

العنوان:

أثر توظيف تطبيقات الذكاء الاصطناعي على الأساليب التقليدية لإدارة المشاريع في المشاريع الإنشائية بالرياض

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Title:

**The Impact of Incorporating AI Application on
Traditional Project Management Styles in Construction
Projects in Riyadh, Saudi Arabia**

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Abstract

This study sought to understand the impact of AI integration on traditional project management processes in construction projects in Riyadh, Saudi Arabia. The construction industry in Saudi Arabia has continued to experience major changes and shifts, evolving from traditional project management and now embracing new technology. Project management in Riyadh follows the traditional approaches in the construction industry that have various limitations such as time wastage and lack of lean approaches hence affecting the success of any project. The research highlighted the significance of AI-enabled project management processes in Riyadh, Saudi Arabia. The study uses a qualitative approach in data collection through semi-structured interviews as the primary data source and analysis of relevant resources as the secondary data source. The results are qualitatively analyzed to identify major themes associated with AI applications in construction project management. The literature used is obtained from major databases including Google Scholar. The results indicate that AI application in traditional project management approaches in construction projects in Riyadh will ensure timely completion, improved efficiency, and quality outcomes of the projects. The project results can be used to guide project managers in the construction industry on various ways they can adopt AI tools for improved outcomes. The general application of the results is on the AI-based research touching on the construction industry. The results will also contribute to a deeper understanding of how AI can be utilized in different levels of the project management processes such as administration form effective project management outcomes.

الخلاصة

سعت هذه الدراسة إلى فهم تأثير دمج الذكاء الاصطناعي على عمليات إدارة المشاريع التقليدية في مشاريع البناء في الرياض، المملكة العربية السعودية. استمرت صناعة البناء والتشييد في المملكة العربية السعودية في مواجهة تغييرات وتحولات كبيرة، حيث تطورت من إدارة المشاريع التقليدية وتتبنى الآن التكنولوجيا الجديدة. تتبع إدارة المشاريع في الرياض الأساليب التقليدية في صناعة البناء والتشييد والتي لها قيود مختلفة مثل إهدار الوقت وعدم وجود أساليب بسيطة وبالتالي تؤثر على نجاح أي مشروع. وسلط البحث الضوء على أهمية عمليات إدارة المشاريع المدعومة بالذكاء الاصطناعي في الرياض بالمملكة العربية السعودية. تستخدم الدراسة منهجاً نوعياً في جمع البيانات من خلال المقابلات شبه المنظمة كمصدر أساسي للبيانات وتحليل الموارد ذات الصلة كمصدر ثانوي للبيانات. يتم تحليل النتائج نوعياً لتحديد الموضوعات الرئيسية المرتبطة بتطبيقات الذكاء الاصطناعي في إدارة مشاريع البناء. يتم الحصول على الأدبيات المستخدمة من قواعد البيانات الرئيسية بما في ذلك الباحث العلمي من Google. تشير النتائج إلى أن تطبيق الذكاء الاصطناعي في الأساليب التقليدية لإدارة المشاريع في مشاريع البناء في الرياض سيضمن الانتهاء في الوقت المناسب وتحسين الكفاءة ونتائج الجودة للمشاريع. يمكن استخدام نتائج المشروع لتوجيه مديري المشاريع في صناعة البناء والتشييد حول الطرق المختلفة التي يمكنهم من خلالها اعتماد أدوات الذكاء الاصطناعي لتحسين النتائج. يتم التطبيق العام للنتائج على الأبحاث القائمة على الذكاء الاصطناعي والتي تتناول صناعة البناء والتشييد. ستساهم النتائج أيضاً في فهم أعمق لكيفية استخدام الذكاء الاصطناعي في مستويات مختلفة من عمليات إدارة المشروع مثل الإدارة التي تشكل نتائج فعالة لإدارة المشروع.

Table of Contents

CHAPTER ONE – Introduction.....	7
1.1 Background.....	8
1.2 Research Problem	10
1.3 Study Purpose.....	10
1.4 Project Aim and Importance of the Research	12
1.5 Research Questions.....	13
1.6 Research hypothesis.....	14
1.7 Theoretical Framework	14
CHAPTER TWO - Literature Review	15
2.1 Introduction.....	16
2.2 Independent and Dependent Variables	16
2.3 Traditional Methodologies in Project Management	17
2.3.1 Overview of AI and application in project management.....	19
2.3.2 Examining the application of AI in the construction industries, benefits, and challenges.....	20
2.4 Theoretical Framework of the Study.....	23
CHAPTER THREE - Methodology and Research Methods.....	25
3.1 Introduction.....	26
3.2 Research Design	26
3.3 Sample and Population of Research.....	27
3.4 Data Collection Procedures	28
3.5 Research Limitations	29
3.6 Method of Analysis.....	30
CHAPTER FOUR - Data Analysis and Results.....	31
4.1 Results from the Interviews	32
4.2 Analysis of Secondary Sources	33
4.3 Results discussion.....	36
4.4 Conclusion and Research Recommendations	38
Appendixes.....	40
References.....	41
Appendixes.....	48
Abstract	52

CHAPTER ONE – Introduction

1.1 Background

The construction industry in Saudi Arabia has continued to experience major changes and shifts, evolving from traditional project management and now embracing new technology. The changes have necessitated the need to adopt new technologies to catch up with the ever-changing management dynamics and practices in project management. For instance, there are new software adopted in the construction industry that are key catalysts in the changes witnessed in project management. These programs have ensured innovativeness while addressing the challenges faced in construction and in project management as a whole. The accuracy and precision cannot be overlooked as well, thanks to new technology. The transformation from the old project management practices to the current methods is attributed to the continuous growth of construction in the Kingdom. In Riyadh, Saudi Arabia new technologies continue to impact project management and construction in a significant manner. Project managers are shifting significantly from traditional methods and adopting new technologies to address major challenges facing the industry today.

The traditional project management practices in Riyadh follow the waterfall methodology or the step-by-step approach where the project is broken down into steps and plans that must be completed with a timeline. The processes involved in the different stages are necessary to ensure that the project manager can assess and manage risks before the completion of every stage. Following such a process makes it challenging to adopt changes when mistakes occur during the project cycle, leading to the failures of most of the projects implemented in Riyadh (Alsuliman, 2019). As such, there is a need to explore additional approaches that ensure agility and precision in project management practices. Artificial Intelligence plays a major role in promoting an agile

and lean approach to project management. Therefore, it is important to understand the impact of incorporating AI on traditional project management styles in construction projects in Riyadh.

According to research on the application of AI in project management, its application will greatly transform construction and project management as a whole. Research indicates that only 35% of construction projects go to completion due to a lack of the required technology to propel project management practices (Abioye et al., 2021). With the application of advanced technology such as machine learning and AI in project management, researchers expect a major shift in success rate. This is based on improved project selection, facilities testing, prioritization, reporting speed, and progress monitoring. In general, the application of virtual assistants will reduce most of their oversight roles while ensuring they focus more on stakeholder management and coaching. Most of the manual tasks and administration can be reduced through the application of AI. In light of this, it is important to assess the impact of this new technology in Riyadh project management, assessing the changes expected to occur and, the advantages and disadvantages of adopting AI in project management.

Understanding the impact of AI on traditional project management styles in construction projects in Riyadh is important to the general society and the project management stakeholders as a whole. Currently, the public sector experiences delays in project completion. The traditional approaches to project management are always blamed for stalled projects that never succeed. Alsuliman (2019) noted that general approaches are always used in project management and despite the conferences and seminars held to discuss new approaches, no success is recorded. Therefore, the findings from this systematic review research will help improve the current situation and ensure projects in Riyadh succeed.

1.2 Research Problem

Project management in Riyadh follows the traditional approaches in the construction industry that have various limitations such as time wastage and lack of lean approaches hence affecting the success of any project. Despite the availability of new technology and approaches in project management, traditional approaches are still in use in Riyadh. AI is the future and will eventually be incorporated into project management approaches yet the impact it has is unknown. A significant problem in project management that uses traditional approaches is the limitation in the success rate of the projects due to limitations of the available technologies, which also occurs in Riyadh's approach to construction and project management. The available technologies have limitations in the assessment of success rates based on deliverables especially due to the changing dynamics in the field of project management. Therefore, there is a need to assess the impact of new technologies, particularly on the application of AI, and how it will improve traditional approaches to project management in Riyadh, Saudi Arabia. The findings will help advise whether the adoption of AI is a necessity in project management to promote agile and lean operations that lead to the success of a project. The research outcomes can be outlined by the Saudi Arabian government to improve its policies on construction projects to ensure they are completed on time. Also, project managers will benefit from this research by implementing the results on the importance of AI in project management.

1.3 Study Purpose

The importance of the study is based on the value it will contribute to Riyadh construction projects through the understanding of how AI contributes to better project outcomes. Notably, the construction industry is one of the areas where technology is yet to be fully adopted. Aldahwan & Alsaeed (2020) noted that the slow adoption of technology in

construction projects has limited the full implementation of AI in traditional project management systems. The importance of this research is based on how it provides insight into the application of AI in the construction industry and how it contributes to improved productivity and efficiency. The research will also contribute to the wider range of AI applications in the construction industry given that the results can be replicated in other geographical regions. It is impossible to underrate the advancement in technology and the greater contribution it will have to the construction industry, particularly in Saudi Arabia. The research will highlight the role of AI in project management and how it changes traditional project management operations. The results obtained will go a long way in contributing to the research conducted on how artificial intelligence is being applied in the construction industry.

The project management sector, particularly in the construction industry is one of a complex area that involves various processes that impact all the stakeholders involved. Some of the key stakeholders make suggestions later when the project is already running which may affect the overall outcomes of the project. Some of these suggestions can only be implemented through the aid of AI to avoid additional costs or challenges in the construction process. According to Haskjold et al. (2020), most of the construction industries experience cost challenges, with managers encountering design omissions and errors. The application of artificial intelligence in construction is meant to address this issue and eliminate the errors that contribute to additional costs. Riyadh project managers also encounter these challenges, hindering the completion of most of the construction projects. By using AI and traditional project management approaches together, the project managers can effectively address these challenges and ensure the projects are completed on time. AI helps address the challenges encountered in the initial stages of the project planning that are likely to impact the entire lifecycle of the project.

Generally, the application of AI in the construction industry has a significant role in addressing the challenges encountered by project managers. According to Ahmed and El-Sayegh (2020), the construction industry continues to experience changes from one decade to the next. New technology such as AI and machine learning (ML) are important aspects of these changes that impact project management in the construction industry in a big way. However, the dynamics of AI are broad and require a deep understanding of how managers can integrate this technology into the construction industry to ensure the effectiveness of project management in Riyadh. For effectiveness in the traditional project management processes applied in the construction industry, it is important to understand AI can be integrated to ensure its success. Therefore, this research looks into how AI can be integrated into project management and how it will influence the construction industry. The results will also contribute to a deeper understanding of how AI can be utilized in different levels of the project management processes such as administration form effective project management outcomes.

1.4 Project Aim and Importance of the Research

AI has a significant impact on project management and therefore, the proposed project intends to investigate the impact of AI on traditional project management styles in construction projects in Riyadh.

The research objectives are important as they highlight the contribution of AI in the field of construction projects and how it impacts project management as a whole. In recent years, AI applications in project management have been on the rise and continue to impact traditional project management processes positively. The research highlights how the AI application has eliminated repetition in project management while highlighting real-time insights into the project's progress (Ahmed et al., 2021). One importance of the application of AI in project

management is based on its ability to analyze historical data and help project managers make informed decisions. The research highlights how AI-powered algorithms are applied in the analysis of data and choose the best project likely to yield more benefits to the organization. Through a systematic review of previous studies relating to the application of AI in project management, the research provides a detailed analysis of how AI can be integrated into traditional project management styles in construction projects and contributes positively to the Riyadh construction industry. The results obtained can be integrated into the entire Kingdom of Saudi Arabia for effective and quality project outcomes while ensuring they are completed on time.

1.5 Research Questions

The research aims to answer the impact of AI integration on traditional project management in construction projects in Riyadh, Saudi Arabia as the main question. Other research questions include:

- 1) What is the impact of artificial intelligence on traditional construction projects in terms of cost efficiency, effectiveness, and project outcomes?
- 2) In what ways does the integration of AI in project management influence the completion of the construction project?
- 3) What are the potential challenges associated with the integration of AI in traditional construction project management and how can they be addressed?
- 4) To what extent does AI integration in traditional project management enhance communication, collaboration, and decision-making processes?

1.6 Research hypothesis

Incorporating AI in traditional project management styles in construction projects in Riyadh will improve the success of project completions.

1.7 Theoretical Framework

Currently, the world continues to witness technological changes impacting various occupations. Project management in construction projects still relies on traditional methods that are unsustainable and with various challenges. The challenges are associated with the reliance on traditional manual processes leading to delays and inefficiencies. This leads to poor communication, inadequate allocation of resources, and unforeseen risks that lead to project stalemate. Therefore, AI provides a solution to the challenges identified in Riyadh construction projects, ensuring improved effectiveness and efficiency. The application of AI in traditional processes applies machine learning (ML) in the analysis of data and making accurate predictions that contribute to process optimization (Mohapatra et al., 2023). Integration of AI processes will ensure that common challenges experienced in management of the construction projects such as schedule delay, communication gaps, resource allocation challenges, and budget allocation are eliminated.

CHAPTER TWO - Literature Review

2.1 Introduction

Traditional project management methods have underlying limitations that prevent the success and completion of most of the projects in Riyadh. The application of AI technology will ensure that project managers successfully initiate and complete the projects at hand. A review of the past literature highlights the various advantages associated with integration of the AI technology in construction project management. The literature review provided information on previous research conducted with interest to the current study which was used to conclude the impact of AI in project management of construction projects in Riyadh. The literature review involved the identification of appropriate literature from reputable sources and the summary of each research documented. Also, the independent and dependent variables were identified as highlighted below.

2.2 Independent and Dependent Variables

2.2.1 Independent variables

- The adoption of AI technologies is one of the independent variables that involves incorporating technologies such as predictive analytics, robotics, and machine learning in the construction processes.
- Implementation of AI strategies considering the initiatives taken to ensure effective implementation of the technology in the management of the construction

2.2.2 Dependent Variables

- The first dependent variable is the project performance of the construction projects. The completion of the project highly depends on cost-effectiveness, efficiency, safety records, adherence to schedule, satisfaction among stakeholders, and work quality.

- The second variable depends on the effective utilization and adoption of AI in construction projects and how it will contribute to efficiency and effectiveness. Successful adoption and utilization ensure that the outcomes are satisfactory by eliminating factors that affect project completion such as insufficient allocation of resources.
- Finally, the growth and sustainability of the Riyadh project management of the construction projects depend on the successful utilization of AI in the projects as an effective technology that contributes to improved project outcomes,

2.3 Traditional Methodologies in Project Management

Nieto-Rodriguez (2023) noted that the approach to project management can be equated to the approach used in different fields but follows a specific approach to achieve set goals and objectives. The traditional methods applied in project management and construction style follow a life cycle, typically referred to as the waterfall approach Nieto-Rodriguez (2023). This means that the project must be subdivided into various stages with distinct deliverables and tasks. In the waterfall approach, the managers ensure that each step is followed subsequently and decisions made in each stage may affect the success of the next one. The traditional approach emphasizes more on the project processes that must be followed effectively to ensure the success is achieved. The outcomes of the projects are also dependent on the risk analysis and prediction of the desired outcomes Nieto-Rodriguez (2023). Based on these factors, the project has to be completed in stages to ensure risks and errors are eliminated at every stage. The mistakes made at every stage may affect the success of the project, preventing timely completion or leading to the stalemate of the entire project.

Nieto-Rodriguez (2023) further noted that, as a strict method used in project management, particularly in the construction industry, the phases are completed in sequences

that involve planning the project and setting out the requirements. The procedures to be followed should be documented while communication is done with everyone in the project to ensure success is achieved. The documentation has to be done on every section of the project.

Therefore, the success of the traditional approaches to these types of projects is based on documentation Nieto-Rodriguez (2023). This allows continuity of the project should any of the members leave during the cycle. It is also considered an easy way of managing the project due to simplified tracking methods. However, it is worth noting that the traditional method applied in project management has extreme challenges when the requirements are not stated clearly. Because the output for every step acts as the input for the subsequent stage, a mistake in the previous stage may affect the success of the project altogether. The traditional approach to project management also experiences challenges based on its lack of adaptability to change leading to more cost. This calls for the need to explore more ways of improving project management approaches such as the application of AI in traditional construction styles.

The impact of the traditional approaches is always quantified based on quality, time, and cost. With the right approach to project management, time, costs, and resources used are saved. Yet most of the project fails to succeed as they follow the traditional approaches that have restrictions hindering the success of the projects. Research indicates that most of the projects following the traditional approach are prone to failure as they have limited flexibility. The traditional approach to construction and project management is characterized as rigid and follows a structured method. The approach does not create room for changes when challenges occur which leads to failures in the project success. Also, the lack of involvement of the customers in the initial stages is blamed for the failures encountered as they are only involved in the final stages.

2.3.1 Overview of AI and application in project management

According to Rasch (2019), artificial Intelligence simulates human intelligence but in the form of machines or computers. Various industries are adopting these new technologies that have changed the dynamics of how things are done today. The technology was developed through ingesting training data, which was then analyzed for pattern and correlation and the outcomes of the patterns used in the prediction of the future outcome of events. Since the introduction of AI, it has significantly changed how people live, play, or work. AI has also contributed a lot to the automation of various activities performed by humans in different fields including quality control of projects, fraud detection, and customer service among others. AI performs most of the tasks better compared to human labor, eliminating repetitiveness, and errors (Rasch, 2019). Tasks are also completed quickly without complaining of fatigue hence its application in different fields today. Generally, it has contributed to efficiency in various fields and continues to find its way into other complex fields such as project management.

Given the benefits of AI in other fields, its application in project management would also contribute to positive results. According to Huang et al. (2019), the application of AI and other technology in the construction industry styles and project management will increase the success rate significantly. Research by Rasch (2019) noted that by 2030, most of the projects will be run through AI with the application of big data, natural language processing, and machine learning technologies. Its application is likely to disrupt most of the processes in project management. One of the aspects that are likely to experience the benefits of AI is prioritization and selection of the projects that are likely to bring more value to the organization. With the application of AI, correct data can be analyzed through machine learning technologies that make accurate predictions. Thus it will help prioritize projects that are beneficial to the organization and only

select those with high success rates. One of the advantages of applying machine learning technology and AI in project management is that bias will be eliminated in the decision-making process promoting the success of the selected project.

Nieto-Rodriguez (2023) noted that AI will optimize office operations in project management to ensure timely monitoring of the projects undertaken. Also, AI will help identify potential problems likely to arise and address them automatically, saving time and resources. Office operations in project management will be improved especially in reporting where reports will be prepared and distributed effectively for timely feedback (Nieto-Rodriguez, 2023). The AI brings with it a virtual assistant for support of risk assessment and checking on the status of the project. With AI applications, project managers will generally automate most of the tasks for effective results. Although some managers fear their administrative roles will be replaced by AI, the new era of AI-enabled project management systems will ensure that managers have new roles (Mohite et al., 2024). For instance, they will be required to cultivate soft skills or leadership skills that promote strategic thinking for the benefit of the organization. Although there are fears of disruption in the industry by AI, it is worth noting that it will contribute to the overall success of the projects, ensuring they are completed on time.

2.3.2 Examining the application of AI in the construction industries, benefits, and challenges

According to Savio and Ali, (2023), AI is being utilized at a global scale to enhance the completion of construction projects globally. This is due to its potential to improve the monitoring of activities, optimize the allocation of resources, enhance strategies in risk management, and promote lean operations (Savio & Ali, 2023). The application on a global scale is attributed to its ability for process optimization, increased productivity, promoting informed

decisions, efficiency, and improved safety. However, it is also important to note that the technology may also experience challenges. For instance, internet connectivity and power supply for the computers remain a major concern as most of the construction sites are remote. The construction activities may also lead to disruption of the internet and power affecting the application of AI tools in the construction industry. The other issue is based on the high initial cost. Abioye et al. (2021) Investing in AI solutions such as acquiring robotics will be a challenge affecting most small firms and subcontractors. There is also an issue of the shortage of AI engineers required to spearhead developments in the construction industry. Available engineers have limited knowledge and skills in construction projects and may not provide the needed technology that serves the interests of project managers.

With the advancement in technology, most of the corporation continues to experience a shift in the way things operate by including robotics and automation processes in the construction industry. These changes have impacted the construction industry in a big way, ensuring that most of the manual work is conducted by new technologies made possible through artificial intelligence. For instance, most of the site surveys are currently conducted through automation processes with equipment such as drones which use a camera and a sensor to capture high-resolution images of the construction site, create a 3-D model of the area, collect topography data and measure the precise distance of the construction area. This eliminates the human error that occurs in the site inspection and surveys by increasing accuracy in data collection. This, in turn, ensures that the decision-making process is sound and helps in the planning of the construction area. Li and Liu (2019) note that introduction of the new technology in the construction industry, particularly the use of robotics and other AI programs has impacted

project management processes by ensuring collected data is accurate and leads to the making of proper decisions on how to approach the project process and ensure it comes to completion.

Given the complexities in the construction industry, it is ranked among the most difficult fields of project management. This is particularly due to challenges experienced during the planning processes that impact the overall outcomes of the project. This means that wrong decisions in the planning process can lead to the stalemate of the entire project or additional costs. With the application of AI and new technologies in the construction processes, project managers have managed to address this issue, ensuring that the right decision is made in the planning phase hence eliminating the unnecessary errors that could negatively impact the entire project. The application of automation and robotics in the entire planning process improves the safety of the project through quality decisions and ensures that the outcomes of the project are of good quality while also ensuring the timely completion of the project (Bock, 2015).

Communication in the project management processes is important in ensuring that projects are completed effectively. With the application of new technology and AI, communication is enhanced using virtual assistants and AI-driven chatbots that ensure real-time updates are provided to the entire team. Also, AI application in the construction industry contributes to timely communication where real-time communication of project progress is made through a cloud-based platform. The seamless communication ensures that prompt decisions are made on time as communication is made easier. Communication ensures that errors are eliminated in all the phases of the construction process, and ensures that every member of the team understands their role in the project to eliminate delays and errors that may cost the entire project.

From the literature, AI is a promising technology in construction project management and is likely to improve efficiency and effectiveness. It provides a simplified way of addressing the most pressing issues in construction management, ensuring that enough resources are allocated to ensure the completion of the project promptly. Research articles note that the adoption of AI technology in the project management of the construction industry has improved. The risks associated with the construction projects have been eliminated while also enhancing communication among the key stakeholders to ensure the success of the entire project. With enhanced technology, traditional construction project managers should take advantage of these new technologies to ensure the success of their projects. This is through understanding what is happening in the construction industry and ensuring they utilize AI to improve the construction process and management of the construction processes. This improves the sustainability of the project, ensuring that minimal resources are used, the projects are completed on time, and effective communication is promoted in the entire operations.

2.4 Theoretical Framework of the Study

The application of Artificial Intelligence in the construction industry is evident from the various literature analyses. The research articles highlight the advantages of AI technology in the construction industry project management through automation of processes, improving accuracy and efficiency, and saving on the overall cost of running the projects. Through AI and machine learning, analysis of historical data to identify efficient ways of running the project. The historical data may also be used in making recommendations for optimal construction methods, materials the appropriate design hence saving on cost while ensuring successful outcomes of the project. The application robots and drones have also ensured the cost of operations is maintained at a minimum through the automation of the processes (Mohapatra et al., 2023). In the

construction phase, AI-aided technologies such as drones can be used in site surveillance and generate accurate models to track the progress of construction activities. These are important activities that would help identify potential risks and address them effectively for optimal outcomes of the project. Riyadh construction projects can utilize this technology to improve efficiency and ensure the outcomes are successful. By adopting these technologies, the projects will be successful, ensuring that safety is improved, reduced cost of operations, and reliability of the project. AI technology will most likely improve project outcomes and ensure successful outcomes of the project. There are additional issues associated with the successful implementation of the AI. The lack of skilled personnel in the application of AI remains a major challenge that should be addressed. The ethical implications of the application of AI in the construction industry, and job displacement issues are also an issue of concern that needs to be addressed effectively.

CHAPTER THREE - Methodology and Research Methods

3.1 Introduction

The research method used in this study uses primary and secondary data to conclude. The primary data was obtained by interviewing project managers who have integrated AI technology into their construction projects. The secondary data involved a comprehensive search of research publications from reputable databases. Being a qualitative research, the data collected was then analyzed to identify common themes in the application of AI in the construction industry. The collection of primary data was relevant in this study as it offered firsthand information from the source ensuring that data is reliable. This was important to ensure the authenticity and reliability of the information from project managers who have implemented AI technology in construction projects. Secondary data was also relevant in this study, to collect historical data on the successful application of the new technology in improving construction project management. It provided information that could not be obtained from primary data collection processes. The advantage of using secondary data in this research is based on its cost savings in obtaining research and ease of access to quality and reliable information. It also eliminates the difficulties that may occur in collecting primary data.

3.2 Research Design

The research used primary and secondary research methods to obtain the data required for analysis. The primary data sources incorporated direct gathering through interviewing professionals in the industry who have already implemented the application of AI in their project management practices. The secondary data was collected from previously published research studies touching on the application of AI in project management. Qualitative analysis was utilized in the analysis of the data to conclude this research.

3.3 Sample and Population of Research

The target population was construction project managers in Riyadh, Saudi Arabia. The study population involved individuals who have implemented AI technologies in running construction projects to understand their experience. However, the questionnaires were distributed among all the construction project managers and only those with AI experience were considered in concluding the impact of AI technology in their project management **activities**.

3.3.1 Sample Characteristics

For the primary data, characteristics of the target population used in this study involved managers in the construction project management who understand the application of AI and its impacts on the construction industry. It involved both men and women in managerial positions, without age restrictions. The population considered in the study had experience in both traditional project management practices and an understanding of new technologies used in the construction industry. They were also required to understand the construction practices in Riyadh, Saudi Arabia. For secondary data, the characteristics of the sample research articles used were based on relevance, source of the publications, and year of publication to ensure relevance. The publications were obtained from reputable databases such as Science Direct, Web of Science, and Google Scholar. The publications also were selected based on relevance in terms of keywords related to AI, the construction industry, and project management of the construction projects. For a comprehensive review, the research papers considered publications from the past decade touching on the implementation of AI in construction project management.

3.3.2 Sample Size

The research had a sample size of 35 respondents for the primary data collection. Out of the 35 respondents, 20 respondents were considered appropriate for the research based on the desired

characteristics highlighted above. The secondary data was obtained from 15 articles considered applicable to answer the research questions. Although the initial articles identified were more than 30, only pertinent articles were selected for the research.

3.4 Data Collection Procedures

3.4.1 Interviews

Interviews are commonly used methods for data collection in qualitative research studies. These methods are vital in gaining in-depth and nuanced insights regarding the participants' perspectives and experiences. This research utilized a semi-structured interview approach that involved conducting a comprehensive survey interview with prospective participants to gather insightful information regarding their opinions on the impact of incorporating AI application on traditional project management styles in construction projects within their respective construction companies within Riyadh, Saudi Arabia. This approach provided an opportunity to delve deeper into the perspectives and opinions of the respondents to help understand the impact of incorporating AI into the traditional project management styles within the construction industry.

3.4.2 Secondary Data

Secondary data was collected before the survey to help understand the perspectives of the previous researchers on the impact of incorporating AI applications on traditional project management styles in construction projects. The utilization of the secondary data helped in enhancing the conclusiveness of our underlying research question. The research focused on the analysis of qualitative data obtained from researchers with real-world experience to understand the impact of AI in Riyadh industries. Analysis of previous research also highlighted the various methods used in the implementation of AI technology in traditional project management and

construction styles. A thorough investigation of the literature was used to identify the most applicable articles for review. The information was obtained from major databases such as Google Scholar and only peer-reviewed articles will be utilized in the study. Search terms such as AI, application of AI in the construction industry, and the impact of AI in the construction industry were used to ensure only extant articles were identified. Case studies and industrial reports were also used to gather the needed data for this project.

3.5 Research Limitations

Given that this is a mixed study approach, the limitations are based on available resources, context, and temporal considerations. One of the limitations is access to quality resources for review. Some of the literature may require a subscription for access, affecting the comprehensiveness of the study. Bias publication is another challenge likely to affect the outcomes of the results; the geographical and temporal scope may limit the outcomes of the results due to the generalization of the construction industry.

The context of the study is limited to the construction industry since it primarily focuses on the implementation of AI applications on traditional project management styles in construction projects. In this case, the scope or the context of the study is limited to construction projects and limits the study to provide a general understanding of the impact of AI applications in traditional project management styles in construction projects. However, the findings may apply to a wide range of project management contexts. The temporal consideration is also another limitation of this study because the study only considers the present and future impact of AI applications on traditional project management styles. In this case, the project will not incorporate the historical aspects when it comes to the evolution of AI technology in project

management within different industries. The other issues are based on the research biases. The research may tend to rely mostly on research that highlights the success of AI integration in construction project management hence affecting the project outcomes. The time limit is also a factor that limits a detailed analysis of the research questions.

3.6 Method of Analysis

The method of analysis in the study followed the qualitative analysis method to identify similarities and differences in the articles, categorization of data, and research themes touching on AI application in construction project management. Primary data was also analyzed using content analysis methods to identify the responses as they relate to the research.

CHAPTER FOUR - Data Analysis and Results

4.1 Results from the Interviews

Questionnaires were distributed randomly to different construction managers and their responses were recorded. When asked about the role and impact of AI in the construction industry, the respondents noted that AI has drastically shifted the traditional process used in managing construction projects. A common theme in the responses was that positive outcomes are seen in most of the projects that utilize AI and new technologies in the decision-making process. The responses from project managers who have adopted AI technology in the construction industry noted that their work in project management had improved and could see the completion of most of the projects done on time. They noted that automation of key processes in the entire project saved time and resources while eliminating the risks that are associated with human errors. Respondents noted that AI had made it easier to allocate resources based on their demand which made the planning of the entire project simple through the informed decision-making process.

Analysis of the responses gathered from the semi-structured interview on the benefits of the application of AI in the traditional project management processes pointed out the improved productivity and efficiency of the construction process. The respondents highlighted the various ways they have benefited from AI-enabled project management processes. For instance, one of the project managers noted that management processes were streamlined through the automation of key processes, allowing him to concentrate on the most critical parts of the project that required his attention. He also noted that AI enabled him to analyze site data to identify risks associated with the project while in the planning process which helped make informed decisions on whether to initiate the project or do away with it. Thus AI helps in making informed decisions through analysis of the available data and important information that determines whether the

project will be completed or not. Most of the project managers who utilize AI in their processes noted that they have managed to complete their projects by analyzing data using AI-powered algorithms to forecast the budget needed, resources required, and timeline of the project.

Another important result from the interview is based on the efficiency attained through the application of AI in the project management processes on construction projects. Most of the respondents noted that they utilized artificial intelligence in solving complex inquiries. Through AI, project managers can plan their activities effectively, allocating tasks to team members without challenges. It also enhanced their decision-making process and communication with the project team to ensure productivity and promote timely completion of the project. By ensuring effectiveness in the communication and scheduling process, project managers could easily focus on other areas of the project ensuring that the project was a success. The respondents noted that the application of AI had great benefits as it eliminated the challenges that face project managers in the traditional process. Its application in construction projects has made it possible to complete most of the projects in time and save on resources. The respondents agreed that the application of AI in Riyadh project management processes would greatly impact the project management processes, ensuring that construction projects are completed on time. Respondents also agreed that, although the application of AI in project management can be complex, the general outcomes in Riyadh projects would be positive.

4.2 Analysis of Secondary Sources

Research by Khallaf et al. (2021) on the application of AI in the construction industry highlighted the various ways the new technology has impacted project management in the construction industry. Through a systematic review of construction industry reports, conference

proceedings, and academic papers, the research discovered that AI utilization in construction projects helped in activities such as project analysis and prediction, risk assessment, communications among stakeholders, risk mitigation, and task collaboration to enhance the overall project outcomes. The researcher also highlighted the relevance of AI in modern project management processes through improved efficiency and effectiveness in task completion. Since its adoption in construction projects, the researchers discovered that project managers had higher chances of completing the project. AI also reduced errors encountered in the decision-making process through effective collaborations and communication processes. Khallaf et al. (2021) also discovered that the success of the AI application in project management of construction processes required skilled personnel to correctly interpret the AI data. The results from this study highlight the importance of incorporating AI in the traditional project management styles used in construction projects. Results indicate that Riyadh project managers can take advantage of AI-driven robotics to address the shortage of labor while also ensuring that projects are completed in time to save on the overall costs of operations.

Research by Pan and Zhang (2021) also provides a comprehensive analysis of the application of AI technologies in the construction industry. The research highlights how various project managers have utilized AI in the performance of key projects in the construction industry. They note that the application of AI in the traditional project management of construction projects has improved the construction processes while increasing productivity. Through AI, project managers have managed to address accidents and other risks that were previously witnessed in the entire construction industry. The increased safety witnessed in construction sites is based on the ability of the AI to analyze the site and provide informative data on potential risks that would affect the project and workers. The researchers also highlight

the benefits associated with adoption of the AI in construction projects, noting that the lifespan of the construction projects is greatly reduced hence saving on resources. With the application of AI-driven robots, the cost of labor is significantly reduced as various processes can be performed using the robots (Pan & Zhang, 2021).

The research by Pan and Zhang (2021) also highlights the reluctance of project managers to adopt new technologies in construction projects. This is due to the lack of AI-skilled individuals in the construction industry which affects data analysis processes. They also note that the construction industry is unstructured, leading to large data that limits effective analysis for efficient operations. Therefore, the research points out that the adoption of the new technology requires skilled individuals to effectively integrate AI into the traditional project management processes used in construction projects. Due to a shortage of skilled workers, the construction industry continues to face the challenge of utilizing AI processes. They recommend collaboration of all the stakeholders in the construction industry to work together in addressing these challenges and research ways to ensure the construction industry fully benefits from AI-driven technology.

Another research by Dede et al. (2019) analyzed the application of AI technologies in Civil Engineering, one of the foundations of construction projects. The research analyzes how AI technology, with a focus on machine learning, can be utilized in project management processes. They note that AI can be used to address the challenges experienced in the process of project management. A key importance of the application of AI in civil engineering projects is connected with its ability to address challenges such as project scheduling, resource allocation, and risk management. The research indicates that AI can be used in the optimization of schedules by analyzing factors that may affect the project such as task dependencies, availability of

resources, and underlying constraints. AI can also analyze risks associated with the project and highlight the mitigation strategies to be used in the construction process. This is based on its ability to analyze historical data and contribute to making a sound decision regarding the project. Dede et al. (2019) also noted that AI-optimized resources. Machine learning has made it possible for AI to analyze data from current and previous construction projects and highlight the most optimal ways of allocating resources (Dede et al., 2019). This research is supported by Huang and colleagues who analyzed the benefits of utilizing machine learning and artificial intelligence in the traditional construction industry. Huang et al. (2019) note that these models are relevant in optimizing processes in the design state eliminating errors, through their research, AI can successfully be integrated into construction project management. They however note that there is a need for skilled experts to analyze and interpret data obtained from AI and ML algorithms to ensure the success of the project.

4.3 Results discussion

From the interviews conducted on the application of AI in the traditional project management process of construction projects, the respondents had a common theme on the potential of AI in project management. They noted that most of the challenges encountered in the traditional process of construction limiting the completion of the projects were significantly eliminated through the adoption of AI and machine learning technologies. The respondents also had a common theme on the optimization of processes in the construction project management that ensured the timely completion of the projects. Notably, professionals in the construction industry had significantly reduced the risks encountered in the construction processes, ensuring that resources were allocated effectively for the completion of the project. The respondents

recommended the application of AI in Riyadh construction projects as a way to address the underlying challenges that prevent the completion of most of the projects.

Respondents highlighted the importance of AI in the analysis of previous and current data in the construction industry that helps make an informed decision. They also highlighted how AI has harnessed communication processes in the project management process ensuring that key stakeholders understand every stage of the project to prevent unnecessary changes that may negatively impact the outcomes of the project. Therefore, they advocate for the application of AI in traditional project management styles used in construction projects in Riyadh, Saudi Arabia noting that it would optimize the process and ensure obstacles that prevent timely completion of these projects are addressed. This is in line with the research hypothesis that incorporating AI in traditional project management styles in construction projects in Riyadh will improve the success of project completion.

Results from secondary data also highlighted a common theme with the research hypothesis. The selected literature noted that the integration of AI in the construction industry had a significant impact on the construction industry. Notably, it impacts resource allocation, decision-making, efficiency, and predictions of the project. Through machine learning (ML), analysis of data, trends, and patterns promotes accuracy in determining, project outcomes and risks that may affect the project. Analysis of data provides early warning on the project risks which can be addressed to ensure the success of the project. Concerning the research questions, the research notes that optimization of processes, resources, and analysis of potential risks helps make an informed decision that promotes the timely completion of construction projects. On the question of how the application of AI impacts project management in terms of cost efficiency, effectiveness, and outcomes, the results indicate that AI tools used in project management can

simulate a project scenario, determine the resources needed, risks associated with the project and help make an informed decision that ensures the projects are completed within the budget. On the question of the challenges encountered in the application of AI in project management, the key theme was based on the lack of skilled individuals to analyze data on construction projects. The research recommends the need to conduct more research in this area and ensure skilled individuals are employed in construction projects. This will help address limitations of data analysis and interpretation which remains a major challenge. On the question of collaboration and communication, AI enhances the communication process through cloud computing ensuring timely access to important communications. Also, the integration of chatbots and virtual assistance in administrative roles ensures that collaboration and communication occur effectively to ensure the objectives of the projects are met. Therefore, the integration of AI in project management in Riyadh will positively impact construction projects and eliminate the challenges encountered that prevent timely completion.

4.4 Conclusion and Research Recommendations

Riyadh construction managers have always used traditional project management approaches that have serious limitations. Despite the availability of new technology and approaches in project management, traditional approaches are still in use in Riyadh. The research highlights the importance of AI in the construction industry, highlighting how various project managers have benefited from ML and AI. This is based on its application in resource allocation, trend, and pattern analysis, and analysis of data to determine the effectiveness of the project. Integrating AI into the traditional project management approaches in Riyadh will have a positive impact, ensuring that resources are optimized, communication is effective, labor issues are addressed by the application of robotics, and the accuracy of the information that contributes to

informed decision-making. However, there is a need to continue conducting more research in this field to address the challenges highlighted by the lack of skilled individuals in AI-based data analysis and interpretation for the effectiveness of its application in the construction industry.

Appendixes

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Appendixes

Appendix 1: Structured interview Questionnaire

1. Please provide a brief information on yourself and your roles in the project management in construction projects
2. How long have you been in this role, particularly in the construction industry?
3. Do you have any background information about AI and its application in construction project management?
4. Have you interacted with AI technology in your role as a construction project manager?
5. What project management processes and tasks are you involved in?
6. Can you highlight some of the AI tools or other methodologies commonly applied in managing the process and tasks mentioned above?
7. How effective are these strategies or tools used management and streamlining of the construction process in your operations?
8. Has your company considered applying AI technologies in the project management process? If yes, in what areas are you applying it?
9. What are the benefits that AI has on the project management of construction projects?
10. Are there unique challenges or concerns in the Riyadh construction industry that can be solved by adopting AI in the traditional project management processes?
11. Can you describe an instance where AI was successfully utilized in your line of duty to address a challenging situation?
12. What were the improvements or outcomes after the implementation of AI in the above situation?
13. What are the factors you consider are important for the successful integration of AI into the traditional project management process applied in the Riyadh construction project?

14. What are the challenges that are likely to occur while implementing AI technology in Riyadh construction projects?
15. What else can you add regarding the integration of AI in traditional project management processes of the construction industry?

Appendix 2: Research Questionnaire

Section 1: Demographic Information

1. Name (Optional):

[Text Box]

2. Position/Job Title:

[Text Box]

3. Industry/Field:

[Text Box]

Section 2: AI Integration in Project Management

5. Are you currently using AI tools or systems in your project management processes?

☐ Yes ☐ No

6. If yes, which AI tools or systems are you currently using in your project management? (Please specify)

[Text Box]

7. How would you rate the overall impact of AI on project efficiency in your organization?
(Scale from 1 to 5, 1 being low impact, 5 being high impact)

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

8. Has AI helped optimize resource allocation in your projects? If yes, please choose the option that best describes how:

- a) Streamlining project timelines and task assignments.
- b) Enhancing budget management and cost predictions.
- c) Improving team collaboration and communication.
- d) Implementing data-driven decision-making for resource allocation.

9. How has AI contributed to reducing project delays in your organization? Please pick appropriately.

- a) Increased project resilience
- b) Increased project team collaboration
- c) Increased project team understanding

d) Other (please specify)

10. How has AI assisted in predicting and mitigating risks in your projects? Please pick appropriately.

- a) Advanced risk modeling and analysis
- b) Real-time risk monitoring
- b) Automated risk response strategies
- d) Other (please specify)

11. Have you noticed cost overrun prevention due to AI-driven project management? Please pick appropriately.

- a) Enhanced cost forecasting accuracy
- b) Automated budget controls
- c) AI-driven resource optimization
- d) Other (please specify)

12. Do you use AI-powered decision support systems for data-driven decision-making in your projects?

☐ Yes ☐ No

13. How has AI supported data-driven decision-making in your project management? Please choose the option that best aligns with your experience.

- a) AI has significantly improved data analysis and decision-making processes.
- b) AI has played a moderate role in supporting data-driven decisions.
- c) AI has had minimal impact on data-driven decision-making.
- d) I have not utilized AI for data-driven decision-making in my project management.

14. Has AI been used for risk assessment and strategic planning in your projects? Please select the option that reflects your situation.

- a) AI has been extensively used for risk assessment and strategic planning.
- b) AI has been moderately applied for risk assessment and strategic planning.
- c) AI has had limited involvement in risk assessment and strategic planning.
- d) AI has not been used for risk assessment and strategic planning in my projects.

Abstract

This study sought to understand the impact of AI integration on traditional project management processes in construction projects in Riyadh, Saudi Arabia. The construction industry in Saudi Arabia has continued to experience major changes and shifts, evolving from traditional project management and now embracing new technology. Project management in Riyadh follows the traditional approaches in the construction industry that have various limitations such as time wastage and lack of lean approaches hence affecting the success of any project. The research highlighted the significance of AI-enabled project management processes in Riyadh, Saudi Arabia. The study uses a qualitative approach in data collection through semi-structured interviews as the primary data source and analysis of relevant resources as the secondary data source. The results are qualitatively analyzed to identify major themes associated with AI applications in construction project management. The literature used is obtained from major databases including Google Scholar. The results indicate that AI application in traditional project management approaches in construction projects in Riyadh will ensure timely completion, improved efficiency, and quality outcomes of the projects. The project results can be used to guide project managers in the construction industry on various ways they can adopt AI tools for improved outcomes. The general application of the results is on the AI-based research touching on the construction industry. The results will also contribute to a deeper understanding of how AI can be utilized in different levels of the project management processes such as administration form effective project management outcomes.

الخلاصة

سعت هذه الدراسة إلى فهم تأثير دمج الذكاء الاصطناعي على عمليات إدارة المشاريع التقليدية في مشاريع البناء في الرياض، المملكة العربية السعودية. استمرت صناعة البناء والتشييد في المملكة العربية السعودية في مواجهة تغييرات وتحولات كبيرة، حيث تطورت من إدارة المشاريع التقليدية وتتبنى الآن التكنولوجيا الجديدة. تتبع إدارة المشاريع في الرياض الأساليب التقليدية في صناعة البناء والتشييد والتي لها قيود مختلفة مثل إهدار الوقت وعدم وجود أساليب بسيطة وبالتالي تؤثر على نجاح أي مشروع. وسلط البحث الضوء على أهمية عمليات إدارة المشاريع المدعومة بالذكاء الاصطناعي في الرياض بالمملكة العربية السعودية. تستخدم الدراسة منهجاً نوعياً في جمع البيانات من خلال المقابلات شبه المنظمة كمصدر أساسي للبيانات وتحليل الموارد ذات الصلة كمصدر ثانوي للبيانات. يتم تحليل النتائج نوعياً لتحديد الموضوعات الرئيسية المرتبطة بتطبيقات الذكاء الاصطناعي في إدارة مشاريع البناء. يتم الحصول على الأدبيات المستخدمة من قواعد البيانات الرئيسية بما في ذلك الباحث العلمي من Google. تشير النتائج إلى أن تطبيق الذكاء الاصطناعي في الأساليب التقليدية لإدارة المشاريع في مشاريع البناء في الرياض سيضمن الانتهاء في الوقت المناسب وتحسين الكفاءة ونتائج الجودة للمشاريع. يمكن استخدام نتائج المشروع لتوجيه مديري المشاريع في صناعة البناء والتشييد حول الطرق المختلفة التي يمكنهم من خلالها اعتماد أدوات الذكاء الاصطناعي لتحسين النتائج. يتم التطبيق العام للنتائج على الأبحاث القائمة على الذكاء الاصطناعي والتي تتناول صناعة البناء والتشييد. ستساهم النتائج أيضاً في فهم أعمق لكيفية استخدام الذكاء الاصطناعي في مستويات مختلفة من عمليات إدارة المشروع مثل الإدارة التي تشكل نتائج فعالة لإدارة المشروع.