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INVESTIGATING THE USE OF ARTIFICIAL INTELLIGENCE (AI) IN CONSTRUCTION INDUSTRY: A REVIEW

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Abstract : The building sector is confronted with difficulties as a result of the worldwide digitization and exponential rise of digital technology. A key element of the digital transformation paradigm is artificial intelligence (AI), which provides new possibilities for project planning and execution. Various articles on AI's applicability to the construction value chain are reviewed in this study. The main users of AI technologies are facility managers, who might potentially profit from proactive site management. Growth in design is another significant benefit. One potential avenue for rapid technological improvement is data augmentation. With this information, building companies will be able to recognize the efficiency and productivity gains of AI technology and make well-informed investment decisions.

Keywords: **Building, construction industry Global Digitization, Inverse the development of digital technology, AI (artificial intelligence) , Increases in productivity.**

I. INTRODUCTION

A subfield of software engineering known as artificial intelligence (AI) focuses on creating intelligent robots that behave and think like people. A section of the workout's Artificial intelligence-enabled PCs are designed to do the following tasks: learning, planning, speech recognition, and problem solving. Software engineering includes artificial intelligence, which aims to create intelligent machines. It is now an essential component of the innovation industry. Programming computers for particular traits, such as knowledge, reasoning, problem-solving, perception, learning, planning, and the ability to manipulate and move objects, is one of the central concerns of man-made consciousness.
The replication of human insight forms by machines, especially PC frameworks, is known as artificial intelligence (AI).
These processes include learning (acquiring information and applying rules to use it), thinking (using rules to arrive at ambiguous or imprecise conclusions), and self-adjustment. AI is specifically used in machine vision, discourse recognition, and master frameworks.

II. STUDY NEED

The need for studying artificial intelligence (AI) in the construction industry

•Efficiency: AI can optimize construction processes, leading to faster project completion times and reduced costs.
•Productivity: AI-driven solutions can enhance productivity by automating repetitive tasks and streamlining workflows.
•Quality: AI technologies can improve the quality of construction projects through advanced data analysis and predictive modeling.
•Safety: AI-enabled tools can enhance safety on construction sites by identifying potential hazards and preventing accidents.
•Sustainability: AI can help optimize resource usage, minimize waste, and promote sustainable construction practices.
•Complexity: Modern construction projects are becoming increasingly complex, requiring advanced technological solutions such as AI to manage various aspects effectively.
•Decision-making: AI provides valuable insights and analytics to support decision-making processes throughout the construction lifecycle.
•Innovation: Studying AI in construction fosters innovation and encourages the development of novel solutions to address industry challenges.
•Future-proofing: As AI continues to evolve, understanding its applications in construction ensures that industry professionals are prepared for future trends and developments.

III. Objective

1. Perform an extensive analysis of the subfields and applications of AI currently used in the construction sector.
2. Determine possible domains and prospects for enhanced AI integration within the construction sector.
3. Determine and evaluate the obstacles preventing AI from being widely used in the construction sector.

IV. STUDY SCOPE

The scope of artificial intelligence (AI) in the construction industry is vast and encompasses various aspects of project planning, execution, and management. Here's an overview of the study scope of AI in the construction industry.

- Project Planning and Design:
- Construction Process Optimization
- Quality Control and Inspection
- Safety and Risk Management
- Facility Management and Maintenance
- Market Opportunities and Business Models

Overall, studying the scope of AI in the construction industry involves exploring how AI technologies can transform traditional construction practices, improve project outcomes, and drive innovation across the entire construction lifecycle.

V. Methods of Research

- Literature Review: Previous studies on AI in the construction industry conducted by various researchers were reviewed.
- Questionnaire preparation: The questionnaires were prepared as per literature review AI in the construction industry.
- Data Collection: The persons now or formerly involved in the construction industry, offer the data collection for the application involved in construction industry.
- Conclusion.

VI. Literature Review

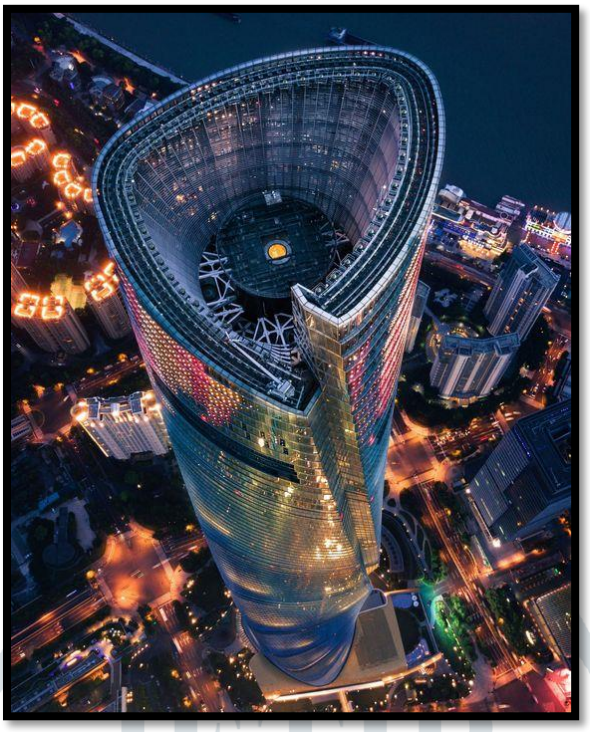
Shengyong et al. This paper includes a summary and introduction to intelligent technologies in civil engineering, as well as the most recent results and applications. Every conceivable perspective is taken into consideration while examining artificial intelligence applications in civil engineering. The study's conclusions were used to illustrate the possible uses of artificial intelligence technology in the field of civil engineering. The study found that artificial intelligence (AI) may increase both individual and group production and has a promising future in the field of civil engineering.

Jiayong, Jiyang Fu, and Yougin Huang the study reviews the evolution and applications of artificial intelligence in civil engineering throughout the years. For many years, the fields of geotechnical engineering, bridge engineering, health monitoring, structural optimization, and structural status evaluation have made extensive use of artificial intelligence (AI) techniques and civil neural networks. Deep learning and big data technologies have lately found success in a range of civil engineering applications. In particular, the field of structural maintenance has benefited greatly from the rapid advancement of big data, and the rapid development of computer vision based on deep learning has made it possible to monitor the health of structures with great precision.

Yuting Zhang This adopts safety management as its main focus and conducts a complete analysis of the emergency management process, covering all aspects of civil engineering construction safety incident prevention, planning, response, and recovery. This enhances the theory of construction safety incident management and promotes the actual development of emergency response capability. This is being done to explore the use of civil engineering construction safety management, with a primary focus on using artificial intelligence machine vision technologies to monitor worker activities during construction in order to assure worker safety. The development of a quantitative link between the coordinates and distances of picture pixels in order to reflect the real distances and trajectories between targets.

VII. Case study

- After being finished in 2015, the Shanghai Tower is regarded as a masterpiece of architecture and a shining example of how artificial intelligence (AI) can have a big impact on skyscraper design and construction. AI was integrated into its creative design process in several important ways.



The Shanghai Tower

Project of the Shanghai Tower Corridor in China: Case Study

- **Energy Efficiency**: To maximize the tower's energy efficiency, artificial intelligence algorithms were used. It made real-time temperature, humidity, and lighting adjustments based on meteorological data and building occupancy trends. Operating expenses and energy usage were lowered as a result.
- **Wind Resistance**: Because of its position and height, wind resistance played a crucial role. AI simulations were utilized to examine wind patterns and produce a distinctive, twisted shape that ensured structural integrity by lowering wind loads.
- **Material Selection**: AI assisted in the selection of materials according to their structural characteristics and effect on the environment. During the decision-making process, sturdy and sustainable materials were chosen, in keeping with the green design principles of the skyscraper.
- **Construction Management**: To plan tasks, distribute resources effectively, and track advancement, AI-powered project management solutions were employed. Delays and cost overruns were reduced as a result.
- **Safety**: Real-time monitoring of safety conditions by AI-powered sensors and cameras ensures worker safety and enables prompt reactions to possible threats.

AI was used throughout the design, building, and management of the Shanghai Tower, demonstrating how technology can produce a famous skyscraper that is energy-efficient, structurally strong, and adaptable to the requirements of its tenants. It establishes an amazing standard for forthcoming eco-friendly and avant-garde architectural projects.

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VIII. Forming of questionnaire

The research tool used in this study is a questionnaire that was designed to ensure that it will address the three main objectives of the study: the first part of the questionnaire focuses on collecting data about the respondents and the firms' profile; questions in this part were created to collect information such as job position, work experience, and project contact information; the second part of the questionnaire aims to have data about the contractors' awareness and understanding of productivity in the construction projects; the third part contains the various aspects of productivity that affect the factors to be rated by the respondents as well as the general experiences implemented to improve productivity and suggested.

- Survey on the Use of Artificial Intelligence in the Construction Industry

1. What is your role in the construction industry?
2. How many years of experience do you have in the construction industry?
3. What type of construction projects do you primarily work on?
4. How familiar are you with Artificial Intelligence (AI) technologies?
5. Which AI applications are you aware of in the construction industry? (Select all that apply)
6. Does your organization currently use AI technologies in any of its projects?
7. If yes, which AI technologies are being used? (Select all that apply)
8. How long has your organization been using AI technologies?
9. What impact has AI had on your projects? (Select all that apply)
10. To what extent do you agree with the following statement: "AI has significantly improved the overall productivity of our construction projects"?

11. What challenges have you encountered while implementing AI technologies? (Select all that apply)
12. Do you plan to adopt or expand the use of AI technologies in your future projects?
13. Which AI applications do you believe will have the most significant impact on the construction industry in the next 5 years? (Select all that apply)
14. What support or resources would help you implement AI technologies more effectively? (Select all that apply).

IX. Data Collection

This survey's questionnaire data serves as an abstract of four theoretical and fundamental AI factors—a combination of technical analysis that have been studied in several research publications, review papers, and through observation. The survey's objective was to rate the aforementioned threats using a suitable methodology.

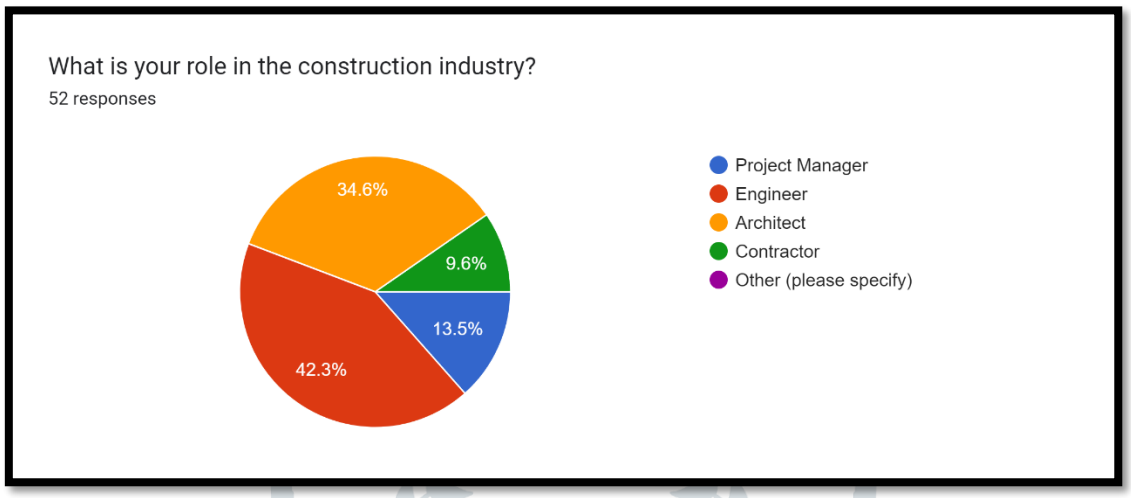

Figure: role in the construction industry

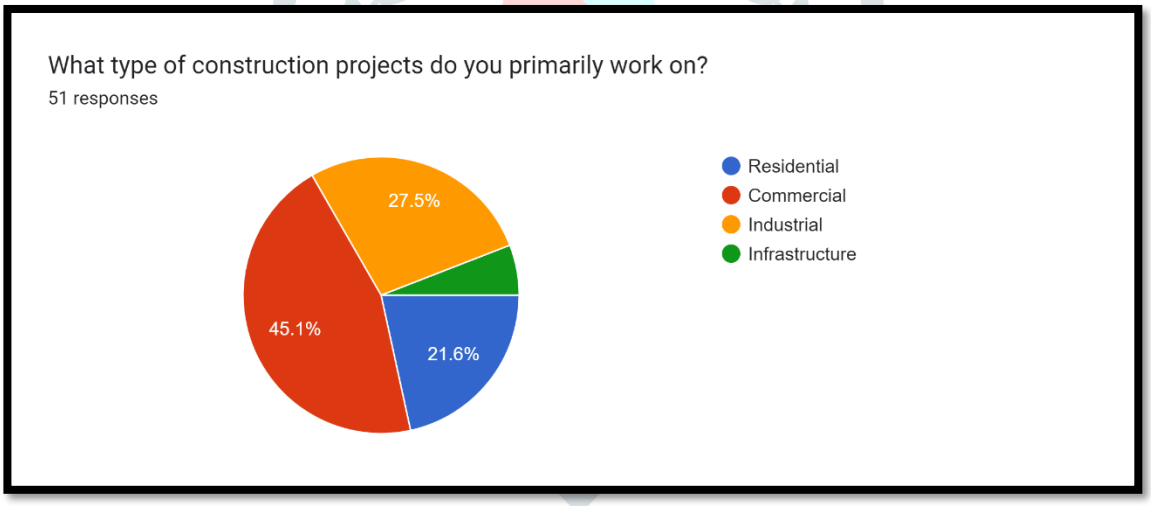

Figure: construction projects primarily work

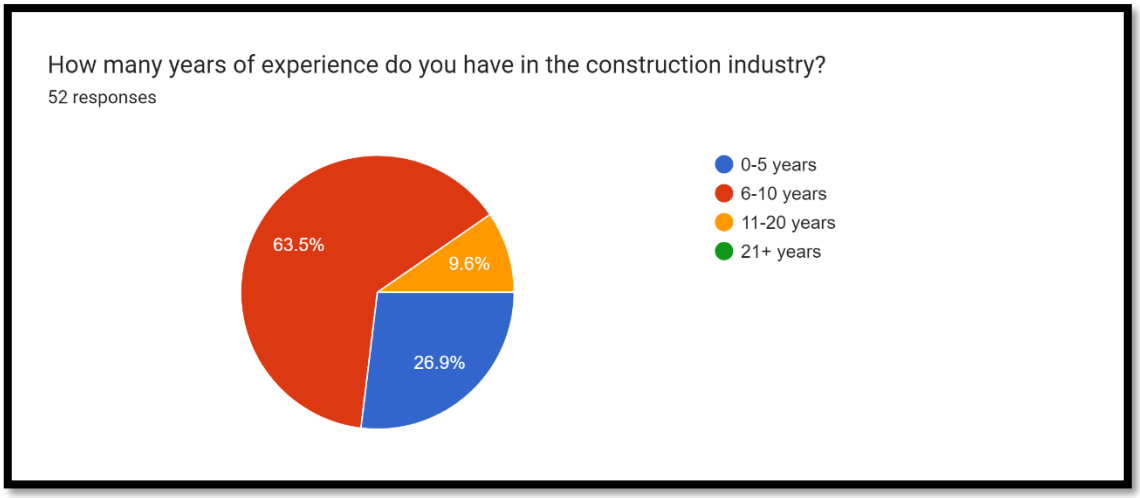

Figure: years of experience in the construction industry

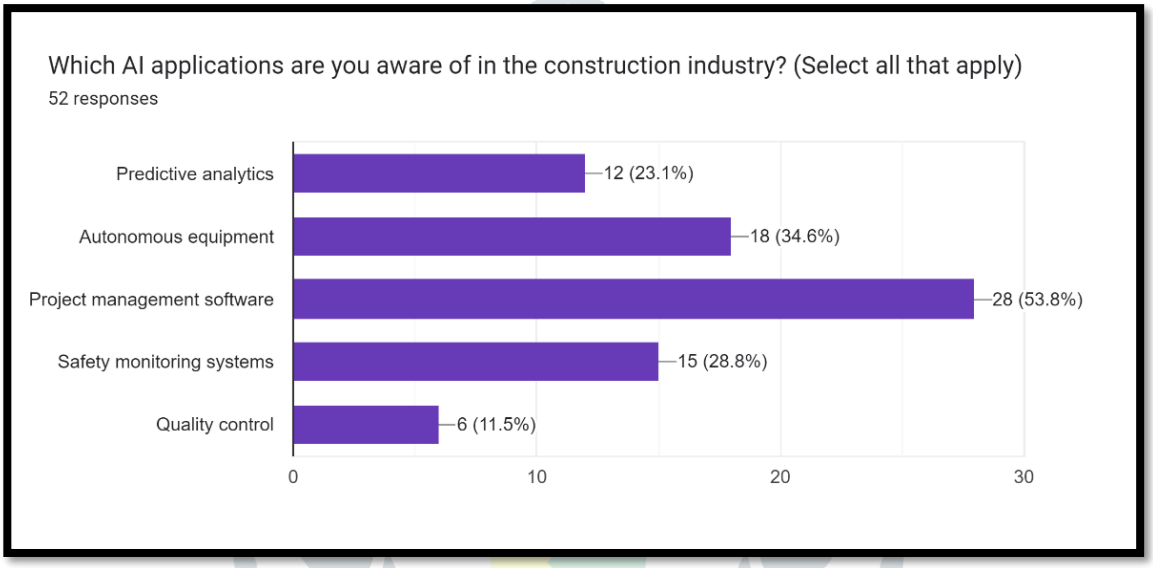

Figure: AI applications in the construction industry

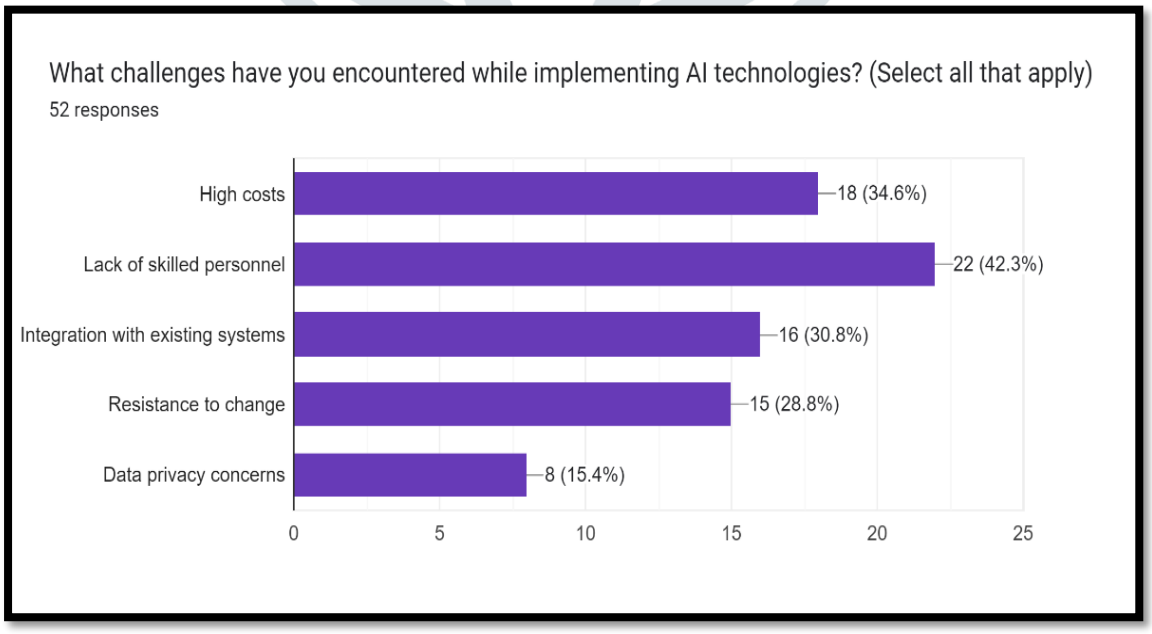

Figure: challenges encountered in implementing AI technologies

X. Conclusion

a) Effective risk management in major projects is a critical component of project management success. There are two distinct approaches to building a metro rail system: elevated metro, which is built at a height above ground, and subterranean

metro. Artificial intelligence (AI) has the power to completely transform the construction sector by boosting output and resolving a number of issues. Artificial Intelligence (AI) has the potential to improve construction processes by utilizing the growing quantity of data produced during the building lifespan and merging it with other digital technologies. This study examined the use of artificial intelligence (AI) in the construction industry, covering robots, computer vision, automated planning and scheduling, machine learning (ML), natural language processing (NLP), knowledge-based systems (KBS), and optimization.

b) There is a strong sense of optimism regarding artificial intelligence's future contributions, with expectations that it will continue to drive technological advancements and improve quality of life. These findings underscore the importance of continued investment in AI research and development, as well as the need for thoughtful consideration of ethical implications to ensure its benefits are maximized for society as a whole. b) the survey results demonstrate a significant majority consensus recognizing the utility and potential of artificial intelligence both in the present and for the future. Participants highlighted AI's current applications in various fields, such as healthcare, education, and business, showcasing its ability to enhance efficiency, accuracy, and innovation.

XI. Work Limitation

1.12 Work Limitation

There are several advantages to implementing artificial intelligence (AI) in the construction sector, such as better project management, higher efficiency, and increased safety. But a few restrictions prevent it from reaching its full potential. These are a few of the main obstacles

1. High Expenses of Implementation

• Initial Investment: A substantial upfront investment in hardware, software, and training is necessary for the adoption of AI technology. These expenses could be too costly for smaller businesses.

• Upkeep and Improvements: The long-term expenses are increased by prospective integration with current systems, upgrades, and ongoing maintenance.

2. Opposition to Change

• Organizational and Cultural Barriers: Historically, the construction sector has been hesitant to embrace new technology. AI integration may be hindered by resistance from staff members and management who are used to using conventional techniques.

• Skill Gaps: Prolonged training and education programs are required since there are insufficiently qualified personnel to handle and apply AI technology.

A multimodal strategy is needed to address these restrictions, including industry-wide standardization initiatives, training and education investments, and the creation of resilient, adaptable AI systems specifically designed to meet the demands of the construction sector.

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