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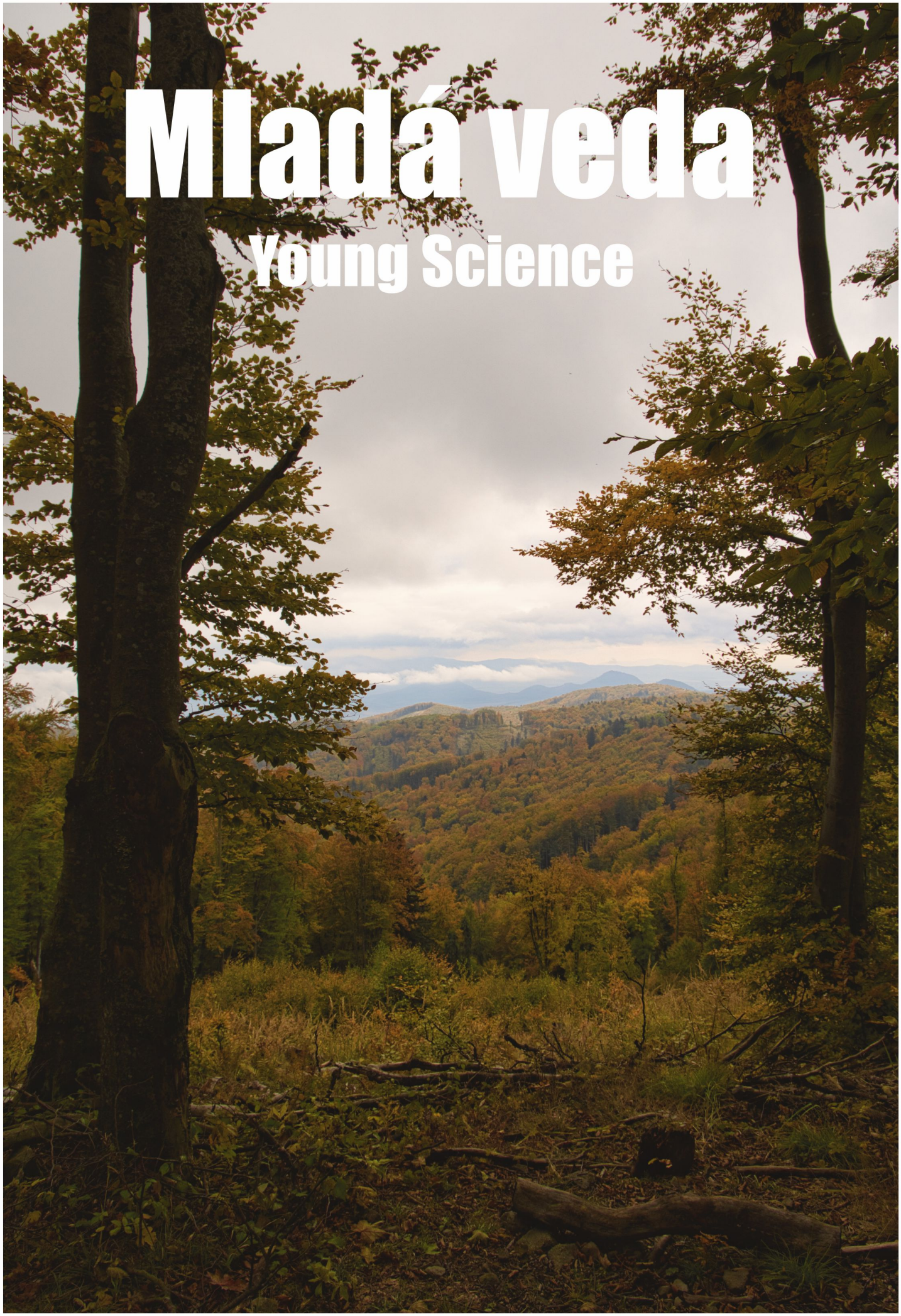

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON MANAGEMENT AND LEADERSHIP PROCESSES IN THE CONSTRUCTION INDUSTRY

VPLYV UMELEJ INTELIGENCIE NA PROCESY RIADENIA A VEDENIA V STAVEBNÍCTVE

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Abstract

The digitalization of construction is becoming a natural development stage for an industry that works with huge amounts of data, complex project documentation and high safety requirements. In this environment, artificial intelligence (AI) is a tool that can significantly speed up processes, improve project preparation, be part of the implementation of smart technologies and can increase safety on construction sites. However, it is not a universal solution, and its benefits are always limited by data quality, a clear legal framework and the level of professional supervision. Artificial intelligence changes the traditional approach to management and leadership in the construction industry by replacing intuition with accurate data and automating complex processes. The main goal of this article is to point out the impact of artificial intelligence on management and leadership processes in the construction industry.

Key words: digitalization of construction, smart technologies, management and leadership in construction

Abstrakt

Digitalizácia stavebníctva sa stáva prirodzenou vývojovou etapou odvetvia, ktoré pracuje s obrovským množstvom dát, komplexnou projektovou dokumentáciou a vysokými nárokmi na bezpečnosť. Umelá inteligencia (AI) je v tomto prostredí nástrojom, ktorý môže zásadne zrýchliť procesy, skvalitniť prípravu projektov, byť súčasťou realizácie inteligentných technológií a môže zvýšiť bezpečnosť na staveniskách. Nie je však univerzálnym riešením a jej prínosy vždy limituje kvalita dát, jasný právny rámec a miera odborného dohľadu. Umelá inteligencia mení tradičný prístup k riadeniu a vedeniu v stavebníctve tým, že nahrádza intuíciu presnými dátami a automatizuje komplexné procesy. Hlavným cieľom tohto článku je poukázať na vplyv umelej inteligencie na procesy riadenia a vedenia v stavebníctve.

Kľúčové slová: digitalizácia stavebníctva, inteligentné technológie, riadenie a vedenie v stavebníctve

Introduction

Virtually no industry that works with data, planning or coordinating complex processes can avoid artificial intelligence today. The construction industry, traditionally considered a sector with a slower pace of innovation, has been undergoing significant transformation in recent years. Automated processes, large-scale data environments, digital modeling and real-time monitoring of workplaces are creating a new technological environment, into which AI naturally enters. Software development, new data from BIM models, the introduction of digital construction management and the pressure for greater safety on construction sites are pushing the boundaries of what is technically possible. However, along with the positive effects come a number of challenges: the issue of legal liability, data quality, technical interoperability and questions of the ethical use of technology.

However, artificial intelligence is not only manifested in administrative processes. One of the most dynamically developing areas can be considered physical construction sites, where AI supports automated machines and monitoring systems. Modern construction machines can now use sensor data, GPS information or lidar scans to accurately perform tasks

that once required precise manual control by an operator. Excavation work, surface leveling or precise placement of material thus become activities that are performed by a machine under human supervision, not by the person themselves. The accuracy, repeatability and speed of these tasks fundamentally change work procedures and open space for more effective time and cost management. [1]

However, digitalization is not just about technology, but also about changing processes and ways of working. The goal is to create an environment in which information is available quickly, transparently and at the right time for all team members. [2]

Artificial intelligence application

AI is a fast-evolving family of technologies that contributes to a wide array of economic, environmental and societal benefits across the entire spectrum of industries and social activities. By improving prediction, optimizing operations and resource allocation, and personalizing digital solutions available for individuals and organizations, the use of AI can provide key competitive advantages to undertakings and support socially and environmentally beneficial outcomes, for example in healthcare, agriculture, food safety, education and training, media, sports, culture, infrastructure management, energy, transport and logistics, public services, security, justice, resource and energy efficiency, environmental monitoring, the conservation and restoration of biodiversity and ecosystems and climate change mitigation and adaptation. [3]

Types of Artificial Intelligence

Our understanding of Artificial Intelligence has evolved over the years, and data scientists are still at work to explore its scope. The study and implementation of the different types of Artificial Intelligence can be complex to understand. However, to understand its value, let's look at its scope.

The types of Artificial Intelligence tools in businesses offer transformative potential in the decision-making process, with the goal of improving customer-centricity and long-term growth.

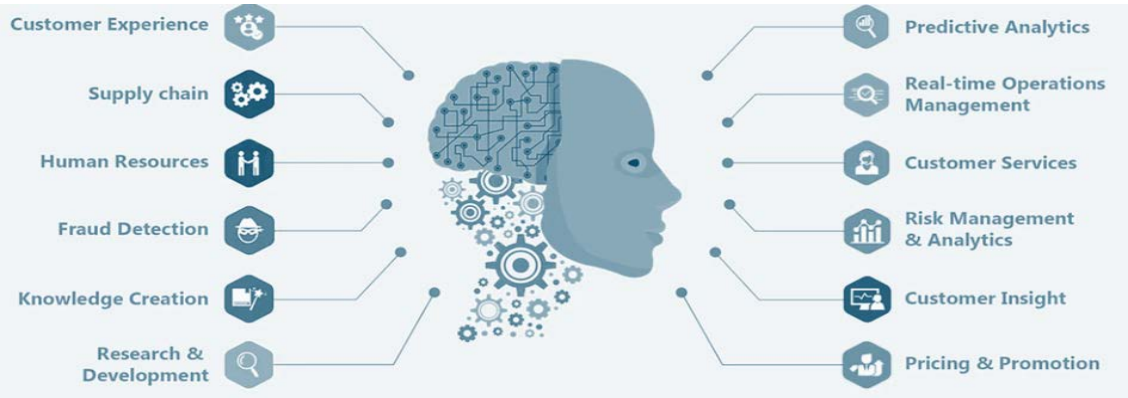

Fig. 1 - Top AI Use Cases
Source: [4]

Automation: The 7 types of artificial intelligence all help in one way or another to manage repetitive tasks. With Robotic Process Automation (RPA), AI frees up time spent here for big picture activities. Your team can focus on strategizing product design, marketing, sales and

overall growth. For example, with the best AI chatbots, customer service agents can focus only on the bigger issues while leaving the easy ones to automated responses.

Data-Driven Decisions: AI helps gather, organize, analyze and interpret large amounts of data about the market, competitors and customers. Using predictive analytics models, you can understand the data and make informed decisions. For example, a retail e-commerce site uses different types of Artificial Intelligence to predict customer demands based on past trends and adjust supply accordingly.

Operational Efficiency: AI can optimize workflow by understanding available resources and allocating them in the most efficient way. For example, AI can keep tabs on a machine's working capabilities, warning the operator about maintenance before complete failure. This saves time.

Personalization: The different types of Artificial Intelligence help analyze customer preferences and behavior. This way, businesses can deliver personalized services based on what customers want. Streaming platforms use recommendation algorithms to suggest content based on user history. This increases satisfaction.

Increased Security: AI can identify cybersecurity threats in real-time, keeping business integrity intact. For example, financial companies use types of Artificial Intelligence to identify fraud and scams.

Empowering Investment Decisions with AI

AI has the potential to revolutionize fields as diverse as energy, agriculture, healthcare, and ocean conservation, helping us monitor, optimize, and predict (MOP) progress toward global sustainability goals. By channeling capital into AI-driven innovations, investors not only accelerate progress toward key global targets, such as the Paris Agreement, the SDGs, and the 30×30 goal of the Global Biodiversity Framework but also unlock potential opportunities for better risk-adjusted returns. In this dual role, they support a more sustainable, low-carbon economy while enhancing their own resilience in a rapidly changing market.

The second approach to sustainability institutional investors is taking with AI to enhance the speed, quality, depth, and scope of their investment decision-making processes. Institutional investors diversify their portfolios across thousands of global companies and securities, creating an ecosystem of millions of data points. This comes with persistent challenges over the quality and coverage of that data and information, and how to turn it into valuable knowledge, wisdom, and action. Enter AI, with the potential to fundamentally reshape all parts of the Knowledge Pyramid behind each investment decision.

For data collection, AI and machine learning are invaluable for capturing information from diverse sources and formats (such as text, tables, and graphs) and improving data reliability. This quality control is not a marginal issue. Our research found that across three data providers that offered clients the same reported emission data points, the data was different 13% of the time and showed a discrepancy of over 20%. [5]

AI can also help close data gaps when corporate self-reported data is not available, making more accurate estimations beyond industry averages by using comparable and alternative sets of information like news or geospatial data. For example, AI tools can now overlay corporate human rights disclosures with information pulled from global news and independent sources to see if they match up.

To transform data into actionable insights, AI assistant solutions now allow institutional investors to converse intelligently with their portfolios on sustainability topics. They can inquire about data sources, methodologies, performance, and recommendations for improving scores. Additionally, AI is being used to provide forward-looking insights. For example, we used AI to analyze the decarbonization plans of the world's 400 largest emitters, finding that only 40% have credible transition plans. [6]

Impact of ai on management and leadership

AI is already helping investors to report back to their many stakeholders in different formats, styles and languages. Perhaps most importantly for investors today, AI can offer ways to optimize compliance reporting, reducing the reporting burden, and allowing responsible investors to focus on making investment decisions.

Artificial intelligence changes management and leadership in construction by automating routine tasks, improving data-driven decisions, and shifting leaders toward emotional intelligence and strategic oversight.

Construction project management involves planning, organizing, and controlling resources. AI is bringing about the following changes in these areas:

Impact of AI on Management Processes

More efficient planning and scheduling:

● Project Planning: Algorithms analyze past project data to predict timelines, budgets, and risks more accurately. If the delivery is delayed, the system will automatically recalculate and adjust the schedule of the entire project.

● Resource Allocation: Smart systems optimize the deployment of heavy machinery, materials, and labor on site.

Risk and safety management:

● Safety Monitoring: AI-powered camera systems on construction sites monitor health and safety compliance. The system will provide timely warnings about missing helmets or movement in dangerous zones. Computer vision and IoT sensors track site conditions in real-time to prevent accidents and ensure compliance.

● Financial management: Algorithms predict the risk of exceeding the budget based on the current pace of spending.

● Administrative Automation: Routine paperwork, invoicing, and reporting are handled by software, reducing human error.

Quality control and BIM (Building Information Modeling):

● Generative Design: AI suggests optimal architectural solutions with respect to materials and costs.

● Clash Detection: The software automatically detects design errors before construction begins.

● Drone monitoring: Drones scan the construction site and compare the real state with a 3D digital model.

Impact of AI on Leadership Processes

Leading people is about motivation, strategic decision-making, and team direction. AI is changing the way leaders approach their subordinates and partners.

Faster and more accurate decision-making:

● Data-Driven Decisions: Leaders rely less on intuition and more on real-time dashboards and predictive analytics.

● Scenario simulations: AI can simulate the impact of management decisions before they are implemented.

Changing the structure and roles in the team:

● Shift in Skills: Leaders spend less time on micro-management and more on complex problem-solving and innovation. They have more time to communicate, resolve conflicts, and motivate workers. Automated systems take over routine task control.

● Change Management: Leaders must guide workers through digital transformation and address fears of job displacement.

● Creation of new positions: Construction companies are starting to hire data analysts and AI systems managers.

Streamlining communication:

● Office-field connectivity: Site information is instantly delivered to company management.

● Communication: AI tools streamline reporting, allowing leaders to focus on team culture and collaboration. Teams need training to use new technology effectively. Managing sensitive project data introduces cybersecurity risks.

● Automatic reports: The leader receives daily progress reports without the need for workers to manually fill out reports. [7]

Traditional Management vs. AI-Enhanced Management in Construction

The construction industry stands at a critical crossroads where artificial intelligence transforms project delivery from reactive problem-solving to proactive timeline optimization. As development projects become increasingly complex and stakeholder expectations continue rising, the question isn't whether AI-driven project management outperforms traditional methods: it's how quickly organizations can adapt to capture measurable competitive advantages.

Modern construction projects utilizing AI-driven scheduling experience up to 40% shorter timelines and 10% cost reductions compared to traditional manual approaches. These aren't theoretical projections but documented performance improvements reshaping how successful development companies approach project delivery, resource allocation, and stakeholder management.

1. *The Performance Gap: Data-Driven Comparison*

Traditional project management relies heavily on manual scheduling tools, spreadsheet-based tracking, and reactive problem-solving methodologies. While these approaches served the industry for decades, they created inherent bottlenecks that AI-powered systems systematically eliminate.

Timeline Acceleration*:* Projects managed through AI-driven platforms demonstrate consistent timeline compression through automated critical path optimization and real-time schedule

adjustments. When material delays or labor shortages occur, AI systems instantly recalculate project dependencies and identify alternative execution pathways, while traditional methods require time-consuming manual replanning sessions.

Cost Control Precision: AI-powered cost estimation achieves 97% accuracy when analyzing historical project data, compared to traditional estimation methods that often rely on outdated benchmarks and manual calculations. This precision translates directly into better budget control and reduced financial risk throughout project lifecycles.

Project Overrun Reduction: Construction teams implementing AI-driven scheduling tools experience 30% fewer project overruns, primarily through enhanced risk prediction and proactive resource allocation. Traditional reactive management approaches typically identify problems after they impact timelines, while AI systems predict and prevent delays before they occur.

2. Operational Excellence Through Automation

Resource Optimization Beyond Human Capability

AI systems process vast datasets to optimize labor scheduling, material procurement, and equipment deployment in ways that exceed human analytical capacity. While traditional methods rely on project managers manually coordinating these elements through phone calls and spreadsheets, AI platforms automatically balance workforce skills, availability, and project requirements to maximize productivity.

Intelligent equipment scheduling ensures machinery utilization rates remain optimized across multiple project phases, reducing costly downtime and improving overall project velocity. Traditional scheduling often creates equipment conflicts or underutilization because manual coordination cannot process all variables simultaneously.

Real-Time Adaptability vs. Manual Updates: Traditional project management operates on scheduled update cycles: weekly progress meetings, monthly budget reviews, and periodic schedule adjustments. AI-driven systems provide continuous monitoring and instant adaptation to changing project conditions, creating significant competitive advantages in dynamic construction environments.

When weather delays affect concrete pours, AI systems immediately adjust subsequent activities, reschedule subcontractors, and optimize resource allocation across affected project phases. Traditional methods require manual intervention, coordination calls, and schedule republication: processes that consume valuable time and create coordination delays.

3. Risk Management Revolution

Predictive Analytics vs. Reactive Problem-Solving: AI-powered project management transforms risk management from reactive firefighting to proactive prevention. By analyzing historical project data, weather patterns, supply chain trends, and local regulatory factors, AI systems identify potential disruptions before they impact project timelines.

Supply chain risk prediction enables proactive material ordering and alternative supplier identification, while traditional methods typically discover supply issues only when materials fail to arrive on schedule. This predictive capability reduces project delays by 30% to 50% through early intervention strategies.

Quality Control Integration: AI systems integrate quality control monitoring throughout project execution, identifying potential rework requirements before they become costly timeline disruptions. Traditional quality management relies on periodic inspections and manual documentation, often discovering issues after significant work completion.

Automated compliance tracking ensures projects maintain regulatory requirements without manual checklist management, reducing approval delays and preventing costly corrections during final inspections.

4. Financial Performance and ROI Analysis

Measurable Efficiency Gains: Project teams utilizing AI-powered project management report 58% efficiency improvements through automated expense tracking, optimized resource allocation, and streamlined communication workflows. These efficiency gains compound throughout project lifecycles, creating substantial competitive advantages for organizations serving demanding markets.

Traditional manual tracking requires dedicated administrative time for progress reporting, budget updates, and stakeholder communication: time that AI systems redirect toward value-adding project activities.

Budget Accuracy and Control: AI-driven cost estimation and budget tracking provide unprecedented financial control throughout project execution. Real-time expense monitoring identifies budget variances immediately, enabling proactive corrective actions rather than end-of-project budget surprises common in traditional management approaches.

5. Implementation of Strategy for Development Organizations

Phased Adoption Approach: Successful AI implementation requires strategic phasing rather than wholesale system replacement. Organizations benefit from pilot project testing, team training, and gradual expansion across project portfolios to maximize adoption success and minimize operational disruption.

Integration with Existing Workflows ensures AI systems enhance rather than replace proven project management fundamentals. The most successful implementations combine AI automation with experienced project management expertise, creating hybrid approaches that leverage both technological capability and human insight.

Stakeholder Communication Enhancement: AI systems improve stakeholder communication through automated progress reporting, real-time dashboard access, and predictive timeline updates. Traditional manual reporting often provides outdated information by the time stakeholders receive updates, while AI platforms offer continuous transparency throughout project execution.

6. Strategic Implications for Portfolio Management

For investment and development organizations managing diverse project portfolios, AI-driven project management creates opportunities for enhanced portfolio optimization, improved resource allocation across multiple projects, and better risk management at the organizational level. Cross-Project Resource Optimization enables dynamic workforce and equipment allocation based on real-time project priorities and resource availability. Traditional portfolio management often creates resource conflicts between projects due to limited coordination capability.

Standardized Performance Metrics across all projects provide portfolio managers with consistent, comparable data for investment decisions, performance evaluation, and strategic planning. This standardization supports improved capital allocation and enhanced stakeholder reporting.

7. Future-Proofing Construction Operations

The construction industry's $4.51 billion investment in AI technology by 2026 demonstrates widespread recognition that AI-driven project management represents operational necessity rather than competitive advantage experimentation. Organizations that delay AI adoption risk falling behind competitors who achieve measurable performance improvements through technology implementation.

Continuous Learning Systems ensure AI platforms improve performance through project experience, creating compounding benefits over time. Traditional systems provide static functionality, while AI systems become more effective with each completed project.
Integration with Emerging Technologies positions AI-driven project management as the foundation for future construction innovations, including IoT sensor networks, drone monitoring, and automated equipment operation.

8. Actionable Implementation Recommendations

Start with pilot projects that demonstrate clear ROI potential while building organizational AI competency. Choose projects with defined scope, experienced teams, and stakeholder support to maximize initial success probability.

Invest in team training combines AI system operation with enhanced project management skills. Successful implementation requires teams that understand both technology capabilities and construction project complexities.

Establish performance measurement systems that track timeline improvements, cost reductions, and quality enhancements to demonstrate AI value and guide system optimization.
Develop vendor partnerships with AI platform providers that offer construction-specific functionality, implementation support, and ongoing system enhancement. Generic project management tools lack the specialized capabilities required for construction project success. [8] [9]

Conclusion

The importance of AI in transforming the workflows in the construction industry is quite remarkable. By integrating AI-powered solutions, construction companies can thrive. Construction is among the oldest professions in the world and today, the industry has evolved significantly with the help of technologically advanced solutions. Workflows such as design, planning and construction processes are completely revolutionized to meet the standards of a rapidly changing world. [10]

Technological methods are being used in construction companies to improve productivity, quality, and worker safety. Over the past few years, AI-based solutions have been booming and are being used by every major construction company. Construction industry tycoons have recognized the potential of AI and are aiming to help with manual labor

and automate workflows. Artificial intelligence has the power to perform tasks that are primarily associated with human beings.

For organizations committed to operational excellence and competitive performance, AI-driven project management delivers measurable advantages that traditional methods cannot match. The question isn't whether to adopt AI-powered project management: it's how quickly organizations can implement these systems to capture timeline acceleration, cost reduction, and quality improvement benefits that define industry leadership. [11]

Artificial intelligence does not replace human work but rather expands the capabilities of experts. Designers, construction managers and architects gain access to tools that can process large amounts of data, support their decision-making and create a safer environment for workers. The construction industry is facing a technological leap that will manifest itself gradually. This is not a revolution for one year, but an evolutionary process in which traditional construction practices will be supplemented by intelligent systems, sensors, robotics and digital platforms. If we manage to set up a high-quality data environment, strengthen the digital skills of the professional community and clearly define the legal boundaries of the functioning of artificial intelligence, artificial intelligence can become one of the most beneficial tools in modern construction.

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References

1. SEMANCOVA, R., 2025. *Artificial Intelligence in Construction: Between Efficiency, Safety and Technological Limits.* [online] published 2025-12-11 [cited 2026-03-30]. Available at: https://www.eurostav.sk/umela-inteligencia-v-stavebnictve-medzi-efektivitou-bezpecnostou-a-technologickymi-limitmi/
2. VOLCKO, M., 2026. *STRABAG Building Construction: Leadership is Based on Quality, Safety and the Ability to Keep up.* [online] published 2026-07-21 [cited 2026-08-10]. Available at: https://www.eurostav.sk/strabag-pozemne-stavitelstvo-liderstvo-stoji-na-kvalite-bezpecnosti-a-schopnosti-drzat-krok/
3. Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonized rules on artificial intelligence. Available at:https://eurlex.europa.eu/eli/reg/2024/1689/oj/eng
4. Jaro Education. [online] published 2024-09-26 [cited 2025-10-10]. Available at: https://www.jaroeducation.com/blog/did-you-know-about-the-seven-types-of-artificial-intelligence/
5. 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.
6. 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
7. JANKOVICHOVÁ, E. – M. HANKO, 2024. *Construction Management. Selected Topics II.* Brno: Tribun EU, Czech Republic, 2024, 121 pp. ISBN 978-80-263-1833-0.
8. McFadden Finch Holdings Company, 2026. AI-Driven Project Management vs Traditional Methods: Which Is Better For Your Construction Timeline? [online] published 2026-06-06 [cited 2026-07-20]. Available at:https://www.m-fhc.com/ai-driven-project-management-vs-traditional-methods-which-is-better-for-your-construction-timeline/

9. Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonized rules on artificial intelligence. Available at:https://eurlex.europa.eu/eli/reg/2024/1689/oj/eng
10. PEJATOVIC, B., 2023. *Leadership vs Management: 11 Fundamental Differences.* [online] published 2023-12-06 [cited 2024-09-08]. Available at: https://pumble.com/blog/leadership-vs-management/
11. 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

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