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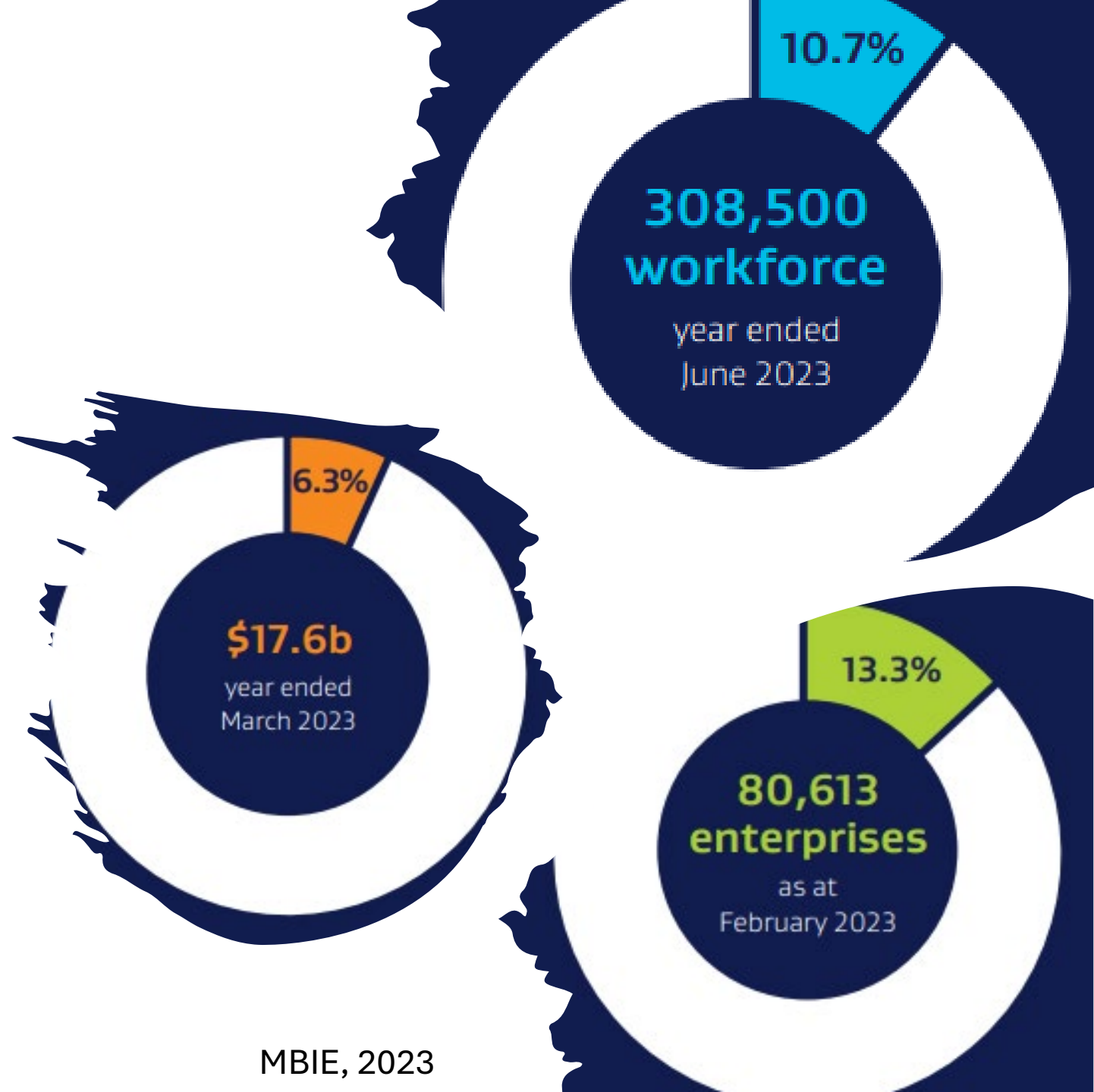
**Exploring the
Current Status of
Digital
Technologies
Implementation in
New Zealand
Construction
Industry**



ITP Research Symposium 2024

Background

It is predicted that the construction industry will provide globally \$15 trillion in revenue globally by 2025 and 14.7% of the world's GDP by 2030 (Ye, Zeng and König, 2022).



Background

- The construction industry is complex and often fragmented with different challenges such as **low productivity, poor safety, time delays, cost overruns, poor quality, and negative environmental impact** (Choudhry, 2017; Li, Greenwood and Kassem, 2019; Opoku, et al., 2021).
- Along with other countries, New Zealand's construction industry also faces similar (**poor productivity, labour shortage, HSE, sustainability**) problems that impede the growth of New Zealand's economy (Productivity Commission, 2018).



Background

- Construction industry practitioners and academics are fully aware of these challenges and are continuously researching new practices and technological solutions to facilitate the transition to **Industry 4.0** (Demirkesen and Tezel, 2021).
- **Construction 4.0** is a concept (similar to the Industry 4.0 movement) aimed at improving the performance of the construction industry by adopting advanced digital, smart technologies and through innovative practices (Alaloul et al., 2020).
- Considering New Zealand's construction industry's inefficiency, Chowdhury et al. 2019 also hypothesized that **digital technology adoption** could be a viable solution to improve efficiency.



Digital Technologies (DTs)

Digital

Definition: The term "digital" refers to anything that involves the use of discrete data represented by binary code (0s and 1s), as opposed to analogue systems that use continuous signals. In a broader sense, "digital" is associated with devices, systems, and processes that involve electronic technology, especially those that process, store, or transmit information using computers or related technologies.

Technology

Definition: Technology refers to the tools, systems, and methods used to solve problems, enhance human capabilities, or make processes more efficient. It encompasses a wide range of fields, from mechanical and industrial technologies to information technology (IT), biotechnology, and even social media platforms.

Hamelink (1997) described DTs as technologies between human and electronic systems to support production, storage, handling, and communication.

Ezeokoli et al. (2016) define DTs as a means to transform analogue information into digital forms, enables faster information processing for various purposes.

DT's in Literature

48 Technologies mentioned
in Literature

Serial Number	Digital Technology	Brief Detail	Source Reference
1	3D printing or additive manufacturing	Build objects automatically from digital models	Chen et al. 2024, Aliu and Oke, 2022; Chowdhury, Adafin and Wilkinson, 2019
2	5G networks	Mobile network that can offer high-speed data and low latency.	Aliu and Oke, 2022
3	ANN	A form of AI that emulate the human brain's neural networks for pattern recognition and analyse big volumes of data in short time.	Chowdhury, Adafin and Wilkinson, 2019
4	Artificial Intelligence (AI)	Machines performing tasks that typically require human intelligence, to solve problems and provide support in decision making.	Chen et al. 2024, Aliu and Oke, 2022
5	Augmented Reality (AR)	Digital model or content overlaid on the physical world in real time via devices.	Chen et al. 2024, Aliu and Oke, 2022; Chowdhury, Adafin and Wilkinson, 2019
6	Automation	Using machines or software to perform tasks without human intervention.	Aliu and Oke, 2022
7	Big Data	Large number of structured and unstructured data to analyse and find patterns, solutions of a problem.	Aliu and Oke, 2022
8	Big Data Analytics	The process of analyzing large number of data sets to identify patterns and solutions of a problem.	Aliu and Oke, 2022
9	Building Information Modelling	A digital representation of the physical and functional characteristics of a facility to analyse and make informed decision by sharing with stakeholders	Chen et al. 2024, Aliu and Oke, 2022; Chowdhury, Adafin and Wilkinson, 2019
10	Barcode Technology	A system for storing and reading information by using barcodes.	Aliu and Oke, 2022
11	Blockchain	A decentralized digital ledger that records transactions across multiple computers.	Chen et al. 2024
12	Cloud Computing	Storing and accessing data and programs virtually (over the internet).	Chen et al. 2024, Aliu and Oke, 2022; Chowdhury, Adafin and Wilkinson, 2019

Virtual Reality



- WHAT IS VIRTUAL REALITY?
- Virtual Reality (VR) is a computer-generated environment with scenes and objects that appear to be real, making the user feel they are immersed in their surroundings.
- This environment is perceived through a device known as a Virtual Reality headset or helmet. VR allows us to immerse ourselves in video games as if we were one of the characters, learn how to perform heart surgery or improve the quality of sports training to maximise performance.
- Immersed in computer-generated reality e.g. BIM
- VR design reviews

INNOVATIVE USES FOR VIRTUAL REALITY

Dining

Now we can **travel virtually** to different places and immerse ourselves in certain environments while tasting the dishes from these locations.



Medicine

The Spanish National Research Council has succeeded in **reducing the effects of Parkinson's** in several patients by applying a treatment that uses VR.



The media

Immersive journalism takes the user to the places where events have occurred with live streaming of 360° videos.



Education

In classrooms, the use of VR allows students to **better retain knowledge** and helps students with learning difficulties.



Entertainment

Users can enter a scene in a **video game** or practice **extreme sports** without moving from their sofa.



Architecture

RV helps architects to **better envisage a space** and present the project to their clients.



Industry

Digital Twins are exact digital copies of physical objects that factory workers can **practice on and test in a virtual world**.



Culture/Art

Some museums and galleries offer **virtual visits** or immersive experiences to help understand the history and culture associated with each work.



Military

The UK Ministry of Defence uses VR for **training in simulated combat environments**.

Application of Virtual Reality

[HTTPS://WWW.IBERDROLA.COM/INNOVATION/VIRTUAL-REALITY](https://www.iberdrola.com/innovation/virtual-reality)

Research Problems

What digital technologies are currently being used by construction companies in New Zealand?



What are the main purposes for adopting these digital technologies?



What benefits do construction companies perceive from using these technologies?



What barriers or challenges do construction companies face in adopting digital technologies?

Research Methodology



QUALITATIVE
RESEARCH



DOCUMENT
ANALYSIS (INITIAL)



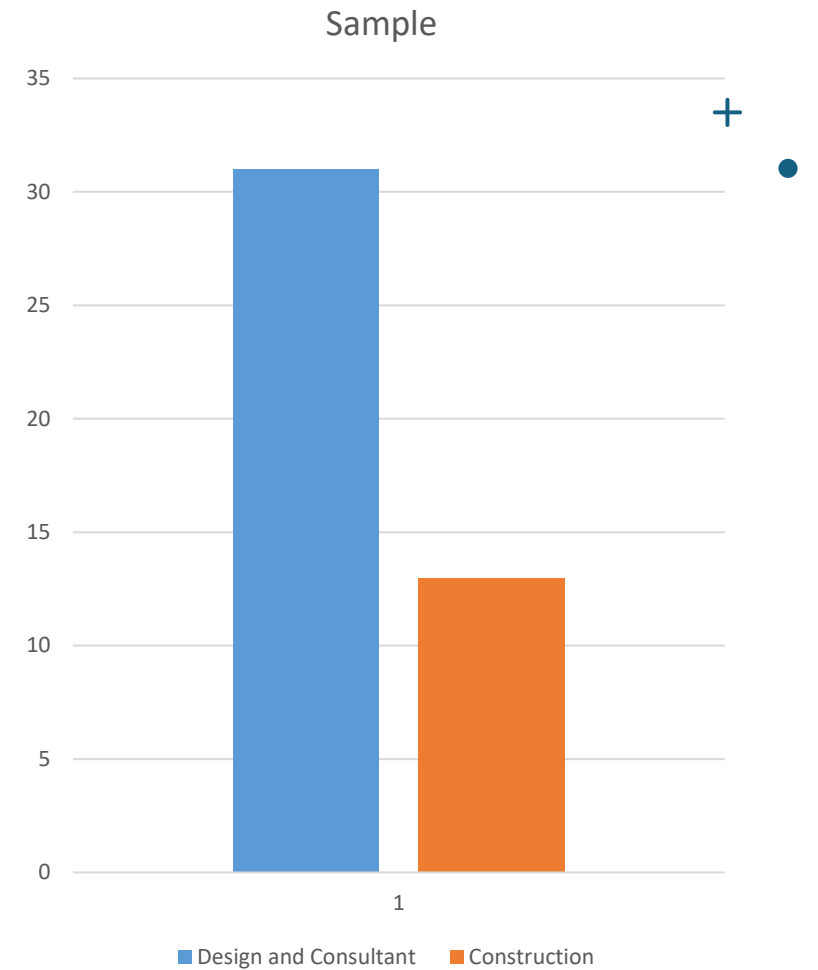
INTERVIEW.



CASE STUDY
ANALYSIS

Data analysis and sample

- Thematic Analysis



Research Output

- Conference papers/ Sympoisum paper
- Journal paper



References

- Alaloul, W. S., Liew, M. S., Zawawi, N. A. W. A., & Kennedy, I. B. (2020). Industrial Revolution 4.0 in the construction industry: Challenges and opportunities for stakeholders. *Ain shams engineering journal*, 11(1), 225-230
- Choudhry, R. M. (2017). Achieving safety and productivity in construction projects. *Journal of Civil Engineering and Management*, 23(2), 311-318.
- Demirkesen, S., & Tezel, A. (2022). Investigating major challenges for industry 4.0 adoption among construction companies. *Engineering, Construction and Architectural Management*, 29(3), 1470-1503.
- Ezeokoli, F. O., Okolie, K. C., Okoye, P. U., & Belonwu, C. C. (2016). Digital transformation in the Nigeria construction industry: The professionals' view. *World Journal of Computer Application and Technology*, 4(3), 23-30.
- Hamelink, C. J. (1997). New information and communication technologies, social development and cultural change (Vol. 86). Geneva: United Nations Research Institute for Social Development
- Opoku, D. G. J., Perera, S., Osei-Kyei, R., & Rashidi, M. (2021). Digital twin application in the construction industry: A literature review. *Journal of Building Engineering*, 40, 102726.
- Productivity Commission. (2018). Better Urban Planning.
- Ye, X., Zeng, N., & König, M. (2022). Systematic literature review on smart contracts in the construction industry: Potentials, benefits, and challenges. *Frontiers of engineering management*, 9(2), 196-213

Thanks