Module 13

Construction 2030

Digitalisation in Construction

24 partners

12 countries

Date of Event

*Author/ **Institute***

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Construction 2030 | Summary

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To equip the learner with the relevant knowledge required to understand the rapid changes to the construction industry and what to look out for in the future.

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Construction 2030 | Objectives

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1. Outline how wearables for VR and AR has developed and what is in development.
2. Outline the principles and benefits of *Blockchain* for the construction industry.
3. Outline the principles of quantum computing and how this can benefit the construction industry.
4. Identify and outline further technological advancements and how they could change the future of the construction industry.
5. Outline the opportunities of the technological advancements for construction.
6. Outline how to avail of training opportunities and develop a career progression path for the future.

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Topic 1 – Quantum computing and blockchain

Topic 2 – Digital in the future

Topic 3 – Future choices

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1. Quantum computing and blockchain

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Other digital impacts on site- blockchain

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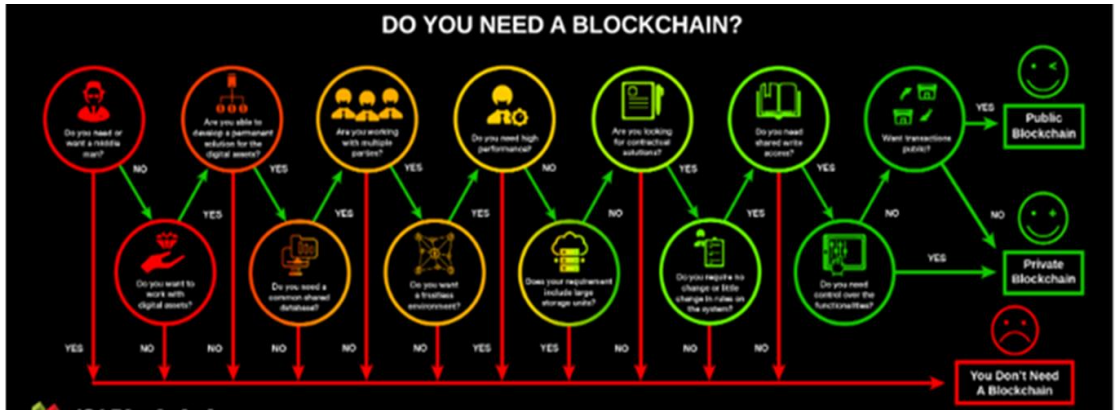
Blockchain

- Blockchain is broadly defined as a system that tracks transactions across a network. In some situations, these transactions are made via either cryptocurrency or bitcoin.
- Blockchain acts as a distributed digital ledger for various kinds of agreements, whether they are financial transactions or contracts.

- A Blockchain system is designed to continuously track updates of digital records, it is very much seen as a technology that could revolutionize the way that project teams build in the future. Basically, blockchain in construction has the potential to be a game-changer.

4 Ways that Blockchain will change construction

1. Smart contracts
2. BIM
3. Payments
4. Supply Chain Management



https://aec-business.com/do-we-need-blockchain-in-construction/

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Other digital impacts on site- blockchain

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- When combined, BIM and **Blockchain can greatly improve the effectiveness of smart contracts**, by holding all parties accountable and creating a higher level of transparency.
- Therefore, all the parties would be working to match the actual construction of the project to the BIM model in the contract.
- This combination could improve the effectiveness of BIM technology using information network sharing, efficient communication and higher quality of workmanship.
- Getting timely payments to all stakeholders and improving relationships between contractors, sub-contractors and suppliers.
- **If your supply chain is not in sync, then your project is going to suffer**. This will likely lead to delays, which will lead to lapses in productivity, cost overruns and unhappy workers and client.
- Blockchain can help contractors to use unique digital-specific identifications IDs to verify vendors and suppliers, and thereby grow their reputation over time.
- These digital IDs can work two-fold, as they can also help the company verify the credentials of any subcontractors before they are ultimately hired.

Benefits include:

Transparency

Designed vs Actual

Quality of Workmanship

Improved Team Relationships

Improved Reputation

Competent Workers

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Other digital impacts on site- quantam computing, DARQ

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Quantum Computing

- All computing systems rely on a fundamental ability to store and manipulate information.
- Quantum Computers:
  - perform calculations based on the probability of an object's state before it is measured.
  - performs a large number of computations at the same time and quantum interference is used to combine these results into something that is useable.
  - reduce power consumption significantly
  - speed up the learning process of AI, reducing thousands of years of learning to mere seconds.

DARQ

Each of the four technologies that make up DARQ will be used individually by businesses across the economy to differentiate their products and services.

“Distributed ledger technology (DLT) Artificial intelligence (AI) extended Reality (XR) Quantum computing (Q) are the next big technology catalysts for change."

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2. Digital in the future

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Interactive Machine Learning

The Term "Interactive Machine Learning" aims to develop methods and approaches that enable machines to learn from human-machine or machine-to-machine interactions.

With these approaches, autonomous robots and synthetic agents which operate in complex environments along humans or other systems over long periods of time will continuously be able to learn.

As a result of the interactions these learning processes are based on, robots will be able to not only improve their own behaviour but also quickly adjust to different challenges within their team.

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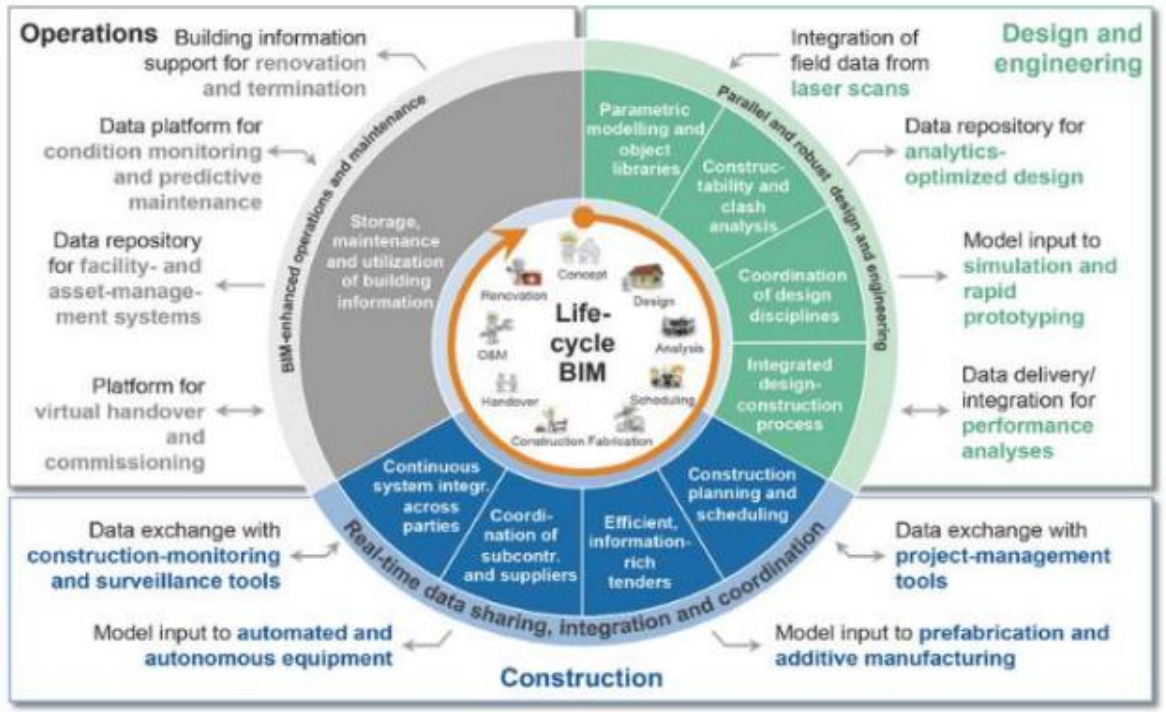
Digital Twins

Figure 35: Application of BIM to the entire construction value chain[170]



BIM Life Cycle
Source: European Construction Industry Observatory

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Digital Twins

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Digital Twin is the real-time digital representation of the physical building or infrastructure.
Usually, data is gathered by on-site **sensors** that continuously monitor changes in the building and in the environment and report back the updated state in the form of measurements, updated data and pictures, which are then processed by a dedicated software and updated in the Digital Twin; this allows companies to continuously monitor progress against the schedule laid out in a 4D BIM model.

A **Digital Twin** differs from BIM for the amount and type of information it includes, as BIM models do not include real time data collected directly from the construction site or building in operation, nor a track record of past issues and interventions . For his reason, it is possible to say that BIM provides the basis for a Digital Twin, since it reproduces a broad set of characteristics that enable simulations of future behaviour; however, it does not provide direct physical-digital linkages and, as such, does not serve as a virtual operation tool203 . Nonetheless, the two technologies can be combined on daily construction activities

Virtual and Augmented Reality (VR/AR)

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Virtual and Augmented Reality (VR/AR) is a technological innovation that incorporates virtual elements into real surroundings or directly by visualising the whole environment.

More specifically, Virtual Reality refers to a completely simulated digital environment, usually with a degree of user interaction possible; whereas Augmented Reality consists of layering digital elements in the real-world environment through computer generated sensory inputs.

VR/AR in construction makes it possible to combine digital architectural models with the physical reality of a construction site, or to directly visualise the final outcome of a project even before construction works have started.

VR/AR can overlay computer generated graphic elements onto camera captured videos, so it appears in real time, in the exact location in the real world. In terms of construction projects, AR involves the placement of a 3D model of a prospective design into the existing space

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There are three primary opportunities for automation in construction:

1. Traditional physical tasks on-site—for instance, **robots** laying bricks and machines paving roads.

2. The automation of **modular construction**—or rather production—in factories, including **3-D printing** of components such as facades.

3. Digitisation and the subsequent **automation** of design, planning, and management procedures, as well as the vast efficiencies those can create on-site.

For example, building information modelling—which essentially brings together the designs of planners and general contractors to identify issues before they move to the site—makes the planning process more efficient. But more importantly, it makes the on-site execution more efficient, allowing project teams to eliminate mistakes and better coordinate the workforce

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3. Future choices

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Drivers

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Both policy and market drivers play a key role in the digitalisation of the construction sector.

The European Commission has put in place ambitious policies to support the uptake of digital technologies within the EU.

The Renovation Wave aims to at least double renovation rates across the EU in the next ten years; the Directive on the Energy Performance of Buildings also promotes smart technologies; and the European Green Deal dedicates a specific attention to the circularity of the construction sector.

The main market drivers are companies' needs to improve productivity and cut costs, and market demand in the uptake of digital technologies, which push construction tech companies to innovate.

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Challenges

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The cost of equipment and software, lack of skilled workforce, and lack of awareness and understanding of digital technologies are the three main factors hindering the faster and broader digitalisation of the European construction sector.

That being said, significant variations are present across MS, technologies, and actors.

For instance, the cost of equipment was assessed as an important limiting factor for 3D printing and robotics, but a secondary issue for the adoption of sensors.
On the other hand, the lack of skilled workforce particularly affects the adoption of Artificial Intelligence and Virtual and Augmented Reality, and limits the use of sensors only to a lesser extent.

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Jobs

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The construction sector is a key pillar of the European Union (hereafter EU) economy, accounting for 18 million jobs and contributing to almost 9% of the GDP . More than its economic weight, the sector has a major social, environmental and climate impact, including to the quality of life of EU citizens or CO2 emissions and waste .

The “Renovation Wave”, which aims to foster building renovation to address climate change and support the recovery and the green and digital transition.

More specifically, the EC aims to at least double renovation rates in the next ten years. This is expected to generate significant market opportunities for the construction sector and contribute to the creation of 160,000 green jobs.

Digital technologies are expected to play a key role in this process

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Wrapping Up

Construction companies are starting to come around to technology adoption. Companies that are researching and using construction technology are reaping the rewards with increased productivity, better collaboration, and completing projects on time and under budget—resulting in higher profit margins.

It might be a tough pill to swallow, but we have got to the point where companies that are not investing in new technologies and solutions are no longer staying competitive, whilst those that are strategically adopting and using technological solutions are moving forward. Construction companies that continue to refuse to innovate are destined to die.

To stay ahead, all professionals and workers need to be trained or upskilled in NZEB and Green design, innovative technologies, new installation techniques and digitalisation.

Assessment

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Thank You

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