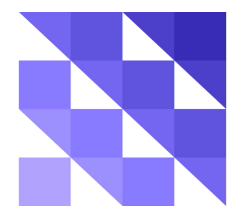


Focus in Crete, Greece

The Importance of AI in Construction Projects



RESEARCH
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Unlock exceptional value through insights to action

APENCO

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Executive Summary

In under seven decades, artificial intelligence (AI) has transformed from a scientific notion into an integral part of the construction industry.

In our everyday lives, many aspects we consider routine are now powered by machine learning.

Whether utilizing a navigation app, converting speech to text through dictation, or unlocking your phone with face ID, these tasks all rely on AI. Companies across various sectors are increasingly embracing and investing in AI to enhance logistics, elevate customer service, boost efficiency, empower employees, and achieve numerous other advancements.

Despite the continuously growing applications of AI, many organizations are only beginning to tap into its full potential and maximize their own investments. In fact, ARENCOS extensive analysis of around 40 Greek construction and engineering companies reveals that merely 8% have progressed their AI maturity sufficiently to attain superior growth and business transformation. These high-performing entities are referred to as the "AI Achievers." An additional 12% of construction firms have achieved a moderate level of AI maturity, leaving the majority, or 80%, still in the early stages of experimenting with AI.

The pursuit of AI maturity has been accelerated for years. Even before the pandemic in 2019, AI Achievers experienced an average revenue growth that was 50% higher than their counterparts. In 2021, among executives from the world's 2,000 largest companies by market capitalization, those who discussed AI on their earnings calls were 40% more likely to witness an increase in their firms' share prices. This marks a notable rise from 23% in 2018, as analyzed by ARENCOS.

86%

of firms in Greece are still testing the Artificial Intelligence waters.

8%

of firms have advanced their AI maturity enough to achieve superior performance and growth.



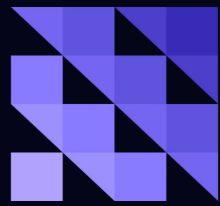
How do AI Achievers in the construction industry distinguish themselves?

While the scientific aspect of AI is apparent, our findings underscore the artistic dimension of AI maturity. AI Achievers in the construction sector are distinguished not by the intricacy of any singular capability but by their proficiency in harmonizing strengths across strategy, processes, and human resources.

Here are six methods through which AI Achievers excel in their expertise:

1. Their foremost leaders advocate for AI as a strategic priority across the entire organization.
2. They allocate significant resources to acquire top talent, maximizing returns on their AI investments.
3. Implementing an industrialized approach, they establish robust AI tools and teams at the core.
4. They design AI responsibly, from the start.
5. They judiciously prioritize both long-term and short-term AI invest.

In summary, advancing AI maturity is not merely an option; it is an opportunity that confronts every industry, not only the construction sector, every department, every supervisor and every leader.



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The significance of AI in constructions.

The significance of AI in construction projects.

There is an increasing consensus that the incorporation of AI is paramount for sustaining a competitive advantage in the construction industry.

According to our survey of over 40 construction companies in Greece, only 8% have seamlessly integrated AI into their business strategies, including the AI implementation in project management and project construction.

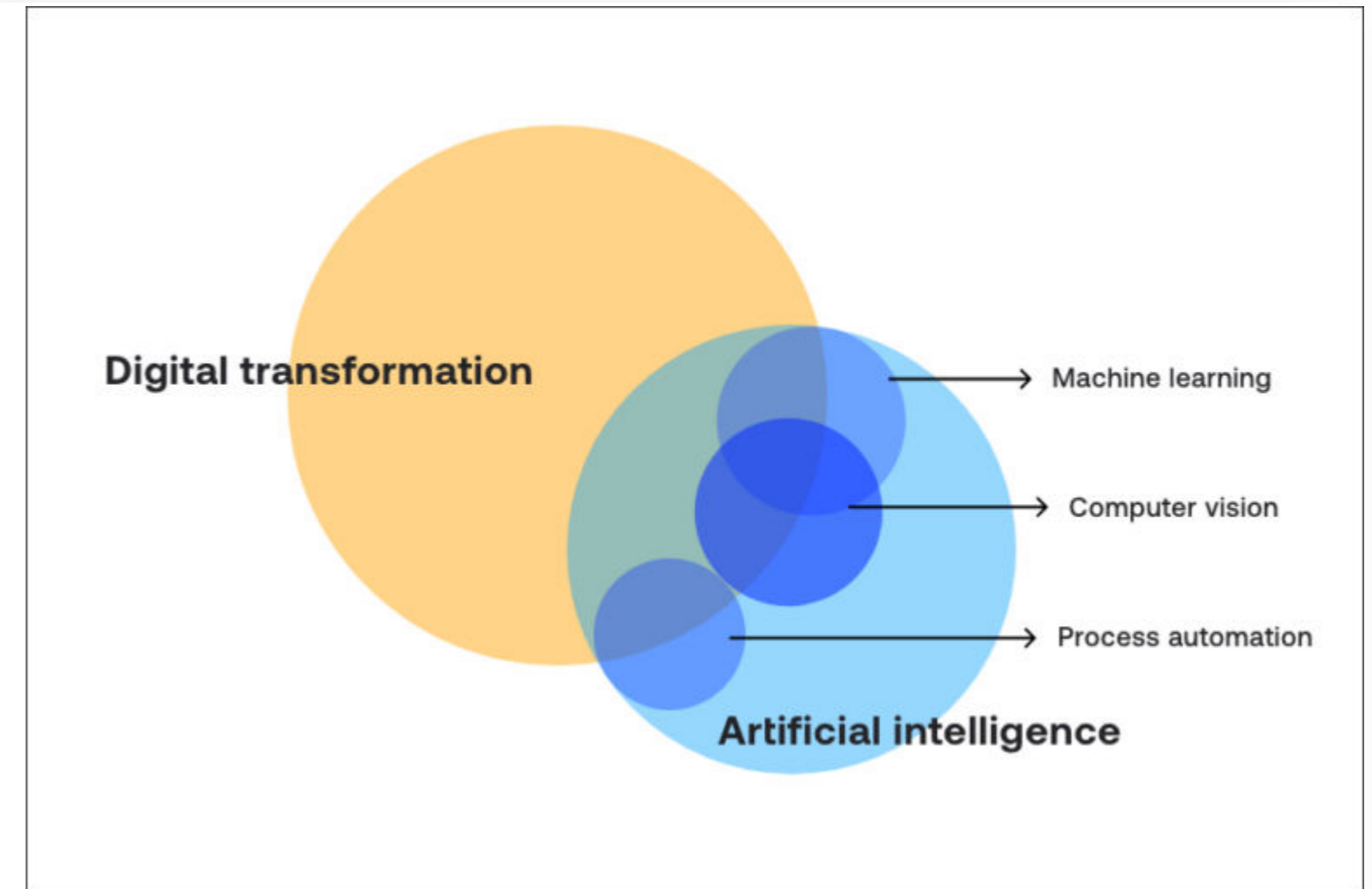
Pioneering companies are witnessing tangible results, with 62% reporting that the returns on their AI initiatives surpassed expectations. In contrast, only 1% expressed dissatisfaction, stating that the returns did not meet their expectations.

AI VS Digital Transformation

Digital transformation delivers operational improvements to any organization at every step along the way. Artificial intelligence is a set of technologies that can accelerate digital transformation and help deliver the value business expects.

Figure 1 shows how digital transformation and artificial intelligence overlap as elements of IT strategy.(Figure 1).

Figure 1: The conceptual relationship between digital transformation and artificial intelligence.



Source: ARENCOS Research



AI Advancement: What it is?

AI Advancement: What it is

If the majority of construction firms in Greece are striving to adopt AI, what accounts for variations in the value they derive from it?

ARENCOS crafted a comprehensive framework for assessing AI advancement in the construction sector. Our research shows that achieving AI advancement hinges on adeptly mastering a distinct set of key capabilities in the right combinations.

AI is increasingly making significant strides in the construction sector, transforming various aspects of project planning, execution, and management.

Recent advancements in AI have propelled the field forward with notable progress in Natural Language Processing (NLP), enhancing language understanding and enabling more sophisticated applications like chatbots and sentiment analysis.

Computer Vision has seen improvements, allowing AI systems to recognize objects, scenes, and emotions in visual data, contributing to facial recognition and medical image analysis.

Generative Adversarial Networks (GANs) have revolutionized image synthesis, while reinforcement learning and explainable AI have improved decision-making in dynamic environments like those complex ecosystems in the construction sector.

In the construction sector, AI advancements are transforming traditional processes and contributing to improved efficiency and decision-making. AI is being utilized in project planning and design through generative design algorithms that optimize designs based on various parameters, enhancing cost-effectiveness and resource utilization.

On construction sites, AI applications include computer vision and IoT-based safety monitoring, which detects potential hazards and ensures compliance with safety protocols.

AI is also streamlining project management by optimizing schedules, mitigating risks through predictive analytics, and enhancing supply chain management by forecasting material demands. Quality control benefits from AI through computer vision inspection, ensuring the precision and quality of construction components.

Additionally, AI is playing a role in post-construction operations, managing and optimizing the ongoing efficiency of completed buildings. These advancements collectively contribute to a more technologically advanced and efficient construction industry.

Furthermore, AI is making notable strides in the construction sector by enhancing project management processes. It aids in scheduling optimization, considering various constraints and resource availability, leading to more realistic timelines.

AI contributes to risk management by analyzing project data to identify and assess potential challenges, enabling proactive decision-making. In supply chain management, AI is used for demand forecasting, ensuring timely availability of materials and minimizing delays.

The technology also assists in inventory management, automating tracking and ensuring efficient material usage. Beyond the construction phase, AI facilitates ongoing building operations through smart building management, optimizing energy efficiency, scheduling maintenance, and ensuring occupant comfort.

These advancements collectively empower the construction industry to operate more effectively, reduce risks, and improve overall project outcomes.

34%
of ARENCOS operations
are using AI tools and
technologies to
improve our decision
making.

46%
of our clients request
automating tracking and
materials usage metrics
through AI.

AI, applied in the construction sector

AI advancements in the construction sector encompass various paradigms:

Project Planning and Design:

- Generative design algorithms optimizing designs for cost-effectiveness.
- Building Information Modeling (BIM) enhanced by AI for improved collaboration.

Construction Site Safety:

- Computer vision and IoT-based safety monitoring.
- Predictive analytics for proactive risk management.

Project Management:

- AI-driven scheduling optimization.
- Risk management through AI analytics.

Supply Chain Management:

- AI-driven demand forecasting.
- Automated inventory management for efficient material usage.

Quality Control:

- AI-powered computer vision inspection

Generative Adversarial Networks (GANs) in Design:

- GANs revolutionizing the generation of synthetic data and images for design simulations.
- Enabling creative exploration and ideation through AI-driven design processes.

AI-Enhanced Building Performance Analysis:

- Utilizing AI for in-depth analysis of building performance data.
- Enhancing energy efficiency, occupant comfort, and sustainability through AI-driven insights.

Digital Twins for Construction Simulation:

AI-driven digital twins creating virtual replicas of construction projects. Facilitating real-time monitoring, predictive analytics, and scenario analysis for optimized decision-making.

Implementation fosters improvement.

AI Real Life Paradigms Implementation

AI applications specifically in project design, construction management, and material selection.

AI is revolutionizing the construction sector, introducing innovative solutions to longstanding challenges. In project design, generative design algorithms powered by AI optimize designs based on cost, materials, and energy efficiency.

Construction management benefits from AI-enhanced Building Information Modeling (BIM), improving collaboration and project documentation. Scheduling optimization, driven by AI, ensures realistic timelines by considering constraints and resource availability.

Material selection is streamlined through AI's ability to forecast demands accurately, minimizing delays in the supply chain. AI's computer vision applications enhance quality control by inspecting construction components for defects, ensuring high-quality outcomes.

Predictive analytics in risk management contribute to proactive decision-making throughout the construction process. These advancements collectively signify a transformative era, where AI is enhancing efficiency, safety, and decision-making across the construction sector.

How can ARENCOS assist you through AI?

Intelligence is reshaping the landscape of construction projects, introducing a new era of efficiency, precision, and innovation that transcends traditional boundaries"

*Stavros Thomas, ARENCOS
Senior Engineer and Computer
Scientist*

Figure 7: These examples showcase how AI is specifically applied in the realms of project design, construction management, and material selection, contributing to more efficient and effective processes in the construction sector.

Category	Key questions
Supply Chain Optimization for Material Selection	AI contributes to optimizing material selection by forecasting material demands accurately through the analysis of historical data, market trends, and external factors, minimizing delays and streamlining the supply chain.
Computer Vision for Quality Control in Construction	AI-powered computer vision systems inspect construction components for defects, ensuring high-quality outcomes during the construction phase and reducing the likelihood of errors.
Predictive Analytics for Risk Management:	AI-driven predictive analytics assess potential risks in project design and construction, providing insights for proactive risk management and informed decision-making.
AI-Driven Scheduling Optimization: AI	AI algorithms are utilized to optimize project schedules by considering constraints, resource availability, and potential delays, leading to more realistic and achievable timelines.

About ARENCOS

Our approach to the concepts of civil engineering, architecture and construction is inclusive; with social, practical, economical and environmental issues integrated within the entire project life-cycle. We consider that the process of design and develop a structure should be a process of dialogue and we involve selected experts and consultants in every stage of the design and construction process. Our design, engineering, research and development teams have learned that we must test, tinker, build and break things to make them much more efficient, sustainable, ergonomic and operational the next time. That's why research is key to our practice. It's a platform for us to experiment, to improve, and to deliver the extraordinary. At ARENCOS we embrace the power of change and critical thinking to create value and shared success for our clients, people, partners and communities.

Visit us at www.arencos.com.

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About ARENCOS Research

ARENCOS research division is pivotal for fostering innovation, staying at the forefront of industry trends, and driving sustained growth. This division serves as the engine for in-depth exploration, experimentation, and development of cutting-edge solutions. By conducting targeted research, the scope is not only to keep ARENCOS abreast of emerging technologies but also plays a crucial role in shaping our long-term strategy.

The collaborative efforts within the research division harness the collective expertise of interdisciplinary teams, ensuring a holistic approach to problem-solving. This commitment to research not only positions the firm as a thought leader but also equips it to navigate evolving market dynamics with adaptability and foresight. Ultimately, ARENCOS research division is our cornerstone of innovation, propelling the firm toward a future of continual progress and success.