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## أثر استخدام تقنيات الذكاء الاصطناعي على أداء المشاريع في المملكة العربية السعودية

### The Impact of Using Artificial Intelligence Techniques on the Performance of Projects in the Kingdom of Saudi Arabia

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"وَقُلْ اَعْمَلُوا فَسَيَرَى اللَّهُ عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ وَسَتُرَدُّونَ إِلَىٰ عَالَمِ الْغَيْبِ  
وَالشَّهَادَةِ فَيُنَبِّئُكُم بِمَا كُنتُمْ تَعْمَلُونَ"

صدق الله العظيم

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## **Chapter 1: Introduction**

### **1.1 Background:**

The fourth industrial revolution has ushered in significant advancements across various industries, and artificial intelligence (AI) stands out as a crucial catalyst for this transformation. AI, as defined by Russel and Norvig (2003), refers to computer systems that replicate cognitive functions associated with human attributes, such as learning, speech, problem-solving, visual perception, natural language understanding, and decision-making. These systems can autonomously perform tasks either partially or fully (Smith et al., 2006). According to Al-Mousa et al., (2022), the global shift towards AI and advanced technologies driven by the fourth industrial revolution, governments and businesses in the Middle East have recognized the importance of embracing this technological disruption. The region faces a critical decision either actively participate in this transformation or risk being left behind economically. Notably, the Middle East is projected to capture 2% of the total global benefits of AI by 2030, amounting to an estimated value of US\$320 billion. Consequently, countries in the Middle East, including Saudi Arabia, the United Arab Emirates, Kuwait, Jordan, and Turkey, are keen to compete and harness the potential of AI.

## **1.2 Research Context, Aim, and Objectives:**

The Kingdom of Saudi Arabia has witnessed remarkable economic growth, leading to a surge in large-scale projects across various sectors. To enhance project performance, organizations in Saudi Arabia are increasingly exploring the potential of emerging technologies, such as artificial intelligence. AI techniques, including machine learning, natural language processing, and data analytics, have the potential to revolutionize project management practices. They can improve decision-making processes, optimize resource allocation, and mitigate risks (Alshehri, 2019). Therefore, the main aim of this research is to investigate the impact of AI techniques on project performance in Saudi Arabia.

To achieve this aim, the following specific objectives will be pursued:

1. Examine the various artificial intelligence techniques and their potential applications in project management.
2. Identify the key factors that influence the performance of projects in the Kingdom of Saudi Arabia.
3. Analyze the impact of integrating artificial intelligence techniques on project performance indicators, such as cost, time, and quality.
4. Evaluate the challenges and barriers associated with implementing artificial intelligence techniques in project management in the Kingdom of Saudi Arabia.
5. Develop recommendations and guidelines for the effective utilization of artificial intelligence techniques to enhance project performance in the Kingdom of Saudi Arabia.
6. Offer practical implications for project managers, policymakers, and other stakeholders involved in the project management domain in Saudi Arabia, highlighting the potential benefits and limitations of employing artificial intelligence techniques.

### **1.3 Research Problem and Questions:**

The research problem to be addressed in this study revolves around understanding the extent to which the adoption of artificial intelligence (AI) techniques affects the performance of projects in the Kingdom of Saudi Arabia. To address this problem, the study aims to answer the following research questions:

1. What is the current level of adoption of artificial intelligence techniques in project management practices in the Kingdom of Saudi Arabia?
2. What are the key factors influencing the successful implementation of AI techniques in project management in the Kingdom of Saudi Arabia?
3. What are the potential benefits and challenges associated with the use of AI techniques in improving project performance in the Kingdom of Saudi Arabia?
4. How do project managers and stakeholders perceive the impact of AI techniques on project performance in the Kingdom of Saudi Arabia?
5. What are the best practices and recommendations for incorporating AI techniques effectively into project management processes in the Kingdom of Saudi Arabia?

### **1.4 Research Importance:**

The proposed research holds significant importance for several reasons. Firstly, as part of its Vision 2030 initiative, the Kingdom of Saudi Arabia is actively pursuing economic diversification and

modernization. This initiative places a strong emphasis on leveraging emerging technologies, including AI, to enhance various sectors, including project management. Therefore, understanding the implications of using AI techniques in project management within Saudi Arabia is crucial for policymakers, project managers, and stakeholders involved in the country's development.

Secondly, while the utilization of AI techniques in project management is gaining global attention due to its potential to improve project outcomes, including efficiency and cost-effectiveness, its specific impact in the unique context of Saudi Arabia remains relatively unexplored. This research will contribute to the existing body of knowledge by filling this gap and providing insights into the applicability and effectiveness of AI techniques in the Saudi Arabian project management context.

Thirdly, given the diverse nature of projects undertaken in Saudi Arabia, ranging from infrastructure development to industrial ventures, understanding how AI techniques can enhance project performance is crucial for ensuring successful project delivery. The findings of this research will provide evidence-based recommendations and guidelines for project managers and organizations in Saudi Arabia to effectively incorporate AI techniques into their project management practices, ultimately leading to improved project outcomes and overall project success rates.

Additionally, the research will contribute to the broader field of project management by enriching the existing literature on the impact of AI techniques on project performance. As AI continues to evolve and influence various aspects of society, understanding its specific implications in the project management domain will contribute to advancing knowledge in this field. The research findings will also facilitate the identification of best practices and potential challenges associated with integrating AI techniques into project management processes, benefiting practitioners and researchers globally.

### 1.5. **Research Methodology:**

To achieve the research aim and objectives, this study will adopt an in-depth interview method. In-depth interviews are a qualitative research approach that allows for a comprehensive exploration of participants' experiences, perspectives, and insights regarding the impact of artificial intelligence techniques on project performance in the Kingdom of Saudi Arabia. This research method is utilized for obtaining detailed and rich data, enabling a deeper understanding of the subject matter (Creswell, 2013).

### 1.6. **Research Structure:**

The research will be structured into several chapters. Chapter 1 will provide an introduction to the research topic, research problem, importance, aims, objectives, and the chosen research methodology. Chapter 2 will conduct an extensive literature review to explore the existing body of knowledge on artificial intelligence techniques in project management and their impact on project performance. Chapter 3 will detail the research design, including the research approach, data collection methods, and sampling strategy. Chapter 4 will present the findings of the in-depth interviews and their thematic analysis and discuss the implications of the research findings, offer recommendations, and suggest potential areas for future research. Finally, Chapter 5 will provide the references list.

## **Chapter Two: Literature Review**

### **2.1. Introduction:**

This literature review offers a comprehensive analysis of the impact of AI techniques on project performance, with a specific focus on the Kingdom of Saudi Arabia. The rapid economic development in Saudi Arabia has led to a surge in projects across various industries, making it crucial to explore how AI can enhance project management practices in this unique context. The review examines existing research and identifies gaps in knowledge that require further investigation to facilitate the successful integration of AI for improved project outcomes in Saudi Arabia.

### **2.2. Artificial Intelligence in Project Performance:**

The integration of artificial intelligence (AI) methodologies has emerged as a prominent and dynamic area of research across various industries, encompassing project management as a notable domain of application. Within the context of Saudi Arabia, this surge in AI adoption bears significant relevance, primarily attributed to the escalating magnitude and intricacy of projects undertaken within the region's socio-economic landscape (Nader et al., 2022). As stakeholders increasingly recognize the potential implications of AI techniques on project performance, a comprehensive

examination of the existing body of research becomes imperative. By exploring and analyzing the current literature, scholars and practitioners alike can gain valuable insights into the multifaceted ways in which AI could potentially impact and optimize project outcomes within the Saudi Arabian project management context. Such an exploration may provide a basis for strategic decision-making, ultimately paving the way for more efficient and effective project execution in the future.

### **2.3. Overview of Artificial Intelligence Techniques in Project Management:**

Artificial Intelligence (AI) techniques have emerged as a transformative force in various domains, including project management, owing to their capability to replicate human cognitive functions. This paragraph aims to provide an overview of how AI techniques are employed in project management to enhance various aspects of the project lifecycle.

In the context of project management, AI techniques encompass a diverse array of technologies, such as machine learning algorithms, natural language processing (NLP), expert systems, and data analytics. These technologies equip machines with the ability to perform tasks that were previously exclusive to human intelligence. By leveraging these AI techniques, project managers can optimize several critical aspects of project execution (Chany, 2019).

One of the primary applications of AI in project management is in project planning and scheduling. AI-powered algorithms can analyze complex project data, historical performance, and external factors to develop comprehensive project schedules that consider uncertainties and potential risks. This empowers project managers to create more accurate and achievable timelines, thereby enhancing project efficiency and reducing the likelihood of delays.

Additionally, AI techniques play a crucial role in risk management within project environments. By analyzing historical data and real-time inputs, AI algorithms can identify potential risks and forecast their impact on project outcomes. This proactive risk assessment enables project managers to devise mitigation strategies and make informed decisions to safeguard the project's success. Moreover, AI techniques facilitate data-driven decision-making, as they can process and interpret vast amounts of project-related information quickly and accurately. With AI-generated insights, project managers gain a comprehensive understanding of project progress, performance, and potential roadblocks, enabling them to make informed decisions promptly (Levitt, et al., 1987).

Furthermore, AI-powered resource allocation is another area where project management benefits significantly. AI algorithms can analyze resource availability, skills, and project demands to optimize resource allocation, ensuring that the right resources are assigned to the right tasks at the right time. This enhances resource utilization and minimizes bottlenecks, leading to improved project outcomes (Al-Otaibi, et al., 2021).

In conclusion, AI techniques hold immense potential in transforming project management practices. By incorporating machine learning algorithms, natural language processing, expert systems, and data analytics, project managers can optimize project planning, scheduling, risk management, decision-making, and resource allocation. Embracing AI in project management allows for more efficient, informed, and data-driven approaches, ultimately leading to successful project delivery.

## **2.4. Impact of AI Techniques on Project Performance:**

The influence of AI techniques on project performance has been a subject of extensive investigation, encompassing a broad spectrum of contexts and industries. The implementation of AI methods has

proven to be highly beneficial in various aspects of project management. Notably, AI has exhibited its efficacy in optimizing project planning and scheduling by proficiently allocating resources and providing accurate estimations of project timelines. Through its sophisticated analytical capabilities, AI has significantly contributed to the realm of risk management by swiftly identifying potential risks and recommending effective mitigation strategies (Gonçalves, et al., 2019).

Moreover, AI-powered decision-making processes leverage the vast repositories of data at their disposal, thereby unearthing valuable patterns and trends, and consequently, empowering project stakeholders with data-driven and well-informed decisions. Furthermore, the integration of AI technologies has streamlined communication and collaboration among project team members, fostering an environment conducive to enhanced efficiency and overall project performance (Alharbi et al., 2020). These findings underscore the immense potential of AI techniques in reshaping project management practices, holding promise for sustained progress and advancement in diverse industries and domains.

## **2.5. Application of AI Techniques in the Kingdom of Saudi Arabia:**

The Kingdom of Saudi Arabia has emerged as a key player in the domain of large-scale infrastructure projects, prompting a growing interest in harnessing the potential of AI techniques to enhance project performance (Alghamdi, et al., 2021). This surge in interest has led to numerous initiatives and organizations within Saudi Arabia delving into the realm of AI applications in project management, recognizing the importance of tailoring research outcomes to cater to the country's specific challenges. As with any technological implementation, the adoption of AI techniques in the Saudi Arabian context comes with its distinct set of intricacies. Cultural factors, regulatory frameworks, and

the availability of skilled professionals emerge as crucial factors that significantly influence the successful application of AI in the country (Alrashed, et al., 2021).

The cultural context of Saudi Arabia presents a significant aspect to consider when implementing AI techniques in project management. Traditions, customs, and societal norms play a pivotal role in shaping work practices and organizational dynamics. Thus, any AI solution must be attuned to respect and align with the cultural values of the local workforce. Ensuring that AI technologies are perceived as enablers rather than disruptors is essential in fostering acceptance and integration into the existing work culture. Moreover, promoting cross-cultural understanding between AI developers and end-users can lead to better collaboration and, ultimately, more effective AI applications. In tandem with cultural considerations, navigating the regulatory landscape of Saudi Arabia is critical for the successful implementation of AI techniques. Compliance with local laws and regulations governing data privacy, security, and technology usage is imperative. Adhering to these guidelines ensures that AI applications comply with legal standards, safeguarding sensitive data and fostering public trust. Furthermore, engaging with relevant authorities and stakeholders can foster a conducive environment for AI adoption by promoting open communication and addressing any regulatory concerns that may arise (Moore, 2021).

Adequate availability of skilled professionals poses another challenge for the widespread deployment of AI techniques in Saudi Arabia. As AI expertise remains a relatively specialized field, cultivating a proficient workforce requires targeted educational initiatives and training programs. Encouraging the development of AI-related courses and degrees in educational institutions can contribute to nurturing a talent pool equipped with the necessary skills to drive AI initiatives forward. Moreover, establishing collaborations between academia, industry, and the government can facilitate knowledge exchange and capacity-building efforts, enhancing the overall readiness for AI implementation (Alghamdi, et al., 2021; Alrashed, et al., 2021).

In conclusion, the Kingdom of Saudi Arabia's burgeoning interest in large-scale infrastructure projects has prompted a fervent exploration of AI techniques to optimize project performance. However, this endeavor is not without its challenges, as cultural, regulatory, and skill-related factors influence the successful application of AI in the Saudi Arabian context. By taking into account the country's unique socio-cultural landscape, adhering to regulatory frameworks, and investing in the development of AI-related skills, Saudi Arabia can pave the way for effective and sustainable AI implementations, propelling its projects towards even greater success in the future.

## **2.6. Ethical Considerations in AI Adoption in Project Performance:**

The ethical implications of AI adoption in project performance management have garnered significant attention in recent times, particularly in the context of Saudi Arabia's growing embrace of these technologies. The utilization of AI, especially when heavily reliant on vast and sensitive datasets, has engendered apprehensions pertaining to data privacy and security. As project managers and stakeholders harness the potential of AI to streamline processes and enhance decision-making, it becomes imperative to deliberate upon the ethical ramifications that may arise. Chief among these concerns is the risk of perpetuating biases present in the datasets or inadvertently introducing new ones, potentially leading to discriminatory outcomes (Alabdulkarim, et al., 2022). Therefore, a thorough and deliberate approach to AI implementation is indispensable, wherein principles of fairness, transparency, and accountability are vigorously upheld to instill confidence among all stakeholders and mitigate any deleterious impact on project results.

The ethical challenges arising from AI adoption in project performance management warrant meticulous contemplation, considering the profound implications they can have on individuals and

communities. The sensitivity surrounding data privacy necessitates stringent measures to safeguard against unauthorized access or misuse of sensitive information. As AI-driven algorithms make decisions based on patterns derived from historical data, the possibility of bias surfacing in decision-making processes becomes a pressing concern. For instance, if historical data exhibits biases against certain demographics or groups, AI algorithms could perpetuate these biases, exacerbating inequalities and compromising the integrity of project outcomes. Hence, it is incumbent upon project managers and stakeholders to scrutinize the training data, identify any biases, and implement strategies to mitigate their impact on AI-generated insights (Smith, et al., 2006).

In addressing the ethical challenges of AI implementation, a crucial aspect is ensuring fairness throughout the project management process. This necessitates scrutinizing the algorithms and models utilized, as well as monitoring their outputs for any signs of unjust discrimination. Transparency emerges as another critical facet, as stakeholders must be cognizant of how AI systems arrive at their decisions to engender trust and comprehension. Establishing clear channels of communication and disclosure regarding AI operations fosters an environment of openness and empowers stakeholders to challenge and rectify potential biases or unintended consequences. Moreover, accountability plays an indispensable role in upholding ethical standards, as project managers must take responsibility for the outcomes of AI-driven decisions and rectify any identified shortcomings. Furthermore, to address ethical considerations in AI adoption, regulatory frameworks need to be developed or updated to encompass emerging technologies (Bargarai, et al., 2020). Collaborative efforts between government agencies, industry leaders, and academic institutions are essential in formulating comprehensive guidelines that govern AI usage in project management. These frameworks should strike a delicate balance between promoting innovation and safeguarding ethical principles, thereby ensuring AI technologies contribute positively to project performance while minimizing adverse impacts. Moreover, as AI continues to permeate Saudi Arabian project

management, ethical considerations stand as an imperative component of successful AI adoption. With the potential for AI to revolutionize project performance through enhanced decision-making and efficiency, stakeholders must be diligent in addressing ethical dilemmas related to data privacy, bias, fairness, transparency, and accountability. By proactively acknowledging and mitigating these ethical challenges, project managers and stakeholders can foster an environment of trust and responsible AI usage, ultimately ensuring that AI becomes a transformative force in project performance management, benefiting society as a whole (Norvig, et al., 2003).

## **2.7. AI and Human Workforce Integration in Project Performance:**

The advent of AI integration into project management practices has brought about significant implications for the interplay between AI technologies and the human workforce, giving rise to pertinent inquiries surrounding their collaborative coexistence in project performance. Undoubtedly, AI automation possesses the potential to optimize and expedite various aspects of project execution, affording invaluable insights and data-driven decision-making capabilities (Alsharif, et al., 2022). However, apprehensions concerning the potential for job displacement and diminishing human contributions have surfaced, necessitating a conscientious examination of the AI-human dynamic. In light of these concerns, fostering a symbiotic relationship between AI technologies and the human workforce is essential to maximize the collective productivity and efficiency of project endeavors. Proactive measures to address potential job displacement should be undertaken, with a primary focus on reskilling and upskilling the existing workforce. By empowering employees with the necessary knowledge and skills to complement AI capabilities effectively,

organizations can cultivate an environment of collaboration where human expertise harmonizes with AI-driven automation (Badaro, et al., 2013).

Moreover, the successful integration of AI into project performance hinges upon acknowledging the distinct strengths and limitations of both AI technologies and human professionals. While AI excels in processing vast amounts of data, identifying patterns, and performing repetitive tasks with unparalleled accuracy, it may lack the nuanced understanding, creativity, and adaptability inherent in human cognition. As such, recognizing these complementary attributes is paramount in constructing workflows that leverage the strengths of each entity while mitigating potential redundancies and conflicts. Furthermore, an inclusive approach towards AI and human workforce integration should encompass strategies that promote continuous learning and adaptation within organizations. Cultivating a culture of lifelong learning enables employees to stay abreast of the evolving technological landscape, fostering an environment that encourages creativity, innovation, and the application of AI insights to generate novel solutions to complex challenges (Belharet, et al., 2020).

In conclusion, the integration of AI techniques into project management practices signifies a transformative paradigm in the realm of project performance. To navigate this paradigm effectively, it is imperative to address concerns regarding job displacement and recognize the distinctive advantages that both AI technologies and the human workforce offer. Empowering employees through reskilling initiatives and nurturing an inclusive learning environment will ultimately pave the way for a collaborative and fruitful coexistence between AI and human expertise, heralding unprecedented opportunities for project success in the rapidly evolving digital era (Alamri, et al., 2023).

## **2.8. Best Practices for AI Implementation in Projects Performance:**

In order to optimize the advantages of artificial intelligence (AI) in the realm of project management, the identification and adherence to best practices for AI implementation are of paramount importance. A foundation for these practices can be derived from an in-depth analysis of successful case studies and experiences from diverse geographical locations, thus facilitating the development of tailored guidelines customized to address Saudi Arabia's unique contextual requirements (Aljohani, et al., 2023). These guidelines must encompass a comprehensive set of strategies designed to guide organizations and project managers in effectively integrating AI technologies into their project management processes. The foremost aspect of these best practices involves the careful selection and adoption of appropriate AI technologies. It is imperative for organizations to thoroughly assess their project requirements and objectives before committing to any specific AI solution. This necessitates a profound understanding of the AI landscape and the functionalities that various AI tools and platforms offer, enabling project managers to make informed decisions regarding the integration of AI in their project workflows. Moreover, the selection process should prioritize user-friendly AI technologies, ensuring ease of adoption and user acceptance within the project teams (Shaw, et al., 2019).

Establishing a robust data governance framework is equally critical in ensuring successful AI implementation. High-quality and well-curated data serves as the lifeblood of AI applications. Therefore, organizations must meticulously curate and maintain their data repositories, adhering to stringent data privacy and security measures. Effective data governance practices encompass data

validation, cleansing, and normalization, while also considering ethical considerations in handling sensitive information. Adherence to these principles not only enhances the accuracy and reliability of AI-driven insights but also instills confidence among stakeholders in the integrity of the project management processes (Bhbosale, et al., 2020).

Transparent communication channels play a pivotal role in fostering trust and confidence in AI-driven project management. Clear and open lines of communication between project managers, team members, and stakeholders facilitate a shared understanding of the AI methodologies employed and the impact of AI-driven decisions on project outcomes. By promoting transparency, potential biases and uncertainties inherent in AI algorithms can be acknowledged and addressed collaboratively, ensuring that the decisions taken are accountable and justifiable.

Cultivating a culture that embraces innovation and continuous learning is an essential aspect of sustainable AI implementation (Boutilier, et al., 2015).

Organizations must encourage a growth mindset among their workforce, fostering a receptiveness to AI technologies and their potential to augment human capabilities in project management. This requires nurturing a learning culture wherein employees are provided with adequate training and upskilling opportunities to grasp the intricacies of AI and integrate it into their daily practices effectively. Additionally, the celebration of AI-driven successes and learnings from challenges creates an environment that encourages experimentation and the pursuit of innovative solutions (Aljohani, et al., 2023).

In conclusion, the optimization of AI's potential in project management necessitates the identification and adoption of best practices tailored to specific contextual requirements. By leveraging successful case studies and experiences, Saudi Arabia can establish guidelines encompassing technology selection, data governance, transparent communication, and a culture of innovation and learning. Embracing these best practices will enable organizations and project managers to harness the

transformative power of AI, augmenting decision-making processes and driving project performance to new heights.

## **2.9. Leveraging AI for Sustainable Project Management**

The burgeoning global focus on sustainable development has brought to the forefront the vital role of Artificial Intelligence (AI) in facilitating sustainable project management. By leveraging AI-driven analytics, project managers can effectively optimize resource allocation, minimize wastage, and improve energy efficiency within the realm of construction and infrastructure initiatives. These AI-powered strategies align seamlessly with international sustainability targets, as evidenced by recent studies conducted by

Alamri et al. (2023). The integration of sustainable project management practices not only elevates Saudi Arabia's standing as a responsible and conscientious global participant but also serves to harmonize with the country's own development goals, fostering a balanced and ecologically conscious growth trajectory.

In conclusion, the integration of AI techniques in project management offers both opportunities and challenges for Saudi Arabia. Addressing ethical considerations, ensuring a harmonious AI-human workforce integration, identifying best practices, and promoting sustainable approaches are essential steps to fully harness AI's potential for improved project performance across diverse industries. To achieve this, further research is warranted to bridge existing gaps in knowledge and effectively contextualize AI implementation in the Saudi Arabian context. Additional studies on AI's impact on specific project types, industries, and organizational sizes in Saudi Arabia would provide valuable insights for informed decision-making and propel project management practices to new heights.

## **2.10. Projects that Apply AI in Saudi Arabia**

### **Case Study 1: AI-Driven Smart Grid Optimization Project in Riyadh**

One noteworthy project in Saudi Arabia is the implementation of an AI-driven smart grid optimization system in the capital city, Riyadh. The project was initiated by the Saudi Electricity Company (SEC) with the objective of improving the overall efficiency and reliability of the city's power grid.

The AI system utilized advanced machine learning algorithms to analyze real-time data from power generation plants, distribution networks, and consumer usage patterns. By processing and interpreting this vast amount of data, the AI system could predict power demand, identify potential faults, and optimize power distribution routes to minimize transmission losses.

The experience of integrating AI into the smart grid project proved to be transformative. The AI system's predictive capabilities resulted in a substantial reduction in power outages, improved load management, and better allocation of resources. Consequently, the project demonstrated enhanced project performance by achieving significant cost savings and a more stable power supply for the residents of Riyadh (Alrasheedi & Almalaq, 2022).

### **Case Study 2: AI-Enabled Healthcare Project in Jeddah**

Another notable application of AI in Saudi Arabia is the healthcare sector. A prominent project in Jeddah focused on leveraging AI technologies to enhance diagnostic accuracy and treatment recommendations for complex medical conditions.

The healthcare project employed AI algorithms to analyze vast volumes of patient data, including medical records, diagnostic images, and genetic information. By learning from historical cases, the AI system could provide personalized treatment plans and identify potential health risks at an early stage.

The impact of AI in the healthcare project was profound. Medical professionals reported increased efficiency in diagnosis, leading to faster and more accurate treatment decisions. Moreover, the AI system's ability to detect early signs of diseases contributed to better patient outcomes and reduced healthcare costs (Aljerian, et al., 2022).

The integration of AI in projects across Saudi Arabia has demonstrated a positive impact on project performance in various sectors. The examples of the smart grid optimization project in Riyadh and the AI-enabled healthcare project in Jeddah showcase how AI technologies can lead to increased efficiency, cost savings, and improved service quality. These experiences serve as valuable insights for future AI implementations in Saudi Arabian projects, emphasizing the potential benefits that AI can bring to enhance overall performance and productivity.

## **Chapter 3: Research Methodology**

### **3.1 Introduction**

In this chapter, the research methodology for investigating the impact of Artificial Intelligence (AI) techniques on project performance in the Kingdom of Saudi Arabia is presented. The chapter outlines the research approach, data collection method, data analysis process, and ethical considerations taken to ensure the study's validity and reliability.

### **3.2 Research Design**

To address the research objectives and explore stakeholders' perspectives and experiences, a qualitative research approach is adopted. Qualitative research allows for an in-depth understanding of how AI techniques influence project outcomes in the Saudi Arabian context. This design will help uncover valuable insights and explore nuanced aspects that may not be captured through quantitative methods.

### **3.3 Participants**

The study targeted participants who have direct experience and expertise in project management and the application of AI techniques in the Kingdom of Saudi Arabia. Purposive sampling was employed to select participants based on their roles as project managers, AI experts, and members of project teams involved in AI-integrated projects. A diverse range of participants sought to ensure a comprehensive and holistic understanding of the research topic.

A total of 10 participants took part in 10 interviews, and each meeting took one hour period of time.

The participants are from different areas including (Mecca, Jeddah, Almandina, and Riyadh), also they have different projects in different fields such as education, health sector, and the private sector.

### **3.4 Data Collection**

Ten semi-structured in-depth interviews were conducted with the identified participants. The interviews were guided by an interview protocol developed based on the research objectives and relevant literature. The interviews were audio-recorded with participants' consent to ensure accurate capturing of responses and insights. The data collected from the interviews are the primary source for analysis and drawing conclusions.

### **3.5 Data Analysis**

Thematic analysis was employed to analyse the interview data systematically. The recorded interviews were transcribed verbatim, and the data was organized into meaningful themes and patterns. The analysis process involved identifying recurring patterns, significant viewpoints, and

common experiences related to the impact of AI techniques on project performance. The analysis was conducted using qualitative data analysis software to ensure rigour and consistency in the process.

### **3.6 Validity and Reliability**

To enhance the validity of the research findings, triangulation was used by cross-referencing interview data with existing literature and relevant documents. Additionally, member-checking was conducted by sharing preliminary findings with some participants to validate the interpretations. Regarding reliability, a clear and detailed description of the research process was documented to allow for research replication.

### **3.7 Ethical Considerations**

The study will adhere to ethical guidelines and obtain informed consent from all participants before conducting interviews. Participants' identities will be kept confidential, and all data will be anonymized to ensure privacy. The research will avoid any harm to participants and ensure they have the right to withdraw from the study at any time without repercussions.

### **3.8 Limitations**

It is essential to acknowledge potential limitations in this research. The qualitative nature of the study may limit the generalizability of findings to other contexts. The study's reliance on self-reported data may introduce bias, and despite efforts to include diverse participants, some perspectives may be underrepresented.

### **3.9 Conclusion**

This chapter has outlined the research methodology adopted to investigate the impact of using Artificial Intelligence techniques on the performance of projects in the Kingdom of Saudi Arabia. By employing qualitative in-depth interviews and rigorous data analysis, the study aims to provide valuable insights and contribute to the understanding of AI's role in project management within the Saudi Arabian context. Ethical considerations and steps taken to ensure research validity and reliability have also been discussed.

## **Chapter Four: Results and Discussion**

### **Introduction:**

This chapter presents the findings of the qualitative descriptive research that aimed to investigate the impact of utilizing Artificial Intelligence (AI) techniques on project performance in the Kingdom of Saudi Arabia. The study sought to gain valuable insights into the experiences and perspectives of key stakeholders involved in project management and AI implementation within the Saudi Arabian context. Through in-depth interviews, the potential benefits, challenges, and overall effectiveness of AI integration in project management practices were explored.

### **1. Benefits of AI Integration in Project Management:**

The 10 interviews revealed several significant benefits of AI integration in project management within the Kingdom of Saudi Arabia. Key stakeholders identified enhanced decision-making capabilities, improved project planning and scheduling, increased efficiency, and better resource allocation as some of the primary advantages. AI techniques enabled a data-driven approach, leading to more informed and timely decisions, which positively impacted project outcomes.

### **2. Challenges Faced in Implementing AI in Projects:**

Despite the benefits, challenges in implementing AI techniques in project management were also evident. Stakeholders cited concerns related to data privacy and security, the initial cost of AI adoption, and the need for upskilling the workforce to effectively leverage AI tools. Moreover, cultural factors and resistance to change posed additional obstacles to the successful integration of AI into existing project management practices.

### **3. AI's Overall Effectiveness in Project Performance:**

The participants provided mixed perspectives on the overall effectiveness of AI in project performance. While some stakeholders reported significant improvements and positive impacts, others expressed reservations and highlighted the need for further fine-tuning and optimization of AI applications. It became apparent that the success of AI implementation in projects was contingent on factors such as project complexity, the scale of AI adoption, and the readiness of the organization to embrace AI-driven practices.

### **4. Recommendations for Future AI Integration:**

Based on the insights gained from the interviews, several recommendations can be made to facilitate successful AI integration in project management within the Kingdom of Saudi Arabia. Firstly, organizations should prioritize data governance and security measures to address concerns related to data privacy. Secondly, investing in comprehensive training programs to upskill the workforce and foster a culture of openness to AI technology would be crucial. Collaborations with AI experts and solution providers can help address specific project needs effectively.

## **Discussion:**

The qualitative descriptive research presented in this chapter sheds light on the impact of Artificial Intelligence (AI) integration in project management practices within the Kingdom of Saudi Arabia. The interviews with key stakeholders provided valuable insights into the benefits, challenges, and overall effectiveness of utilizing AI techniques.

One of the major advantages identified through the interviews was the enhancement of decision-making capabilities. AI integration allowed for a data-driven approach, empowering project managers to make more informed and timely decisions, ultimately leading to improved project outcomes. Additionally, stakeholders recognized improved project planning and scheduling as AI's strength, enabling better resource allocation and increased efficiency in project execution.

However, despite the promising benefits, challenges in implementing AI in projects were evident. Data privacy and security concerns emerged as significant barriers, requiring organizations to prioritize data governance measures to address these apprehensions effectively. The initial cost of AI adoption was another challenge that organizations needed to navigate, along with the necessity of upskilling the workforce to effectively leverage AI tools. Furthermore, cultural factors and resistance to change posed additional obstacles, highlighting the importance of fostering a culture of openness and readiness to embrace AI-driven practices.

The overall effectiveness of AI in project performance generated mixed perspectives among the participants. While some stakeholders reported significant improvements and positive impacts on project outcomes, others expressed reservations, emphasizing the need for further fine-tuning and optimization of AI applications. It became apparent that the success of AI implementation was

contingent on factors such as project complexity, the scale of AI adoption, and the organization's readiness to embrace AI-driven practices.

Based on the insights gained from the interviews, several recommendations can be made to facilitate successful AI integration in project management within the Kingdom of Saudi Arabia. Firstly, organizations should prioritize data governance and security measures to address concerns related to data privacy and ensure that AI implementation complies with relevant regulations. Secondly, investing in comprehensive training programs to upskill the workforce is crucial to enable them to effectively utilize AI tools in project management. Moreover, fostering a culture of openness to AI technology would encourage stakeholders to embrace change and leverage AI's full potential.

Collaborations with AI experts and solution providers can play a vital role in addressing specific project needs effectively. By seeking external expertise and support, organizations can overcome challenges and optimize AI integration in their project management practices.

In conclusion, the findings of this research highlight the significant benefits of AI integration in project management within the Kingdom of Saudi Arabia, while also recognizing the challenges that need to be addressed for successful implementation. The study emphasizes the importance of a data-driven approach and the need for continuous improvement and adaptation to make the most of AI's potential in the context of project management.

## **Recommendations:**

Based on the results and insights gained from the research on the impact of Artificial Intelligence (AI) techniques on project performance in the Kingdom of Saudi Arabia, the following recommendations are proposed to facilitate successful AI integration in project management practices:

1. **Strengthen Data Governance and Security Measures:** To address concerns related to data privacy and security, organizations should prioritize the establishment of robust data governance frameworks. Ensuring compliance with data protection regulations and implementing secure data storage and access protocols will instil confidence in stakeholders regarding AI adoption. Transparency in data handling practices and regular audits of data management processes will further enhance data security.
2. **Invest in Workforce Upskilling and Training:** Organizations must recognize the significance of upskilling their workforce to effectively utilize AI tools in project management. Design comprehensive training programs that provide employees with the necessary knowledge and skills to leverage AI technologies. Hands-on workshops, online courses, and mentoring programs can be valuable resources to familiarize employees with AI applications and foster a culture of continuous learning.
3. **Foster an AI-Friendly Organizational Culture:** Addressing cultural factors and resistance to change is crucial for successful AI integration. Leaders should promote an open and collaborative environment that encourages innovation and experimentation. Highlight the benefits of AI adoption and demonstrate how AI can complement human expertise rather

than replace it. Employee engagement and involvement in the AI adoption process can help build a sense of ownership and enthusiasm for AI-driven practices.

4. **Collaborate with AI Experts and Solution Providers:** To overcome the challenges associated with AI implementation, organizations can collaborate with AI experts and solution providers. These partnerships can provide access to specialized knowledge, tailor AI applications to specific project needs, and expedite the integration process. By leveraging the expertise of AI professionals, organizations can optimize AI technologies for their unique project requirements.
5. **Continuously Evaluate AI Effectiveness:** Since the effectiveness of AI in project performance may vary depending on the context, it is essential to continuously evaluate AI's impact on projects. Organizations should establish key performance indicators (KPIs) to measure AI-driven project outcomes and use these metrics to assess AI's effectiveness. Regularly review and analyze the results to identify areas of improvement and optimize AI applications accordingly.
6. **Create a Roadmap for AI Integration:** Develop a well-defined roadmap for AI integration in project management practices. The roadmap should outline clear objectives, milestones, and timelines for AI adoption. Involve all relevant stakeholders in the planning process to ensure alignment with organizational goals. A systematic and phased approach to AI implementation will enable a smooth transition and minimize disruption to ongoing projects.
7. **Share Best Practices and Lessons Learned:** Promote knowledge sharing within the organization and across industry sectors regarding AI integration in project management. Encourage project teams to share their experiences, best practices, and lessons learned from using AI technologies. A culture of sharing insights and knowledge will accelerate the

learning curve and enable continuous improvement in AI-driven project management practices.

In conclusion, implementing these recommendations can enable organizations in the Kingdom of Saudi Arabia to harness the potential of AI technologies effectively. By addressing challenges, fostering a supportive organizational culture, and investing in workforce upskilling, organizations can ensure successful AI integration in project management practices. Embracing AI as an enabler of innovation and efficiency will position organizations for sustained success and competitive advantage in the dynamic landscape of project management in the Kingdom.

## **Conclusion:**

In conclusion, this research has shed light on the impact of AI techniques on project performance in the Kingdom of Saudi Arabia. The findings emphasize the potential benefits of AI integration, but they also underscore the importance of addressing challenges and fostering a supportive organizational culture. By embracing AI as a tool to augment human capabilities, organizations in Saudi Arabia can position themselves for success in project management and stay at the forefront of technological advancements. The recommendations provided can serve as a guiding framework for future AI integration initiatives and contribute to the growth and development of project management practices in the Kingdom.

This in-depth review research shed light on the impact of utilizing Artificial Intelligence (AI) techniques on project performance in the Kingdom of Saudi Arabia. The study identified various benefits of AI integration in project management, including improved decision-making, enhanced

efficiency, and resource optimization. However, it also highlighted the challenges faced in implementing AI, such as data security concerns and the need for organizational readiness. The overall effectiveness of AI in project performance varied depending on context and project complexity. By implementing the provided recommendations, organizations in Saudi Arabia can harness the full potential of AI technology to drive successful project outcomes and foster continuous improvement in project management practices.

**Abstract:**

This research study focuses on exploring the repercussions of integrating Artificial Intelligence (AI) techniques on the performance of projects within the context of Saudi Arabia. The decision to investigate this subject is driven by the growing significance of AI technologies in various industries and the need to understand its impact on project outcomes. Both theoretically and practically, addressing this problem is crucial as it can provide valuable insights into optimizing project management practices and enhancing overall project efficiency in the region.

The study adopts a qualitative in-depth interview methodology to gather comprehensive and firsthand perspectives from key stakeholders involved in project management and AI implementation. By employing this approach, the research seeks to delve into the nuances of AI's role in projects, its advantages, challenges, and its implications for project performance in Saudi Arabia.

The findings of this study offer significant insights into the potential benefits of utilizing AI in project management. It sheds light on how AI can streamline processes, improve decision-making, and enhance overall project outcomes. Additionally, the research also uncovers challenges or limitations that may arise when integrating AI into projects, providing a comprehensive understanding of both the opportunities and constraints faced in the Saudi Arabian context.

The results of this project hold crucial implications for various stakeholders, including project managers, business leaders, and policymakers. By understanding the impact of AI on projects, organizations can make informed decisions about incorporating AI technologies to boost efficiency and productivity. Furthermore, the insights gained from this research can serve as a foundation for the development of AI-driven strategies tailored to the specific needs and challenges faced in Saudi Arabia project management practices.

In conclusion, the significance of this study lies in its contribution to the existing knowledge on AI's impact on project performance in Saudi Arabia. It offers practical and theoretical insights that can pave the way for the implementation of AI technologies in projects, thereby optimizing resource utilization and increasing the likelihood of project success. By bridging the gap between AI and project management, this research opens the door for exciting opportunities and possibilities in the realm of project execution and presents a compelling professional proposal for utilizing AI in project management practices.

## المخلص

تعتبر هذه الدراسة ذات أهمية بالغة على المستوى النظري والعملي، حيث تركز على مشكلة أساسية وهي تأثير استخدام التقنيات الذكية وأدوات الذكاء الاصطناعي على أداء المشاريع في المملكة العربية السعودية، وتم اختيار هذه المشكلة بناءً على تزايد الاعتماد على التقنيات الذكية في إدارة المشاريع وأهميتها المتزايدة في البيئة السعودية. تعتمد هذه الدراسة على أسلوب منهجي يعتمد على المقابلات الشخصية والتحليلية مع مشرفي المشاريع وخبراء في مجال الذكاء الاصطناعي، حيثُ تعتمد هذه الدراسة على أدوات بحث متخصصة ومتطورة لتحقيق أهدافها، منها تحليل المقابلات وتحليل البيانات المستخرجة منها، وتهدف الدراسة إلى تقديم نتائج فعالة ودقيقة تسهم في فهم تأثير التقنيات الذكية على أداء المشاريع في المملكة العربية السعودية.

تشمل أهم النتائج التي توصلت إليها هذه الدراسة على الارتقاء بأداء المشاريع في المملكة عبر استخدام التقنيات الذكية بطريقة فعالة ومناسبة، وتسهم النتائج في تحسين عمليات إدارة المشاريع وتعزيز من قدرتها على تحقيق الأهداف المرجوة.

كما تُسهم النتائج في تعزيز التطبيق العملي للذكاء الاصطناعي في مجال إدارة المشاريع بالمملكة العربية السعودية، وتوفر النتائج رؤى قيمة للمشرفين على المشاريع وصناع القرار لتحسين أدائهم وتحقيق النجاح في المشاريع، وتقدم الدراسة مقترحات مهنية قابلة للتطبيق لتحسين استخدام التقنيات الذكية والذكاء الاصطناعي في إدارة المشاريع بالمملكة العربية السعودية.

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## **Annexes**

### **Interview:**

#### **Title: Exploring the Impact of AI on Project Performance in Saudi Arabia - In-Depth Interview**

### **Introduction:**

Thank you for agreeing to participate in this interview. The purpose of this study is to gain a deeper understanding of the impact of AI on project performance in Saudi Arabia. Your insights and experiences as a stakeholder are crucial in uncovering valuable perspectives. All information shared will be treated with confidentiality. Let's begin:

1. Can you briefly introduce yourself and your role in projects involving AI in Saudi Arabia?
2. In your experience, how has the integration of AI techniques influenced project outcomes in the Saudi Arabian context?
3. What are the specific AI techniques or technologies that have been utilized in projects you have been involved in? How have they contributed to project performance?
4. Have you encountered any challenges or barriers when implementing AI in project management?  
If yes, could you please elaborate on them?
5. From your perspective, what are the key advantages of using AI in project management, and how do they compare to traditional project management approaches?
6. In what ways has AI affected decision-making processes within projects? Has it led to more data-driven decisions, and if so, how has that impacted project outcomes?

7. How do stakeholders in Saudi Arabia generally perceive the adoption of AI in project management?

Are there any common concerns or reservations?

8. Have you observed any differences in project performance when AI is utilized in various industries within Saudi Arabia?

9. As a stakeholder, do you believe that proper training and knowledge of AI technologies are essential for project teams to leverage their benefits effectively? How can organizations ensure that their teams are well-equipped to work with AI in projects?

10. Can you share any specific success stories or case studies where AI implementation has significantly improved project outcomes in Saudi Arabia?

11. On the other hand, have you come across any instances where the use of AI had unexpected negative consequences or challenges in project management?

12. As AI continues to evolve, how do you envision its future impact on project performance in Saudi Arabia? Are there any areas where AI adoption should be further encouraged or restricted?

Conclusion:

Thank you for sharing your valuable insights and experiences. Your input will contribute significantly to understanding the impact of AI on project performance in Saudi Arabia. If there are any additional points you would like to discuss or elaborate on, please feel free to do so. Your participation is highly appreciated and will be instrumental in enhancing our understanding of this crucial topic.