

Application of artificial intelligence in the field of engineering management

Hanyuan Gao

College of Water Conservancy and Hydropower Engineering, Sichuan Agriculture University, Ya'an, Sichuan, 625014, China

186441266460@163.com

Abstract. The primary topic of this work is the utilization of artificial intelligence (AI) in the domain of engineering management. This paper provides an overview of the application history, development trend, and research goal and significance of artificial intelligence in the field of engineering management. This paper, through a method of literature review, thoroughly examines the theoretical foundation of artificial intelligence in engineering management and showcases its practical implementation in intelligent decision support and intelligent monitoring using real-life examples, and the effectiveness of these applications is assessed qualitatively. Furthermore, this paper examines the challenges faced by artificial intelligence in engineering management applications, including data collecting and model optimization, and suggests appropriate risk response tactics. The research concludes by summarizing the primary effort, achievements, and breakthroughs, and provides a prospective outlook on the future development of artificial intelligence in the field of engineering management.

Keywords: artificial intelligence, engineering management, application effects, challenges and countermeasures.

1. Introduction

In recent years, artificial intelligence (AI) technology has experienced significant advancements globally, leading to widespread integration across various sectors, including engineering management. Engineering management is a substantial field within management that encompasses multiple aspects like project planning, organization, implementation, and control. The integration of artificial intelligence has revolutionized these aspects, leading to remarkable transformations.

In the practice of engineering management, artificial intelligence has demonstrated extensive potential in several application prospects. During the project planning stage, artificial intelligence can utilize data mining and predictive analysis to enhance the scientific and precise foundation for project decision-making. Artificial intelligence can aid in the efficient allocation of resources and improve the effectiveness and quality of projects during the process of organization and implementation. At the same time, AI may monitor the project implementation in real-time, promptly identifying and alerting to any dangers, ensuring the project's seamless progress.

Nevertheless, the implementation of AI in engineering management has encountered obstacles. However, other practical difficulties still need to be addressed. These include ensuring data security and privacy protection, enhancing the reliability and stability of algorithm models, and promoting effective

collaboration between artificial intelligence and engineering management. Hence, when advocating for using artificial intelligence in engineering management, it is imperative to thoroughly evaluate its advantages and disadvantages and develop a feasible implementation strategy that aligns with the current circumstances.

The application of artificial intelligence in the field of engineering management will show a broader development space in the future. As technology progresses and costs decrease, artificial intelligence will become increasingly incorporated into all elements of project management. Hence, it is highly important to investigate the utilization and progression of artificial intelligence in the field of engineering management to promote the sustainable development and practical innovation of engineering management discipline.

2. Application of Artificial Intelligence in Engineering Management

2.1. Theoretical basis

In the field of engineering management, the application of artificial intelligence is gradually changing the traditional engineering management mode and process. In order to delve deeper into this change, we first need to understand the theories related to AI and how these theories fit into engineering management practices.

The application of artificial intelligence is mainly reflected in intelligent decision support, automatic process control, optimal allocation of resources, and risk management. These applications not only improve the efficiency and accuracy of engineering management but also bring greater competitive advantages to enterprises.

First of all, intelligent decision support is one of the important applications of artificial intelligence in engineering management. Through the use of technologies such as big data and machine learning, artificial intelligence can analyze and predict various possible situations in engineering projects, providing managers with a scientific basis for decision-making. This intelligent decision support not only improves the accuracy of decision-making but also shortens the decision-making cycle and makes engineering management more efficient.

Secondly, automated process control is another highlight of artificial intelligence in project management. With the help of advanced sensors, actuators, and control systems, AI can enable real-time monitoring and automatic adjustment of all aspects of the project. This not only reduces labor costs, but also improves engineering quality and safety.

In addition, artificial intelligence also plays an important role in the optimal allocation of resources. Through the analysis on data of various resources in engineering projects, artificial intelligence can help managers find the optimal resource allocation scheme so as to improve the efficiency of resource utilization and reduce project costs.

Finally, risk management is an indispensable part of project management. Artificial intelligence can use its powerful data processing capabilities to identify and evaluate potential risks in engineering projects and provide managers with timely risk warnings and response strategies. This greatly enhances the anti-risk ability of project management and ensures the smooth progress of the project.

To sum up, the application of artificial intelligence in engineering management has a wide range of possibilities and great potential. Through in-depth understanding and application of relevant theories of artificial intelligence, this advanced technology can be better integrated into engineering management practice and promote innovation and development in the field of engineering management.

2.2. Practical application

There are countless practical cases of artificial intelligence in the field of engineering management.

Intelligent decision support and intelligent monitoring are two typical application directions.

In terms of intelligent decision support, artificial intelligence technology provides engineering managers with unprecedented data insight capabilities through big data analysis and machine learning algorithms. Taking a large-scale infrastructure construction project as an example, the project team

introduced an intelligent decision support system that can collect various data in real time during the construction process, including key indicators such as construction progress, cost consumption, quality, and safety. Through deep learning and pattern recognition, the system can accurately predict the future development trend of the project and give optimization suggestions. This not only greatly improves the transparency and predictability of project management but also helps managers make more informed decisions in a complex and dynamic engineering environment.

Intelligent monitoring is another major application scenario for artificial intelligence in project management. Safety monitoring is crucial during the construction process. Traditional monitoring methods often rely on manual inspection and video surveillance, but this method has problems such as many blind spots and slow response speed. Through the introduction of artificial intelligence technology, the intelligent monitoring system can realize all-round and dead-end monitoring of the construction site. The system can automatically identify and analyze potential safety hazards on the construction site, such as not wearing safety helmets, illegal operations, etc., and send out an alarm at the first time to remind managers to intervene in time. This intelligent monitoring method not only improves the level of construction safety, but also reduces management costs and improves work efficiency.

In addition to the above two cases, the application of artificial intelligence in engineering management is also reflected in many aspects, such as intelligent resource allocation, intelligent risk assessment, etc. Together, these applications constitute a complete ecosystem of artificial intelligence in the field of engineering management, which has brought revolutionary changes to engineering management. It is foreseeable that with the continuous progress of technology and the continuous expansion of application scenarios, artificial intelligence will play a more important role in the field of engineering management and promote the development of engineering management in a more intelligent and efficient direction.

2.3. Evaluation of effectiveness

The application of artificial intelligence in the field of engineering management has attracted extensive attention and has gradually become an important force to promote the innovation of engineering management. However, the introduction of any technology requires a scientific evaluation of its effects to ensure that it can truly bring real value to project management. This section will focus on the evaluation of the effect of artificial intelligence in engineering management, and comprehensively analyze its specific performance in improving efficiency and reducing costs from both quantitative and qualitative dimensions.

In terms of quantitative evaluation, the application of artificial intelligence has significantly improved the efficiency of project management. Through the introduction of intelligent algorithms and data analysis technology, information processing and decision-making in the process of project management can be more rapid and accurate. For example, in project management, AI can automatically analyze project data, predict project risks, and give corresponding optimization suggestions. This not only greatly reduces the time and cost of manual analysis, but also improves the timeliness and effectiveness of risk response. In addition, AI can assist in resource allocation and schedule control to ensure that projects can be completed on time and with quality. By comparing the project management data before and after the introduction of artificial intelligence, it is clear that positive changes such as shortening the project cycle and reducing costs can be clearly seen.

In terms of qualitative evaluation, artificial intelligence has brought many hidden benefits to project management. First of all, it improves the intelligent level of project management and makes the management process more scientific and standardized. Through the introduction of the intelligent monitoring system, the progress of the project can be monitored in real time, and potential problems can be found and dealt with in a timely manner, so as to ensure the quality of the project. Secondly, the introduction of artificial intelligence has also promoted collaboration and communication among engineering management teams. The intelligent collaboration platform can integrate information from all parties and provide convenient communication channels, so that team members can work together more efficiently. Finally, the application of artificial intelligence in engineering management also

stimulates innovation. With the continuous progress of technology, many new application scenarios and solutions have emerged in the field of engineering management, injecting new impetus into the sustainable development of the industry.

To sum up, the application effect of artificial intelligence in engineering management is significant. Through quantitative and qualitative evaluation, we can clearly see its positive effect on improving efficiency and reducing costs. However, AI is not the key to everything, and its application effect is also affected by many factors, such as technology maturity, data quality, and personnel quality. Therefore, in future practice, we need to continue to explore and improve the integration path of artificial intelligence and engineering management, so as to give full play to its potential and contribute to continuous innovation and development in the field of engineering management.

3. Challenges and solutions

3.1. difficulties in Application

Although the application of artificial intelligence has brought unprecedented convenience and efficiency, it has also encountered many challenges and difficulties in the actual operation process. First of all, the problem of data acquisition has become a major bottleneck for artificial intelligence in project management. The core of artificial intelligence lies in data, and without sufficient and high-quality data, even advanced algorithms are difficult to perform as effectively as they should. In engineering management practice, it is often difficult for AI systems to effectively integrate and analyze data due to the diversity of data sources, confusion of data formats, and uneven data quality. In addition, some engineering projects involve trade secrets or private information, and it is even more difficult to obtain and share data, which greatly restricts the wide application of artificial intelligence in project management.

In addition to the problem of data acquisition, model optimization is also a difficult point that cannot be ignored in the application of artificial intelligence in engineering management. As the complexity of engineering projects continues to increase, traditional management models have struggled to adapt to this change. Although artificial intelligence has powerful learning and optimization capabilities, building accurate and efficient models in the face of a highly complex and changeable engineering management environment has become a major challenge. This requires researchers not only to have deep knowledge of engineering management, but also to have a deep understanding and mastery of artificial intelligence algorithms, so that they can adjust and optimize the model in a timely manner according to the actual situation.

The application of artificial intelligence in engineering management also faces many challenges, such as rapid technological updates, talent shortages, and lagging laws and regulations. The rapid pace of technological updates means that enterprises need to continuously invest money and manpower in technological upgrades to maintain a competitive advantage; the shortage of talents requires enterprises to increase talent training and introduction efforts to ensure that they can keep up with the pace of technological development; the lag of laws and regulations may bring potential legal risks and moral disputes to the application of artificial intelligence in engineering management. Therefore, in the process of promoting the application of artificial intelligence in the field of engineering management, it is necessary to fully consider these difficulties and challenges, and formulate practical countermeasures to ensure that artificial intelligence can truly bring revolutionary changes to engineering management.

3.2. Risks and coping strategies

Artificial intelligence technology is still in the stage of continuous development and improvement, and the accuracy and stability of its algorithms and models need to be further verified. In the practice of project management, over-reliance on immature artificial intelligence technology may lead to decision-making errors, which in turn will affect the overall progress and efficiency of the project. Second, data security is also a major risk in AI applications. In the process of project management, a large amount of sensitive data is involved, such as project costs, personnel information, etc. Once this data is illegally

obtained or tampered with, it will have a serious impact on the smooth progress of the project and may even lead to legal disputes. Finally, the interaction between AI and human decision-makers cannot be ignored. In the practice of engineering management, artificial intelligence often exists as an auxiliary tool, and the final decision still needs to be made by humans. However, due to the black-box nature of AI algorithms and models, it may be difficult for human decision-makers to fully understand their operating logic and decision-making basis, resulting in misjudgment or blind follow-up.

In view of the above risks, we need to adopt corresponding countermeasures to ensure the safe and effective application of AI in project management. First of all, the R&D and verification of artificial intelligence technology should be strengthened to ensure that the accuracy and stability of its algorithms and models meet the requirements of engineering management. At the same time, establish a sound technology update mechanism, and apply the latest artificial intelligence technology to engineering management practice in a timely manner to continuously improve management efficiency. Second, in terms of data security management, strict data protection policies should be formulated to clarify the standards for data collection, storage, use, and sharing. Through the use of advanced encryption technology and access control mechanisms, the security and integrity of project data are ensured. In addition, data security is regularly audited and inspected to discover and deal with potential security risks in a timely manner. Finally, in order to solve the problem of interaction between AI and human decision-makers, we should strengthen explanatory and transparent research on AI technology. By developing easy-to-understand algorithms and models, human decision-makers can better grasp the decision-making logic and basis of AI. At the same time, a human-machine collaborative decision-making mechanism should be established to give full play to the auxiliary role of artificial intelligence, while retaining the final decision-making power of human decision-makers. Through the implementation of these strategies, we can effectively reduce the risks of artificial intelligence in the application of engineering management and promote continuous innovation and development in the field of engineering management.

4. Conclusion

Regarding practical implementation, people accomplished noteworthy outcomes. They have effectively implemented AI technology in various areas of project management, such as project planning, schedule control, and quality management. Through the development of an intelligent decision support system, people have achieved the ability to monitor and analyze engineering project data in real-time. This system provides managers with precise and timely information to support their decision-making process. Furthermore, researchers employ artificial intelligence technology to enhance the allocation of resources in engineering projects, hence increasing resource utilization efficiency and minimizing project expenses.

Furthermore, this paper also investigate further potential applications of artificial intelligence in the realm of engineering management, in addition to its current use in project management. For instance, in the context of human resource management, artificial intelligence technology is applied to assess employee performance in a smart manner. This offers organizations a rational foundation for identifying exceptional talents. Within the realm of risk management, this paper develops an artificial intelligence-driven risk early warning system, whose purpose is to promptly identify and address any risks associated with engineering projects.

References

- [1] Exploratory Governance of Artificial Intelligence Risks: Conceptual Framework and Case Analysis[J]. LI Chong; LI Xia. China Soft Science, Issue 04, 2024
- [2] Exploration of the Application of Artificial Intelligence in the Traditional Publishing Industry[J]. FAN Lina. Communication and Copyright, Issue 06, 2024
- [3] Research on the Risk and Governance of Generative AI Training Data[J]. CHEN Hongguang; AN Shifeng. Journal of Hainan Open University, Issue 01, 2024

- [4] An Exploration of the Anti-monopoly Regulatory Path of Generative Artificial Intelligence Implied Algorithm Collusion[J]. WANG Yaping. Journal of Hainan Open University, Issue 01, 2024
- [5] How to take into account the development of artificial intelligence and labor employment? and the experience of typical developed countries[J]. ZHANG Yuanzhao. Journal of Fujian Normal University (Philosophy and Social Science Edition), 2024.02
- [6] Optimization and Design of Practical Teaching System for Statistics in the Context of Artificial Intelligence and Digital Technology[J]. DU Jiang; Dai Jun; CAO Ruiyuan. Journal of Higher Education, Issue 09, 2024
- [7] Research on the Challenges and Coping Strategies of Artificial Intelligence Application to News Production[J]. Ma Chenyang; LIU Haoming; YANG Guoxing. Media Forum, Issue 06, 2024
- [8] Research on the Construction Path of College English Project-based Teaching Mode in the Context of Artificial Intelligence[J]. WANG Yaning; GAO Danyang. Journal of Baoding University, Issue 02, 2024
- [9] Discussion on the Application of Artificial Intelligence in Electrical Engineering Automation[J]. XU Dongfeng. China Equipment Engineering, Issue 06, 2024
- [10] Research on the Governance of Generative Artificial Intelligence Generated Content: From the Perspective of ChatGPT [J]. ZHAO Wen. Communication and Information Technology, Issue 02, 2024
- [11] Application of Artificial Intelligence in Visual Communication Design[J]. ZHANG Wentao. Tianjin University of Electrical Studies, Issue 01, 2024
- [12] Research on the Legal Status of Generative Artificial Intelligence from the Perspective of the Convergence of Substantive Law and Procedural Law[J]. CHEN Jia; ZHANG Wenrui. Journal of Baoding University, Issue 02, 2024
- [13] Sora, Generative Artificial Intelligence and the New Ecology of China's International Communication[J]. ZHANG Yuqiang; JI Deqiang. External Communication, Issue 03, 2024
- [14] Application and development prospects of artificial intelligence in the field of information and communication[J]. CHEN Jian; ZHANG Xin. Science and Technology Innovation and Application, Issue 09, 2024
- [15] The Origin and Practice Path of Labor Education Reform in Colleges and Universities in the Era of Artificial Intelligence[J]. HU Keying. Continuing Education Research, Issue 04, 2024