

Time to get serious about digitalisation of the built environment



Mark Enzer, strategic advisor at Mott MacDonald, visiting professor at the University of Cambridge and former director of Centre for Digital Built Britain, says civil engineers need to accelerate digitalisation of the built environment if they really want to deliver net-zero emissions.

1. Introduction

The world around us is undergoing huge change, and it is time for industries that serve the built environment to step up and take their place on the side of the solution, not the problem.

On one hand, societies face the genuine existential threats of climate change and biodiversity collapse, caused in no small measure by what we have built. More than 50% of carbon dioxide emissions are associated with the built environment; it is by far the biggest user of natural resources; and the total mass of the built environment now exceeds that of everything that lives on our planet.

On the other hand, if we pull

together, we have the power to change things. We are developing data and digital capabilities and tools, which could hardly be imagined even a few years ago, that can help us to deal with the big, system-wide issues. In this context, digitalisation is not only key to unlocking greater value from the built environment, but it is also an essential enabler in addressing the greatest challenges of our generation.

However, digitalisation simply cannot deliver its promised value if it is not joined up. I believe we need an ambitious, purpose-driven approach to digitalisation of the built environment, which we will explore by way of three interconnected themes: outcomes, systems and community.

First, we need to unpack what we mean by the 'built environment' and 'digitalisation'.

2. The built environment

Essentially, the built environment is everything we have built. All the networks for energy, transport, water, waste, telecoms and flood defences that make up our 'economic infrastructure'; all the residential, industrial and commercial buildings and the hospitals, prisons and schools that make up our 'social infrastructure'; and all the interfaces with natural environment, like urban spaces and managed landscapes.

The built environment provides the essential foundations for our society to thrive. More than just providing water, power or transport services, it boosts the quality of life and supports productivity and prosperity. We must keep the built environment working for as long as we want society to function, so it must be sustainable, safe, resilient and equitable.

3. Digitalisation

Digitalisation is not an end in itself, rather it is an enabler. Most importantly, digitalisation is about enabling people. Done right, digitalisation enables people to use information to make better decisions, to improve processes and to apply and integrate data and digital technology more wisely.

It is clear that digitalisation makes good business sense. In its ground-breaking work, accounting firm KPMG (2021) showed that every £1 invested in information management could potentially secure £5.10 of direct labour productivity gains and £6.90 in direct cost savings (Figure 1). Digitalisation of other industries has delivered efficiencies of up to 30% of the costs associated with undertaking processes, and this quantum of saving is still available to the built environment because its level of digitalisation is far behind other parts of the economy.

The root of the value of digitalisation is in 'making better decisions faster', based on better insight derived from better analysis of better data.

4. Outcomes-focused

The UK construction industry's vision for the built environment (CLFBE, 2021: p. 4) articulates very neatly that the whole purpose of the built environment is 'to enable people and nature to flourish together for generations'. Therefore, achieving better outcomes must be the overarching aim of industries that serve the existing built environment or its future development.

We must ensure that outcomes are aligned all the way from the global level, as described by the UN Sustainable Development Goals, through to local outcomes that respond

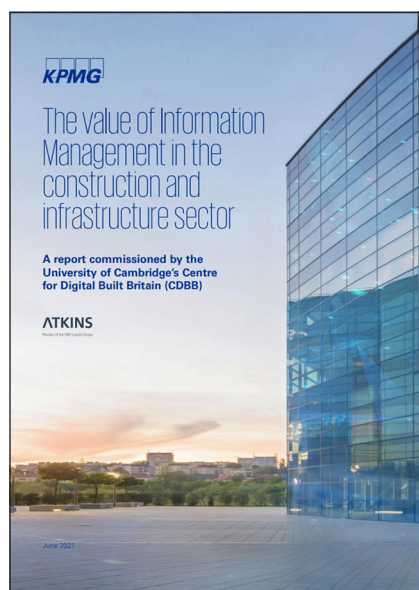


Figure 1. KPMG's report showed significant returns from investing in digitalisation

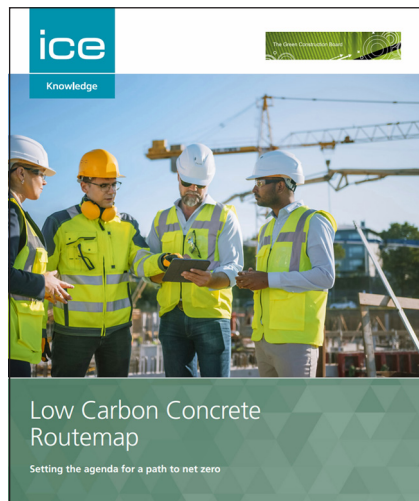


Figure 2. A digitalisation route map could be modelled on ICE's path to low carbon concrete

to local needs. The route to better outcomes flows through the services that the built environment provides. Whether we consider mobility, shelter or warmth, these services are the connection between the outcomes we desire and the systems we use to achieve them.

With a focus on improving outcomes for people and nature, it therefore becomes crucial to understand built and natural systems better so that we can improve the performance of the built environment by intervening more effectively.

5. Systems-based

Assets and networks are inextricably linked across the built environment. In other words, the built environment functions as a complex 'system of systems'. And significant challenges like climate change, resource depletion and biodiversity loss impact the entire system. These systems-level challenges demand systems-based solutions – they cannot be solved in isolation. Silos in policy, decision making, development and operation can only produce suboptimal outcomes.

To get more from the existing built environment, as well as from what we are yet to build, we must address the whole system and all its asset life-cycle processes. While we cannot

control these complex systems, we can influence them. Therefore, we must strive to understand them better, which is about mastering the relevant data, information, knowledge and wisdom.

We must also intervene more effectively, which is essentially about making better decisions faster in our projects and delivery processes. This is what digitalisation can do for us, but it needs to be a shared endeavour.

6. Community-enabled

The way that the industry has evolved means that the built environment is run in silos. The construction industry is famously fragmented, primarily because its principal way of working is by way of projects. Each project is effectively a prototype and, more often than not, the supply chain is reconfigured for each successive project.

So, at an industry level, learning is not transferred, capability is not progressively built and shared solutions are not developed. While this characterisation is an over-simplification, it does point to real challenges to effective digitalisation. To be effective, many elements of digitalisation have to be shared. If every organisation undertakes digitalisation in their own unique way, then it will not be effective at an industry level.

Fundamentally, people must be at the heart of digitalisation because its purpose is all about enabling people to decide and to act more effectively. People make it happen and people get the benefits. Therefore, digitalisation must address human and organisational factors: it is not just about technical change, it is 'socio-technical'.

7. What is needed

At a high level, a paradigm shift is required: we must recognise the built environment as a system of systems and manage it accordingly. The capabilities and tools to enable such a paradigm shift are already becoming available, such as systems engineering, complexity science and digital twinning. We now need systems-based policies and strategies that will enable us to understand and coordinate the built

environment effectively.

At a more practical level, there has been progress in digitalisation in many individual areas, with some outstanding examples of good practice from industry leaders. However, the sector as a whole still lags all other comparable industries.

The fact remains that isolated efforts have not transformed the industry, so it is time for a more joined-up approach to digitalisation, which must address all of the following:

- projects – the delivery of interventions on the built environment system
- assets and systems – the operation, maintenance and use of our built environment
- organisations – the ecosystem of organisations that serves the built environment.

In short, we need a practical national route map for the digitalisation of the built environment. The *Low Carbon Concrete Routemap* published by the Institution of Civil Engineers in April last year (ICE, 2022; Figure 2) is an excellent example of this approach. It provides a clear vision and, most importantly, a practical way forward that is shared across the industry. We now need this for digitalisation.

If civil engineers are to help meet the challenges of achieving net-zero greenhouse gas emissions, providing climate resilience, delivering infrastructure equity, creating a circular economy and protecting biodiversity, we need to accelerate the digitalisation of the built environment. We need a joined-up strategy that is outcomes-focused, systems-based and community-enabled.

References

- CLFBE (A collaboration of leading figures in the built environment) (2021) *Our Vision for the Built Environment*. Centre for Digital Built Britain, Cambridge, UK, <https://doi.org/10.17863/CAM.68205>.
- ICE (Institution of Civil Engineers) (2022) *Low Carbon Concrete Routemap*. ICE, London, UK. See <https://www.ice.org.uk/engineering-resources/briefing-sheets/low-carbon-concrete-routemap/> (accessed 07/03/2023).
- KPMG (2021) *The Value of Information Management in the Construction and Infrastructure Sector*. KPMG, London, UK.