

APPLICATIONS OF ARTIFICIAL INTELLIGENCE IN CONSTRUCTION
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ABSTRACT

The AI enhances risk reduction and maximizes resource use, both of which lead to better project results. In order to examine the economic growth and sustainability under catalyst influence AI, the study intends to assess Artificial Intelligence-Driven Plans in Project Management in Construction. A sample of 100 persons was employed in the study to test six hypotheses using a Google form survey. Using primary quantitative data, it examines how well AI systems perform in risk management, construction management, resource allocation, rescheduling, and predictive skills. Smart PLS software has been used to analyze data in order to comprehend statistical operations and statistical support for the context of viability and reliability. The findings demonstrate that AI technologies have a beneficial impact on risk management in the construction industry, as well as on resource allocation and rescheduling through predictive capacities. The study has good ramifications for the future since it provides suggestions on how project managers and decision-makers might employ AI technology to address the difficulties facing the construction industry.

Keywords: Artificial Intelligence, Project Management, Construction^{*}Corresponding Author. E-mail: rabail.tanveer@gcwus.edu.pk

INTRODUCTION

Over time, the application of artificial intelligence (AI) for project management has expanded in various sectors, including the construction sector. Because automation boosts GDP and aids in global economic growth, it is crucial for both economic expansion and productivity improvement [1]. In addition to promoting the idea of green sustainability in construction, the study examined how artificial intelligence is a real driver for the improvement of the construction sector and is providing solutions for sustainability and risk management [2]. In order to improve

the concept of expedited project timeline rules in cash flows and construction output boosting, the study is an investigation and crucial topic to comprehend the requirement for various AI technologies, including BIM building information modeling and budgeting schedules. In order to investigate algorithms for resource allocation optimization, the goals also place a strong emphasis on risk management and resource allocation.

Automation of business procedures and decision-making is aided by artificial intelligence [3]. For this reason, it is crucial

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to research the subject in order to comprehend how the use of AI tools might improve the project as a whole. Predictive analysis, robots, and machine learning are examples of prominent AI tools that are advancing the notion that construction and project management could undergo a revolution. The problem of the transition of construction activities from traditional techniques to risk handling should be reviewed in light of the topic's significance and the thought that AI may increase efficiency and lower the risk of developing sustainable solutions. The subject has been examined via the prism of current hazards and mishaps in building projects, where conventional project management has failed to effectively grapple with and resolve all-encompassing problems. The all-encompassing problems that require assistance from struggling tools and the introduction of AI. It's important to comprehend how AI can actually stimulate progress and sustainable growth.

All have been shown to play a professional and necessary part in addressing the difficulties facing the construction sector, but machine learning focuses on predictive analysis to speed up the process with improved risk management and cost application models. Additionally, by lowering project risks through precise forecasting and planning, it promotes the notion that resource optimization can improve decision-making and allocate labor and materials [4]. Computer versions that affect safety compliance and lower errors are among the other technologies. By improving administrative overhead and project data accessibility, NLP plays a professional role in investigating chat boards that lower the likelihood of mishaps and improve communication with stakeholders. In addition to providing excavation and demolition procedures that boost production and lower the risk of accidents during manual labor, robotics is replacing humans in a variety of settings.

Risk Management and Resource Allocation

The AI enhances risk reduction and maximizes resource use, both of which lead to better project results. Because predictive analytics may assist in recognizing seasonal weather trends, which reduces the likelihood of accidents caused by external weather and environmental elements, risk management is a crucial concern in the construction business [5]. Using risk exposure models, scenario planning, simulation, and automated operations to create budgets and resource availability timelines are more examples of risk managing. Because risk scoring can also assist in handling high-risk work routes and examining dangerous areas, risk control is crucial. The transformative effect of AI-driven plans into sustainable goals is helpful in the application of promotion of inclusivity and innovation cultivation projects by AI-driven applications [6]. AI-driven applications have also helped with resource allocation, which lowers costs and encourages the facilitation of inefficiencies by modifying labor schedules and ensuring that equipment may be assigned to high-priority jobs. Dynamic scheduling for automatic task delay control and resource exploration-based parallel task maximizing are also included in resource allocation. In order to reduce weariness and assist in interacting with AI systems, it describes how the designated skilled personnel can be vitally assisted in completing tasks and optimizing shift patterns. In addition to increasing efficiency and ensuring that eco-friendly and sustainable practices have been followed, the two procedures can cooperate to improve safety.

Through predictive analytics, artificial intelligence (AI) improves project scheduling in the construction industry, lowering delays and boosting timeline dependability. By decreasing human mistake and preserving time for automated repetition, artificial intelligence has been

shown to play a professional role in scheduling. By syncing the 3D models with the visual construction activities, building information modeling can provide the schedule specifics, and the predictive capabilities help the user comprehend the various dimensions of projects. Predictive capabilities have a beneficial function in identifying bottlenecks to meet errors, as demonstrated by weather forecasts. In order to fill in the gaps in equipment availability, the weather forecast aids in error prevention and bottleneck identification. By optimizing resource allocation and utilizing AI management systems for decision-making, risk management is made feasible by predictive insights and modeling application capabilities that support the attainment of sustainability goals.

Adoption of AI in the construction industry is positively correlated with its wider economic advantages. It has been discovered that it not only boosts productivity but also lowers project expenses [7]. The GDP is growing as a result of this assistance. By cutting down on delays and overruns, it helps close the gaps and time lapse that are promoting the use of machine-driven technologies in cost-saving. In addition to sustainability in reducing risk, the approachable role of facilitation has aided in decision-making and improved efficiency. Evaluating AI's contribution to sustainability in the building sector is also beneficial. The function has been to encourage sustainable urbanization, reduce waste, and increase energy efficiency. Achieving sustainability is a real goal that requires the use of scheduling and forecasting capabilities. Real-world applications can assist validate the notion that a balanced approach between the environment and society is necessary to meet economic goals [8]. According to an analysis, the endogenous economic growth model can successfully address the requirement for a low-carbon energy transformation without compromising sustainability, which would otherwise negatively impact AI-based applications in

various industries. The economic growth model, where AI has enabled innovation to go beyond the level of issue monitoring and risk assessment procedures, is ideally being implemented by the professional ways.

The broad use of AI in construction is hampered by organizational, technological, and regulatory obstacles. In order to meet the financial goals of any industry, particularly the construction sector, artificial intelligence (AI) technologies can play a beneficial role in removing obstacles and ensuring that society and the environment remain balanced. Because RPA robotic process automation and machine learning can collaborate to reduce failure risk and ensure that successful applications have been encouraged to understand the needs of any system, predictive modeling is said to be useful in this regard.

The study aims to review Artificial Intelligence-Driven Plans in Project Management in Construction to review the Economic Growth and Sustainability under catalyst impact AI. The main objectives are: To determine whether AI tools are already being utilized in construction project management and evaluate how they affect productivity and efficiency.

To assess how AI enhances risk reduction and maximizes resource use, resulting in better project outcomes.

To examine how AI improves project scheduling by using predictive analytics, which lowers delays and boosts project timeline dependability.

To investigate how the use of AI in construction relates to its wider economic advantages, such as lower project costs, higher productivity, and GDP growth contributions.

The study is important because it illustrates the potential benefits of AI adoption in the building sector. It is putting into practice the advantages of quicker infrastructure development and cutting costs to raise the likelihood of profitability in the building industry. Additionally, it advances the notion that a trained labor force can serve

as a catalyst for innovation and application, generating employment opportunities in the construction sector while maintaining safety and security [9]. The current study has a crucial role and significance in reviewing the previously mentioned hypothesis to support the idea of how cost reduction and risk security have been made possible in the construction industry under the privilege of AI tools, especially in light of the gap in the literature left by the previous authors regarding the catalyst impact of AI in risk management and acceleration of innovation.

METHODOLOGY

The approach gives the researcher a framework for highlighting the use of pertinent methodological tools in data collection and analysis. In order to test the hypothesis and establish a relationship between different variables, the study has opted for a primary quantitative design that asserts evidence-based analysis. It has been used in the current study, where validation scales and supporting evidence for comprehending the primary context in interpretation and reporting based on the data obtained from the respondents have been supported by primary data [10, 11].

The quantitative design has been supported with the application of a survey form online with the help of the Google platform. The survey has been facilitated by the closed-ended questionnaire so the respondents will be able to provide the relevant data without any confusion.

In order to evaluate the data from the respondents based on the closed-ended questionnaire survey project, the research has opted for positivist philosophy. The concept aids in the analysis of data since it demonstrates how the researcher can articulate pertinent viewpoints based on respondents' experiences in the context of AI application in the construction sector. In the framework of a pertinent study plan, the philosophy is also useful while extracting and modifying the data with the aid of particular hypothesis testing.

Three theories need to be tested in the current strategy, hence the deductive approach was chosen for the investigation. Because theory testing and hypothesis application have been given preference in the framework of a deductive approach, the method aids in testing the theory. In order to examine the suggested theories and steer clear of general interpretations based solely on the hypothesis, the deductive technique also aids in revealing the empirical findings based on the theoretical framework. The hypothesis has been investigated in order to comprehend the technological support for the theoretical evidence and arguments wherever the facilitation of statistical output has been the basis for concluding remarks and authenticity. The clever PLS program, which analyzed the data under the particular software to generate the key conclusions and summarize the study's findings, has backed the statistical output.

Relevant research tools have been used to support the primary quantitative study design. A survey tool to gather primary quantitative data from pertinent respondents working in the particular field makes up the research instrument [12]. Because it is an effective method for picking precise respondents and ensuring that non-probability sampling supports the selection of pertinent respondents within the framework of the deductive approach, the purposive sampling technique has been used. In order to avoid irrelevant individuals and provide significant results with an appropriate sample size, the sample size was set at 100 respondents. Respondents have been sent a consent form to approve the data collection plan, which is intended to be used exclusively for the current study plan. Respondents were emailed the link to complete the Google survey, and the information was gathered to preserve the statistical record for future research. The statistical method of clever PLS, which is deemed a good choice to manage a small sample size as stated in the current study, was used to evaluate the data.

It is also useful for describing the relationship based on the appropriateness and accuracy of the variables and providing a diagrammatic outlook of the variables. In order to deal with the variables and aid the researcher compare the variables and their effects on each other, the analytical tool provides the Cronbach alpha and HTM ratio, where P and beta values are helpful. In addition to determining if the hypothesis previously identified in the early stages of the research is supported or not, it also provides evidence to support the theory and literature.

RESULTS AND DISCUSSION

The results of the demographic survey indicate that the majority of respondents 65% were male. However, the female part was only covered by 35% of the respondents.

According to a comparative comparison of several professional reviews of the population, project managers account for roughly 32% of the total responders, with the highest percentage at 56%. The remaining 12% of the miscellaneous group consists of consultants, analysts, and architects.

AI APPLICATIONS

Explore AI Technologies in Construction Management

The AI technologies now employed in construction project management have been examined, and their effects on productivity and efficiency have been evaluated. The useful arguments have been settled in cases when the majority of the data supports the usage of AI tools to improve robotics and predictive analysis productivity. This has been supported by both the literature's findings and the respondents' comments.

Enhance Risk Management and Resource Allocation

The other AI-related question enhances risk reduction and maximizes resource use, which leads to better project results. All have been shown to play a professional and necessary part in addressing the difficulties facing the construction sector, but machine

learning (ML) focuses on predictive analysis to speed up the process with improved risk management and cost application models.

Improve Scheduling and Predictive Capabilities

There has been a review of how AI can improve project scheduling through predictive analytics, cutting down on delays and boosting timeline dependability. Predictive capabilities have a beneficial function in identifying bottlenecks to meet errors, as demonstrated by weather forecasts. In order to fill in the gaps in equipment availability, the weather forecast aids in error prevention and bottleneck identification. In order to attain sustainability goals through resource allocation optimization and the use of AI management systems for decision-making, it is also advised that risk management be made feasible by predictive insights and modeling application capabilities.

Evaluate Economic Growth Impact and Sustainability

It examined how the use of AI in the construction industry relates to its wider economic advantages, such as lower project costs, higher productivity, and GDP growth contributions. The results have been found to be positive. Achieving sustainability is a real goal that requires the use of scheduling and forecasting capabilities. Real-world applications can assist validate the notion that a balanced approach between the environment and society is necessary to meet economic goals. It examined how AI may help the construction sector become more sustainable, especially by reducing waste, increasing energy efficiency, and fostering sustainable urbanization. Because risk scoring can also assist in handling high-risk work routes and examining dangerous areas, risk control is crucial. It is widely acknowledged that the transformational impact of AI-driven plans on sustainable goals is beneficial when it comes to the use of AI-driven apps to foster innovation and promote inclusivity.

Identify Barriers to AI Adoption

The review of technological, organizational, and regulatory barriers that can hinder the widespread adoption of AI in construction has been analysed. This explained that the broad use of AI in building is hampered by organizational, technological, and legal obstacles. In order to meet the financial goals of any industry, particularly the construction sector, artificial intelligence (AI) technologies can play a beneficial role in removing obstacles and ensuring that society and the environment remain balanced.

Lean construction and the triple bottom line, two key TBL theories, are useful in this situation. Through the sharing of digital model applications and the implementation of collaborative management concepts in construction, optimization and longer building lifespans have been achieved, demonstrating the positive influence that sustainability has played in this approach. Furthermore, BIM theory uses the phenomenon of AI integration as a top priority when it comes to comprehending the necessity of predictive maintenance and optimizing design-oriented solutions. In order to ensure that the construction has benefited from improved safety and security measures as indicated in the results, it highlights the importance of safety and security as a top priority. The three primary pillars of sustainability are the emphasis of the triple bottom line theory. Under the auspices of TBL theory, the integration of AI with intelligent efficiency solutions in building design is contingent upon the economic, environmental, and social pillars [13]. Sustainable growth and risk

management have also been demonstrated to benefit from this.

CONCLUSION

By improving risk management and resource allocation, artificial intelligence (AI) technologies have been discovered to play a professional role in the construction industry. It has been demonstrated that economic expansion has played a favorable role, supporting the idea. In addition to robots, the pragmatic techniques can assist in identifying the obstacles and resolving them through the use of AI in technology implementation and creative application.

Because AI utilization cannot be disregarded, project managers are strongly advised to schedule and utilize predictive skills while taking into account the findings of the current study as well as the outlines provided by the various writers. In order for project managers to be prepared to employ pertinent techniques, it is necessary to substantiate the facts and ensure that pertinent information has been supplied within the framework of economic growth. When research meets the literature, it can have beneficial effects for project managers. Experts in the IT sector may also find it useful. This is beneficial for the industry's implications of AI as well.

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