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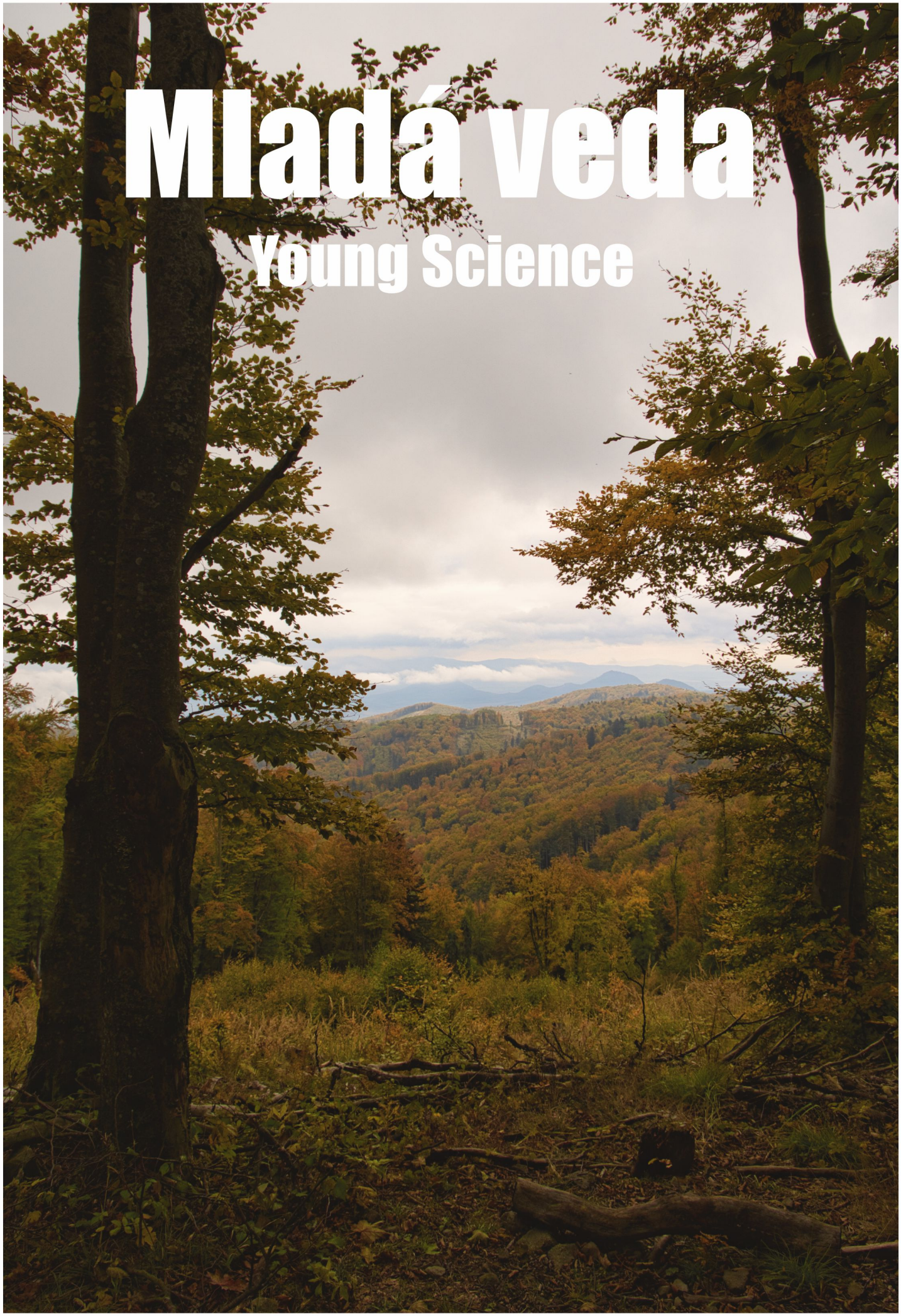

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THE ROLE OF THE CONSTRUCTION MANAGER IN THE ERA OF ARTFICIAL INTELLIGENCE

ÚLOHA STAVEBNÉHO MANAŽÉRA V ÉRE UMELEJ INTELIGENCIE

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Eva Jankovichová pôsobí ako docentka na Katedre technológie stavieb Stavebnej fakulty na Slovenskej technickej univerzite v Bratislave. Vo svojom výskume sa venuje problematike ekonomiky a manažmentu v stavebníctve a podnikateľskej etiky. Martin Hanko pôsobí ako výskumný pracovník na Stavebnej fakulte Slovenskej technickej univerzity v Bratislave. Vo svojom výskume sa venuje problematike facility managementu v stavebníctve, stavebnému inžinierstvu v praxi a ekonomike stavebníctva. Lucia Paulovičová pôsobí ako odborná asistentka na Stavebnej fakulte Slovenskej technickej univerzite v Bratislave. V oblasti výskumu sa venuje problematike časového plánovania, kalkulácií a rozpočtovania v stavebníctve a ekonomike stavebníctva.

Abstract

The role of the construction manager is fundamentally changing in the era of artificial intelligence (AI) from administrative coordinator to strategic decision maker. AI does not replace the human factor, but it radically increases efficiency, accuracy and safety on the construction site. Managers who adapt can lead projects faster and at lower costs. One of the main arguments in favor of artificial intelligence in construction is its ability to simultaneously improve safety and efficiency. Hazard detection systems reduce accidents, while predictive models improve schedule and cost management. Studies show that artificial

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intelligence can reduce construction cost overruns by 10 to 15 percent by minimizing planning errors. However, these benefits come with risks. Therefore, artificial intelligence only improves management and safety if it is integrated into a clear governance framework where humans remain in control. The main goal of this article is to point out the impact of artificial intelligence on the role of the construction manager in the construction planning and execution process.
Key words: digitalization of construction, construction manager, risk management, predictive planning

Abstrakt
Úloha stavebného manažéra sa v ére umelej inteligencie (AI) zásadne mení z administratívneho koordinátora na strategického rozhodovateľa. AI nenahrádza ľudský faktor, ale radikálne zvyšuje efektivitu, presnosť a bezpečnosť na stavenisku. Manažéri, ktorí sa prispôsobia, dokážu viesť projekty rýchlejšie a s nižšími nákladmi. Jedným z hlavných argumentov v prospech umelej inteligencie v stavebníctve je jej schopnosť súčasne zlepšiť bezpečnosť a efektívnosť. Systémy na detekciu rizík znižujú počet nehôd, zatiaľ čo prediktívne modely zlepšujú riadenie harmonogramu a nákladov. Štúdie ukazujú, že umelá inteligencia môže znížiť prekročenie stavebných nákladov o 10 až 15 percent minimalizáciou chýb pri plánovaní. Tieto výhody však prinášajú riziká. Umelá inteligencia teda zlepšuje manažment a bezpečnosť iba vtedy, ak je integrovaná do jasného rámca riadenia, kde si ľudia ponechávajú kontrolu. Hlavným cieľom tohto článku je poukázať na vplyv umelej inteligencie na úlohu stavebného manažér v procese prípravy a realizácie výstavby.
Kľúčové slová: digitalizácia stavebníctva, stavebný manažér, riadenie rizík, prediktívne plánovanie

Introduction

For a long time, the site manager has been the central figure in the construction industry, ensuring compliance with plans, the safety of crews, and the progress of the work. Their expertise was rooted in on-site experience, team coordination, and their ability to anticipate unforeseen events. But as construction projects grow in complexity, scale, and regulatory constraints, this model is reaching its limits. Artificial intelligence is now emerging as a key driver for managing this growing complexity. According to the World Economic Forum, the construction sector accounts for nearly 13% of global GDP, yet remains one of the least productive, with annual productivity growth below 1% for the past two decades. [1]

At the same time, McKinsey estimates that more than 60% of major construction projects exceed their initial deadlines and budgets. [2] Given these findings, AI appears to be a tool capable of transforming construction site management not by replacing human expertise, but by complementing it with predictive analytics and real-time monitoring capabilities.

Civil engineers are key creators of the infrastructure that forms the foundation of our society. They design, construct, supervise, operate and maintain a wide range of structures – from bridges, roads, dams and tunnels, to buildings, water and sewage systems, to airports and railways. Their work ensures not only the functionality and safety of these structures, but

must also consider environmental impacts, economic efficiency and societal needs. It is a profession that requires deep technical knowledge, analytical skills and practical judgment.

It is in this complex engineering discipline, which works with huge amounts of data, complex calculations and complex projects, that artificial intelligence (AI) is increasingly penetrating. AI offers new possibilities for data analysis, design optimization, project management and predictive maintenance. It is therefore essential to examine how AI will affect the work of civil engineers – whether it will become just another powerful tool, or whether it has the potential to replace human expertise and decision-making. [3]

MANAGER IN A CONSTRUCTION COMPANY

The construction manager coordinates and supervises the building of all types of residential, commercial, industrial, and civic structures — from roads to bridges, and office buildings to factories. A construction manager must have a deep understanding of all facets of the building process, from the initial planning and foundational work through to project completion. Their job is to oversee a lot of moving pieces at once, and keep the project on track, on time, and on budget. Since they act as the intermediary between clients, architects, engineers, subcontractors, and regulatory personnel, they must have excellent communication and leadership skills and attention to detail. There are degrees to be a certified construction manager, however most of the skills required come from experience.

As a construction manager, you will be responsible for overseeing all the logistics of a construction project. Duties may include creating work schedules for your team and allocating responsibilities. You might also be required to conduct site visits and report to senior managers on project progress.

The role of construction manager involves the following duties:

- Overseeing the logistical requirements of a project
- Delegating work to colleagues within your team
- Meeting regularly with clients, third parties and other managers to report on progress
- Setting targets, objectives and responsibilities for all supervised staff
- Regularly reviewing timings, budget, labor, risk and project plans to ensure work stays on track
- Setting and agreeing budgets
- Conducting site visits to inspect work, check materials and ensure staff are following health and safety guidelines
- Dealing with contracts and mitigating the impact of any issues
- Ensuring the delivery of high-quality work within contract timescales

Working in an office and on a construction site. [4]

The construction manager is the key manager of the construction company. Organizes, manages and coordinates construction work and other activities on the construction site and on the construction site and keeps records of them in the construction diary. [5]

Competence of Construction Manager

Construction project managers oversee all phases of the building process, with their main goal to ensure the project is completed on time and within scope and budget. An efficient and

effective construction project manager must be well-versed in all construction methodologies and procedures and able to coordinate a team of professionals of different disciplines to achieve the best results. If you are thinking about taking your career to the next level and becoming a project manager, here are the 6 skills you need to be successful:

1) Technical Communications

As middle management, you will be communicating daily with both contractors and staff as well as upper management and executives. Having strong verbal, written and presentation skills will help you communicate effectively with all parties, ensuring the project is done with minimal frustrations and avoid miscommunication.

2) Building Code Knowledge

Building zoning, bylaws, design specifications, fire protection and structural standards affect the design and construction of a building. As a project manager it will be your responsibility to ensure the safety and integrity of the building and adjust as necessary.

3) Construction Estimating

Estimating and controlling construction material quantities allows you, as a project manager, to accurately forecast and budget costs and materials to ensure the project is profitable and that the workers have enough supplies and material to complete the project without roadblocks.

4) Project Control and Scheduling

Planning a construction project is one of the most important skills for project managers. Recognizing cost controls, scheduling the use of project resources and understanding the organization's processes are all essential to the job. Additionally, knowing how to maintain construction change orders, accurately record project data and perform cost control functions will ensure project managers are able to present the project's details to upper management effectively.

5) Team Management

Construction sites have many layers of teams: upper management, middle management, hired staff, contractors, and teams within each subcontractor's company. It takes a significant amount of skill to manage, schedule and communicate with each team and facilitate communication between them. The most efficient, productive project managers have excellent team management skills, understand team dynamics and create a positive environment where teams work efficiently together.

6) Leadership Skills

Leadership differs from management in that management consists of controlling a set of entities to accomplish a goal, whereas leadership refers to one's ability to influence and motivate others to work towards a common goal. Not all managers are good leaders; however, the best project managers are able to influence those around them in a positive way. Strong leaderships skills are arguably the most important skill in any management position. [6]

Other competencies include:

• required professional qualification,
• sufficient professional experience and proof of successful practical work at

construction management,
• control of the technologies necessary for the management and implementation of construction
processes,
• knowledge of the administrative agenda of the building,
• controlling the competences of subordinate workers,
• knowledge of technical and legal regulations regarding construction works,
• control of regulations related to OSH, OZP, fire regulations and
hygienic,
• personal qualities suitable for management (ethical, moral, integrity).

Project managers with a deep understanding of their industry's trends, regulations, and challenges can lead projects more effectively. Managers must align individual project goals with the organization's broader strategic objectives, ensuring that each project contributes to the mission and success. [7]

How AI is Integrated into Construction Site Management and Oversight

Artificial intelligence is gradually being integrated into every stage of the construction project lifecycle, from planning through to final delivery. It relies on the convergence of several technologies, including BIM, IoT sensors, computer vision, and predictive systems.

- *Predictive planning:* Algorithms analyze thousands of past projects to anticipate the risk of delays caused by weather conditions, material availability, or conflicts between trades. Some companies have reduced delays by 20% using these models.
- *Real-time monitoring:* The use of drones and cameras integrated with AI-powered vision systems allows for a comparison of the actual condition of the construction site with BIM models, instantly identifying any discrepancies.
- *Enhanced safety:* Models automatically detect instances where personal protective equipment is not being worn, hazardous areas, or risky behavior. The International Labor Organization estimates that these systems can reduce serious accidents by up to 25%. [8]
- *Smart resource management:* AI optimizes the allocation of teams, equipment, and vehicles, reducing downtime and logistics costs.
- *Predictive maintenance*: Heavy machinery is equipped with sensors that monitor vibrations, temperatures, and usage cycles to anticipate breakdowns before they disrupt construction operations.

These applications profoundly transform the timing and visibility of construction site operations, providing the site manager with a comprehensive and dynamic overview of the work environment.

A New Role for the Site Manager

In this context, the role of the site manager is changing significantly. No longer content to simply coordinate teams on-site, he is becoming a conductor of data and decisions. Predictive dashboards, automated alerts, and scenario simulations are transforming the way he plans and makes decisions.

► *He oversees algorithmic systems* that suggest priorities and adjustments.
► *He retains ultimate responsibility* for decisions, particularly regarding safety and compliance.
► *He interprets the subtle cues provided* by AI based on his practical experience.
► *He plays a central role* in coordinating between engineers, site supervisors, suppliers, and subcontractors.

AI doesn't eliminate uncertainty on a construction site, but it makes it easier to understand. The site manager remains indispensable for handling the unexpected, resolving interpersonal conflicts, and adapting decisions to local conditions. [9]

What Skills Does a Construction Site Manager Need in the Age of AI

The core competencies of a site manager—technical expertise, hands-on leadership, and organizational skills—remain essential. But in the age of connected construction sites and predictive algorithms, new skills are now being added to the mix.

Technical and digital skills

- Understanding BIM tools and AI-enhanced monitoring platforms.
- Read and interpret predictive dashboards.
- Interact with computer vision systems and sensor data.
- Data literacy: The ability to interpret analytics and recommendations from AI systems.

Analytical and decision-making skills

- Assess the reliability of algorithmic alerts.
- Balancing automatic recommendations with human constraints.
- Anticipate the medium-term impacts of decisions made in real time.

Human, regulatory, and ethical competencies

- Maintaining team buy-in in the face of increasing automation.
- Ensure compliance with safety standards and legal liability requirements.
- It is important to understand that the final decision remains a human one, even when it is supported by algorithms.
- Emotional intelligence: Deepening communication with people that machines cannot replace.
- Cybersecurity: Protecting sensitive project data from attacks.

According to the Boston Consulting Group, more than 70% of construction site managers will need to acquire advanced digital skills by 2030 to remain employable. [10]

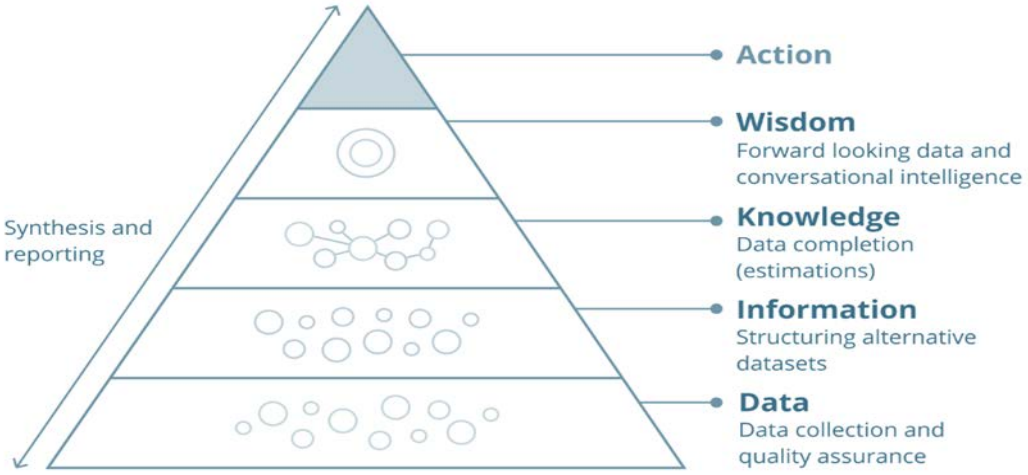

Fig. 1 - The Knowledge Pyramid
Source: [11]

Key Skills for the Future of a Civil Engineer

The following will be key to future success for civil engineers:

■ *Strong engineering fundamentals*: Deep understanding of statics, dynamics, materials, geotechnics, hydraulics, etc.

■ *Systems thinking:* Ability to see the project as a whole and understand the interactions between its parts.

■ *Critical thinking and problem solving:* Ability to analyze complex situations, evaluate solutions (including AI-generated ones) and make informed decisions.

■ *AI and data literacy*: Understanding of AI/ML principles, ability to work with data and use relevant software tools (BIM, CAE, AI platforms).

■ *Adaptability and willingness to learn:* Readiness for rapid technological changes and new methodologies.

■ *Communication and collaboration skills:* Effective collaboration in multidisciplinary teams and with various stakeholders.

■ *Project management.*

■ *Ethical awareness and responsibility:* Consideration of safety, sustainability and social impact. [12] [13]

Conclusion

What will the job of a construction foreman look like in the future? The site manager of the future will work in hybrid environments that combine on-site operations with digital management. They will be assisted by AI co-pilots capable of simulating scenarios, anticipating delays, and flagging emerging risks. Construction sites will become increasingly automated and connected. New roles will emerge, such as BIM-AI supervisor or algorithmic security coordinator. The site manager will play a key role in the green transition by optimizing resource use and reducing the carbon footprint of projects.

Despite these changes, their role will remain fundamentally human. The ability to lead teams, handle unexpected situations, and make responsible decisions cannot be automated. [14]

It is extremely unlikely that AI will completely replace the civil engineer. While AI can excel at data analysis, optimization, and automation of routine tasks, it lacks the human judgment needed to solve unstructured problems, the creativity to find innovative solutions, the ability to adapt to unpredictable construction conditions, and the ethical responsibility for the safety and impact of construction.

AI is becoming an indispensable tool that enables civil engineers to design and build better, more efficiently, and more sustainably. The role of the engineer is shifting to strategic decision-making, system integration, managing complex projects, and using AI to achieve better results.

The future belongs to civil engineers who can combine their deep expertise with a mastery of new technologies. AI will help construction managers meet the challenges of the 21st century – from climate change to increasing urbanization. [15]

This article was recommended for publication in a scientific journal Young Science by:
Assoc. Prof. Sabah Shawkat, PhD.

References

1. World Economic Forum, 2023. *Shaping the Future of Construction***.** [online] published 2023-10-25 [cited 2026-03-30]. Available at: https://www.weforum.org/about/world-economic-forum/
2. McKinsey & Company. 2024. *The Next Normal in Construction.* [online] published 2024-03-11 [cited 2026-04-15]. Available at: https://www.mckinsey.com
3. GAŠPARÍK, M., 2025. *AI: Civil Engineer in the Age of Artificial Intelligence.* [online] published 2025-04-07 [cited 2026-08-10]. Available at: https://www.michalgasparik.sk/ai-stavebny-inzinier-v-ere-umelej-inteligencie/
4. CONSTRUCT, 2026. *Construction Manager.* [online] published 2026-05-25 [cited 2026-06-05]. Available at: https://www.goconstruct.org/construction-careers/what-jobs-are-right-for-me/construction-manager
5. KOZLOVSKÁ, M. - I. HYBEN, 2015. *Construction Manager. New Challenges and Realities.* Bratislava: EUROSTAV Ltd. 2015. 288 pp. ISBN 978-80-89228-43-0.
6. Brighton College, 2023. *6 Skills You Need to Be a Construction Project Manager.* [online] published 2023-10-10, [cited 2024-09-08]. Available at: https://brightoncollege.com/blog/6-skills-you-need-to-be-a-construction-project-manager/
7. TSONEV, N., 2024. *13 Key Skills and Competencies for Project Managers in 2024.* [online] published July 2024-07-15 [cited September, 2024-09-08]. Available at: https://businessmap.io/blog/project-manager-skills
8. International Labor Organization, 2023. *AI and Safety at Work.* [online] published 2023-10-25 [cited 2026-03-30]. Available at: https://www.ilo.org
9. AIVANCITY, 2026. *When Artificial Intelligence Transforms Construction: The Site Manager Put to the Test by Algorithms.* [online] published 2026-01-20 [cited 2026-06-05]. Available at: https://aivancity.ai/en/blog/quand-lintelligence-artificielle-redessine-la-construction-le-metier-de-chef-de-chantier-a-lepreuve-des-algorithmes/
10. Boston Consulting Group, 2024. *Digital Transformation in Construction.* [online] published 2024-02-15 [cited 2026-06-05]. Available at: https://www.bcg.com
11. SAA, L., 2025. *The Essentials of AI and ESG: Opportunities, Risks, and Governance Insights for Institutional Investors.* [online] published 2025-08-14 [cited 2025-09-10]. Available at: https://www.clarity.ai

12. GASPARÍK, M., 2025. *AI: Civil Engineer in the Era of Artificial Intelligence.* [online] published 2025-04-07 [cited 2026-09-10]. Available at: https://www.michalgasparik.sk/ai-stavebny-inzinier-v-ere-umelej-inteligencie/
13. MAHR, N., 2023. *Mintzberg's Managerial Roles.* [online] 2023-11-11 [2024-09-21]. Available at: https://study.com/academy/lesson/henry-mintzbergs-managerial-roles.html?srsltid=AfmBOoqdqtp8NkL5VVtCUNcH2bS7MbuiY9qgOpwpiiwA4CrrlleHFeI8
14. JANKOVICHOVÁ, E. – M. HANKO, 2025. *Ethics and Artificial Intelligence in Construction.* Brno: Tribun EU, Czech Republic, 2025, 111 pp. ISBN 978-80-263-1857-6.
15. MAHR, N., 2023. *Mintzberg's Managerial Roles.* [online] published November, 2023, [cited September, 2024]. Available at: https://study.com/academy/lesson/henry-mintzbergs-managerial-roles.html?srsltid=AfmBOoqdqtp8NkL5VVtCUNcH2bS7MbuiY9qgOpwpiiwA4CrrlleHFeI8

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