in modern construction projects". *Ain Shams Engineering Journal*, 14, 102551.
- Weng, J. (2023). Putting Intellectual Robots to Work - Implementing Generative AI Tools in Project Management.
- Wang, J. (2023). Intelligent Decision Support System for Building Project Management Based on Artificial Intelligence. *Journal of Physics: Conference Series*. 2665. 12022.
- Fridgeirsson, T.V.; Ingason, H.T.; Jonasson, H.I.; Jonsdottir, H. An Authoritative Study on the Near Future Effect of Artificial Intelligence on Project Management Knowledge Areas. *Sustainability* 2021, 13, 2345. <https://doi.org/10.3390/su13042345>
- Fridgeirsson, T.V.; Ingason, H.T.; Jonasson, H.I.; Gunnarsdottir, H. A Qualitative Study on Artificial Intelligence and Its Impact on the Project Schedule, Cost and Risk Management Knowledge Areas as Presented in PMBOK®. *Appl. Sci.* **2023**, 13, 11081. <https://doi.org/10.3390/app131911081>
- M. Chowdhury and A. Sadek, "Advantages and Limitations of Artificial Intelligence", The National Academies Press, no. 6, 6-8, 2012.

Yaseen Z., (2020). Prediction of Risk Delay in Construction Projects Using a Hybrid Artificial Intelligence Model. Sustainability

Zadeh E., Khoulenjani A., Safaei M. (2024). Integrating AI for Agile Project Management: Innovations, Challenges, and Benefits. International Journal of Industrial Engineering and Construction Management



Thesis Title:
**Factors Influencing AI-Based Project Management and Its
Outcomes in Industrial Engineering Projects**
“Design and Consultancy Engineering Projects”

(Questionnaire)

Rev.00

by
MAJID TALEB ALFLFEL
Saudi Arabia

Factors Influencing AI-Based Project Management and Its Outcomes in Industrial Engineering Projects

"Design and Consultancy Engineering Projects"

العوامل المؤثرة في إدارة المشاريع القائمة على الذكاء الاصطناعي ومخرجاتها في المشاريع الهندسية الصناعية "

"المشاريع الهندسية التصميمية والاستشارية "

*This questionnaire is designed to collect empirical data to explore the factors influencing the **utilization of AI tools**, their role in **AI-based project management**, and the resulting **project outcomes in design and consultancy engineering projects in Saudi Arabia**.*

تم تصميم هذا الاستبيان لجمع رؤى شاملة حول العوامل المؤثرة على إدارة المشاريع القائمة على الذكاء الاصطناعي في مشاريع التصميم والاستشارات الهندسية في المملكة العربية السعودية.

Section 1: Demographic Information

1. **Position in Organization:** What is your role in design and consultancy projects within your organization?
 - Top management
 - Project Manager
 - Project Engineer
 - Engineer
 - Other (please specify)
2. **Years of Experience:** How many years of experience do you have in managing design and consultancy projects?
 - Less than 1 year
 - 1–3 years
 - 4–6 years
 - 7–10 years
 - Over 10 years
3. **Organization Size:** What is the size of your organization in terms of employees working on design and consultancy projects?
 - Small (<50 employees)
 - Medium (50–249 employees)
 - Large (250+ employees)
4. **Level of Familiarity with AI Tools:** What is your level of familiarity with AI tools in design and consultancy project management?
 - Not familiar
 - Somewhat familiar
 - Moderately familiar
 - Highly familiar
5. **AI Tools Used:** What types of AI tools or software does your organization currently use in design and consultancy projects (if any)?
 - Decision-making tools
 - Quality tools

- *Data Collection tools*
- *Data Analysis tools*
- *Risk Identification tools*
- *Communication tools*
- *Other (please specify)*

Section 2: Independent Variables

Data Privacy and Security

6. To what extent do concerns about data privacy and security influence the utilization of AI Tools in your organization?

- Extremely effectively (over 75%)
- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

7. How effective are the current measures in your organization to secure data when using AI Tools?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

Resistance to Change

8. What level of resistance to AI utilization have you observed among your team?

- No resistance at all (0%)
- Minimal resistance (up to 25%)
- Moderate resistance (26–50%)
- Significant resistance (51–75%)
- Extreme resistance (over 75%)

9. How does the rapid evolution of AI affect your organization's willingness to utilize AI Tools?

- No impact (0%)

- Small impact (up to 25%)
- Moderate impact (26–50%)
- Significant impact (51–75%)
- Very significant impact (over 75%)

Cost of Implementation

10. To what extent do budget constraints hinder your organization's decision to utilize AI Tools?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

12. How does your organization balance the costs of AI implementation Tools with the expected benefits in design and consultancy projects?

- Not effectively at all (0%)
- Slightly effectively (up to 25%)
- Moderately effectively (26–50%)
- Highly effectively (51–75%)
- Extremely effectively (over 75%)

Compatibility with Existing Infrastructure

12. How compatible are AI tools with your organization's current infrastructure?

- Not compatible at all (0%)
- Slightly compatible (up to 25%)
- Moderately compatible (26–50%)
- Highly compatible (51–75%)
- Fully compatible (over 75%)

13. What challenges do you face in integrating AI with legacy systems?

- No challenges (0%)
- Minor challenges (up to 25%)
- Moderate challenges (26–50%)

- Significant challenges (51–75%)
- Extreme challenges (over 75%)

Workforce Development

14. To what extent does the lack of technical skills hinder AI utilization?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

15. How effective are your organization's training programs in preparing staff to utilize AI tools?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

Ethical Considerations

16. How significant are ethical concerns (e.g., bias, transparency, accountability) in influencing AI tool utilization?

- Not significant at all (0%)
- Slightly significant (up to 25%)
- Moderately significant (26–50%)
- Highly significant (51–75%)
- Extremely significant (over 75%)

17. What measures are taken to ensure ethical and responsible AI use in your organization?

- No steps taken (0%)
- Minimal steps taken (up to 25%)
- Moderate steps taken (26–50%)
- Significant steps taken (51–75%)
- Extensive steps taken (over 75%)

Section 3: Mediating Variable; Project Management via Artificial Intelligence

18. To what extent have AI tools streamlined project management processes (e.g., scheduling, documentation)?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

20. How effective are AI tools in improving resource allocation?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

21. To what extent do AI tools support task prioritization and schedule management?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

22. How effectively do AI tools assist in tracking and reporting project progress?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)

- Extremely effective (over 75%)

23. How significant is the role of AI in improving communication and coordination among teams?

- Not significant at all (0%)
- Slightly significant (up to 25%)
- Moderately significant (26–50%)
- Highly significant (51–75%)
- Extremely significant (over 75%)

24. To what extent do AI tools enhance forecasting and planning capabilities?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

Section 4: Dependent Variables

Enhancing Decision-Making

25. To what extent do AI tools improve decision-making accuracy?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

26. How do AI tools support data-informed decision-making and risk analysis?

- No role (0%)
- Minor role (up to 25%)
- Moderate role (26–50%)
- Significant role (51–75%)
- Major role (over 75%)

Improving Project Quality

27. How significantly do AI tools contribute to delivering high-quality outputs in design and consultancy projects?

- Not significant at all (0%)
- Slightly significant (up to 25%)
- Moderately significant (26–50%)
- Highly significant (51–75%)
- Extremely significant (over 75%)

28. In what ways has AI improved your organization's project performance? (*Check all that apply*)

- Improving the accuracy of deliverables
- Reducing time to complete tasks
- Enhancing collaboration between team members
- Identifying and mitigating risks early

Data Collection Accuracy

29. To what extent have AI tools improved the accuracy of data collection?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

30. How effectively do AI tools handle large datasets in design and consultancy projects?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

Enhancing Data Analysis and Insights

31. How effectively do AI tools analyze project data and provide actionable insights in design and consultancy projects?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

32. What role do AI tools play in identifying patterns that improve decision-making?

- No role (0%)
- Minor role (up to 25%)
- Moderate role (26–50%)
- Significant role (51–75%)
- Major role (over 75%)

Risk Identification Accuracy

33. How accurately do AI tools identify potential risks in design and consultancy projects?

- Not accurate at all (0%)
- Slightly accurate (up to 25%)
- Moderately accurate (26–50%)
- Highly accurate (51–75%)
- Extremely accurate (over 75%)

34. To what extent do AI tools support proactive risk mitigation in design and consultancy projects?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

Saving Time for Project Managers

35. To what extent do AI tools reduce the time spent on routine tasks in design and consultancy projects?

- Not at all (0%)
- To a small extent (up to 25%)
- To a moderate extent (26–50%)
- To a great extent (51–75%)
- To a very great extent (over 75%)

36. How effectively do AI tools free project managers to focus on strategic decision-making in design and consultancy projects?

- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

Effective Collaboration and Communication

- How effectively do AI tools improve team collaboration and stakeholder communication?
- Not effective at all (0%)
- Slightly effective (up to 25%)
- Moderately effective (26–50%)
- Highly effective (51–75%)
- Extremely effective (over 75%)

Section 5: Open-Ended Questions

37. What are the most significant challenges your organization faces in the utilization of AI tools in project management for design and consultancy engineering projects?

38. In your opinion, what changes—whether organizational, technical, or regulatory—would support more effective **utilization of AI-based project management**?
39. What tangible benefits has your organization experienced from utilizing **AI-based project management practices**?
40. What recommendations would you propose to enhance the **utilization and outcomes** of AI-based project management in the Saudi design and consultancy sector?
41. From your perspective, does **organization size**, sector type, or the demographic profile of project managers affect the **utilization or outcomes** of AI in project management? If yes, how?

Thesis Title:

**Factors Influencing AI-Based Project Management and Its
Outcomes in Industrial Engineering Projects**

“Design and Consultancy Engineering Projects”

(Interview Structure)

Rev.00

by
MAJID TALEB ALFLFEL
Saudi Arabia

The interview will include **3 main sections**, each section is mapped to the thesis variables and objectives.

1. Introduction (Opening Script)

Thank you for agreeing to participate in this interview. This is part of my PhD research on the factors influencing the utilization of AI-based project management and its outcomes, particularly within the design and consultancy engineering sector in Saudi Arabia. Your insights will contribute to bridging academic research with practical industry experience.

This interview will be kept strictly confidential, and your identity will not be disclosed in any part of the thesis. With your consent, I would like to record the conversation solely to ensure accuracy during the analysis phase.

2. Section 1: Factors Influencing the Utilization of AI-Based Project Management (Independent Variables)

These questions explore the key challenges and enabling factors that influence the **utilization** of AI-based project management practices.

Data Privacy and Security

→ *How do concerns about data privacy and security affect your organization's willingness to utilize AI-based project management tools?*

Resistance to Change

→ *What kinds of change resistance have you encountered from staff or leadership when implementing AI-based project management practices?*

Cost of Implementation

→ *How does the cost of acquiring, customizing, or maintaining AI tools influence your organization's AI utilization decisions?*

Compatibility with Existing Infrastructure

→ *Can you describe how the compatibility between AI tools and existing systems has affected their adoption?*

Workforce Development

→ *How well-prepared do you think your team is to utilize AI-based project management tools? What training or development has been needed?*

Ethical Considerations

→ Are there any ethical concerns (e.g., bias, data transparency, accountability) that influence how your organization approaches AI in project management?

3. Section 2: Utilization of AI-Based Project Management (Mediating Variable)

These questions assess how AI is actually being applied and integrated into project management processes.

Transformation of Management Practices

► How has the utilization of AI transformed your overall approach to managing design or consultancy projects?

Improvement of Project Management Functions

► Which specific functions (e.g., scheduling, resource allocation, reporting) have improved due to the utilization of AI-based project management tools?

Support for Strategic Execution

► To what extent has AI-based project management supported better decision-making or risk management throughout project execution?

4. Section 3: AI Impact on Project Outcomes (Dependent Variables)

These questions examine the actual or perceived results from implementing AI-based practices.

Enhancing Decision-Making

→ How has AI utilization affected decision-making processes in your projects?

Improving Project Output

→ Have you observed any improvements in project outcomes—such as efficiency or quality—since implementing AI-based management?

Data Collection Accuracy

→ How has AI impacted the accuracy and consistency of data collection across your projects?

Enhancing Data Analysis

→ In what ways has AI improved your ability to analyze project data and generate insights?

Risk Identification Accuracy

→ How effective has AI been in identifying or forecasting risks in your projects?

Saving Time for Project Managers

→ *Have AI tools helped project managers save time or focus on more strategic tasks? How?*

Effective Collaboration and Communication

→ *How has the use of AI tools influenced collaboration and communication across project stakeholders?*