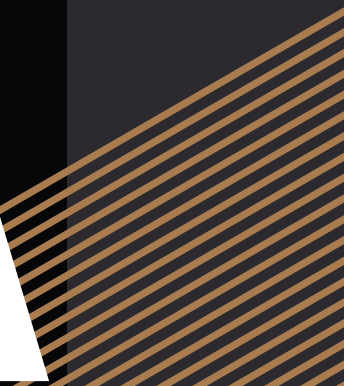


ARTIFICIAL INTELLIGENCE AND TECHNOLOGY TRENDS IN CONSTRUCTION MISSED OPPORTUNITIES FOR DEVELOPMENT



IMPACTING OMAN'S CONSTRUCTION INDUSTRY THROUGH ARTIFICIAL INTELLIGENCE AND TECHNOLOGY

Artificial Intelligence (AI) can no longer be a construction industry nicety. A bold statement, but with roughly seven percent of the world's labour force employed in an industry that spends upwards of \$10 trillion per year, it's crucial to integrate AI for industry benefits.

While other sectors have integrated AI, along with other technologies to improve productivity and cost streamlining, the construction industry is still one of the most under-digitized industries that could see greater, cost saving results by updating their technology tools.

Before diving into the value behind AI integration, let's first understand what it is. AI is technology - including machines - that has "cognitive" human abilities, such as problem solving, learning, and recognizing patterns. While traditional software is programmed to work with data within certain parameters, AI, such as Machine Learning, is designed to better predict and make decisions based on data input.

In a 2017 McKinsey report, it was noted that construction companies could boost production by 50 percent through AI. AI, along with robotics and the Internet of Things, building costs could be reduced by up to 20 percent. In such a competitive market, can Oman's construction industry overlook these opportunities?

Despite the predictions of massive job losses, AI is unlikely to replace the human workforce. Instead, it will:

- Alter business models in the construction industry,
- Reduce expensive errors,
- Streamline processes and repetitive work,
- Reduce worksite injuries, and
- Make building operations more efficient.

The remainder of this paper dives into key AI and Construction Technology that can positively impact the Oman construction market. Specifically, we'll be focusing on:

- Building Information Modelling
- Drones or Unmanned Aerial Vehicles
- Virtual Reality
- 3D Printing
- Robotics
- Exoskeletons
- Wearable Technology



AI TECHNOLOGY FOR THE CONSTRUCTION INDUSTRY

Technology has changed immensely over the past decade alone. What follows is a high-level analysis of key innovations directly impacting the construction industry.

BUILDING INFORMATION MODELLING

Building Information Modelling (BIM) is software that uses machine learning algorithms to explore all the variations of a solution and generates design alternatives. It creates 3D models of structural mechanical, electrical, and plumbing (MEP) systems while simultaneously making sure that routes for MEP systems do not clash with the building architecture.

BIM provides a space for better collaboration, risk reduction and efficiency increases. BIM also helps with problem-solving in the design and planning stages of a project by automating clash detection and providing a more complete picture of the project.

DRONES AND UNMANNED AERIAL VEHICLES

Drones and Unmanned Aerial Vehicles (UAV) allow for visuals previously unattainable. They help create strong 3D maps, accurately and efficiently conduct site surveys, gather and analyse information, monitor site progress, and proactively identify costly issues. Drones can be used to undertake inspections, covering vast areas of land in just a few minutes, while improving safety and productivity of construction workers and projects. Companies to follow that are leading the industry on commercial drone and UAV development are Doxel and Skycatch.

A great benefit as to why drones are growing in popularity is that they are able to inspect extremely hard to reach places and do so safely. Companies are finding the ability to monitor on-site progress helps to keep their costs and timelines on track. This means clients are able to receive daily progress updates at a lower cost. As drone technology continues to rapidly develop its accuracy and precision of readings, even less human involvement will be necessary, keeping safety risks low and efficiencies high.

Already, there is adoption of drones within the Middle East for improving construction projects. In Abu Dhabi city municipality, drones are being used to monitor and inspect construction sites.

VIRTUAL REALITY

Virtual Reality (VR) has finally made its way out of the gaming industry and fully into the real world. 4D-VR models allow clients and other stakeholders to become fully immersed in the environments of planned construction during the planning and design stages. This allows for better understanding of the project ahead, along with what risks, challenges, or obstacles that must be addressed.

VR technology is often used in conjunction with BIM for complex projects as it gives stakeholders a tangible understanding of how all elements work together for the final result.



3D PRINTING

3D printing offers the capability to print full structures, which, as a construction technology, will change the way materials are sourced. For prefabrication, materials can be printed and then transported to the job site, ready for use immediately. This results in an increase in construction speed while reducing both waste and costs.

With 15 percent of UK's construction materials ending in land sites due to mismanaged schedules and materials, while building-related waste makes up 25 - 40 percent of America's solid-waste stream, it's clear that 3D-printing can reduce unnecessary waste. 3D printing also makes it possible to print materials on site, further reducing waste while saving costs on transportation and storage.

Dubai's construction industry is already seeing results from using 3D printers in their construction initiatives. As part of an effort to reduce waste and improve safety, 25 percent of new buildings constructed in Dubai are planned to be completed utilizing 3D printing by the year 2030.

ROBOTICS

No longer just for science fiction, robots are now entering the construction industry in a number of areas. Autonomous roving machines can help increase efficiencies and create detailed site inspections. Mechanical arms automate highly repetitive tasks, such as brick-laying and bending/tying rebar. Using 3D scans of construction sites, the management team is able to identify small problems before they become big, often costly, issues. As we move towards 2020, robotics continues to gain momentum in the industry, particularly through "reinforcement learning." This AI learning allows robots to learn through trial and error, assessing endless combinations and alternatives for an optimal path forward.

Construction companies are increasingly relying on off-site factories staffed by autonomous robots to piece together components of a building. These pieces are then further put together on-site by human workers. Structures, such as walls, can typically be completed in a more efficient, less erroneous manner when developed using autonomous machinery. This leaves the finer details and finishing work, such as plumbing, HVAC, and electrical systems, to human workers once the structure is fitted together.

As these robots become more precise and accurate, they will be a large driving force across the construction industry. While the costs of robotics will be high in the beginning, the long-term ROI will be well worth the payoff. Examples of how companies are already seeing results from their robotic investments are seen in the form of self-driving construction machinery for repetitive tasks, such as concrete pouring, bricklaying, welding, and demolition. In addition, excavation and prep work are performed by autonomous or semi-autonomous bulldozers alongside a human programmer who sets the exact specifications.



EXOSKELETON

An exoskeleton is a wearable device that supports labourers during heavy, repetitive, body-laborious work. The exoskeleton reinforces and improves the wearer's performance, keeping them protected and healthy from injury and risk, such as hand-arm vibration. While they were originally developed for military use and patient mobility/rehabilitation, they are now making waves in the construction industry because of their ability to augment performance.

As an exoskeleton's benefits are huge for both worker safety and project productivity, they are rapidly being adopted in complementary industries, such as manufacturing. Live trials for construction sites have begun this past year, with results already indicating that the development and uptake of exoskeletons will be an ongoing trend through 2020 and beyond.

WEARABLE TECHNOLOGY

Wearable technology isn't just for exercising. While Fitbit's, 3D glasses, Google Glass, armbands, and body monitors are well integrated into our individual everyday lives, they are becoming an important piece of technology to keep workers safe when onsite.

For example, workers are able to talk to one another via this technology, removing the need to reduce their focus on the task at hand. Additionally, wearable tech can help track where a worker is if there is an accident, or even tell if they are overheating so they can take care of their health before it's an issue! While not currently mandatory for workers, we suspect that this technology will become so at some point in the future because of the safety and health benefits.





AI, TECHNOLOGY, AND OMAN'S CONSTRUCTION INDUSTRY

In the 2017 McKinsey report, it was noted that construction firms could boost productivity by as much as 50 percent through real-time analysis of data. They also note that adoption of AI in the construction sector will be modest at first due to slow adjustment to change. Nonetheless, a move towards AI and technology is coming, and Oman's construction industry must prepare for this paradigm shift.

WHAT DOES THIS MEAN FOR YOU?

For your construction project, you must start asking how contractors and sub contractors are embracing the new technologies to drive down construction costs and increase safety on sites. This is crucial for your project to realize the value of AI.

With these new technologies, more highly skilled labour will be required, offering more opportunities for local labour engagement rather than expatriate labour. Universities and colleges need to update curriculums to train a new generation of construction professionals for the new age, preparing them for the industry ahead and not the one behind us.

Knowing this is where Oman's construction industry is eventually going, we must ask, what is holding the market back? Why is our industry reluctant to embrace these tools that can significantly benefit the country as a whole? Is it a lack of client demand, lack of knowledge, outdated local regulations? These questions must be answered to understand how to keep the industry apace with the rest of the globe.

If even some of the tools mentioned above are used in the Omani construction sector, we could see significant savings due to improved project efficiency and enhanced safety levels – all beneficial to our clients and their end user.

Here at MEC, we clearly see the potential value of embracing new technology to improve cost, time and safety on construction sites. We hope clients will request innovation, contractors will offer tools, and employees will update their skills to allow the continued development of the construction sector.

To discuss your next project or technology, visit www.majaneng.com or contact Kevin Ellis at k.ellis@majaneng.com.

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