Building Information Modelling (BIM) as an OSH management tool in modular construction

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Motivation

Grenfell Tower fire, 72 deaths
North Kensington, London
June 2017
Investigation

**Ignorance** – regulations and guidance not always read by those who need to, and when they do the guidance is misunderstood and misinterpreted.

**Lack of clarity on roles and responsibilities** – there is ambiguity over where responsibility lies.

**Indifference** – the primary motivation is to do things as quickly and cheaply as possible rather than to deliver quality homes which are safe for people to live in.

**Inadequate regulatory oversight and enforcement tools** – the size or complexity of a project does not seem to inform the way in which it is overseen by the regulator.
Proposed solution

“We must also begin thinking about buildings as a system so that we can consider the different layers of protection that may be required to make that building safe on a case-by-case basis.” (Hackitt 2018)

The golden thread of information:

• A tool to manage buildings as systems and allow people to use digital records to safely and effectively design, construct, and operate residential buildings.

• The UK government set out that the golden thread, as a digital platform, will apply to all buildings within scope of the new more stringent building safety regulations, being introduced through the Building Safety Bill.
Review

Using **BIM in the safety risk management of modular construction**

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**ABSTRACT**

Governments internationally encourage and support the development of modular buildings as they can improve efficiency in the construction industry. Meanwhile, judging from the numerous reports published by public agencies responsible for the regulation and enforcement of workplace safety (e.g., HSE UK), occupational health and safety is an important aspect that the construction industry has been concerned with as there is still much room for improvement. Therefore, practitioners and scholars have begun to study the safety risks of modular construction. In a similar manner, this paper summarises the existing literature on the application of Building Information Modelling (BIM) technology in the safety management of the construction industry in general and the main safety hazards of modular construction. The authors then analyse the application of BIM technology in the safety risk management of modular construction as a joint topic. This is the main contribution of this paper as there is very little research being done that links all three subjects together. The findings show that BIM technology has a great application potential in modular construction, and specifically in the training of staff, safety inspection, and crane management. By adopting BIM-based solutions it is likely to improve worker safety awareness, detect hazardous factors and scenarios and optimise site layout.
Modular construction

• The process of factory-built building units (i.e. the modules) being fabricated or partly assembled in a manufacturing plant away from the construction site, then transported to and assembled on-site.
“[…] a BIM system can enable the duty holders to ensure accuracy and quality of design and construction, which are crucial for building-in safety up front. Having BIM-enabled data sets during occupation means that duty holders will have a suitable evidence base through which to deliver their responsibilities and maintain safety and integrity throughout the lifecycle of a building. Information can be updated as and when changes are made during the building lifecycle” (Hackitt 2018).
Research findings

Training and warning

Safety inspection

Crane management
Benefits

Visual, virtual, and interactive learning environment provided by BIM, in combination with other compatible technologies (e.g. VR), is likely to mitigate safety risks particularly encompassed in modular construction due to lack of specialised competencies and experience.

From manufacturing to construction, BIM-based dynamic automatic detection systems can effectively identify possible safety risks in modular construction and guide manufacturing and construction activities, protecting workers from exposure to danger.

With the help of BIM, operators and managers can more intuitively and accurately analyse potential conflict factors and find unreasonable lifting plans, thereby avoiding casualties caused by crane collision.
Challenges

It’s complicated!

- Data protection
- Data assurance
- Modelling accuracy
- Tool acceptance and culture shift
- New roles and responsibilities
- Lack of trust in new technology
- Cost
- Operation and maintenance
- Information overload and situational awareness
- IP and commercial interests
- Skills shortage
- IP and commercial interests
**Context and perspective (1/2)**

*It is important not to forget that:*  

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<tr>
<th>They are not here to replace humans – <strong>human thought</strong>, critical thinking, and evaluation still need to go into safety management.</th>
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<td><strong>Visual perception</strong> of the intangible – perhaps a more inclusive approach.</td>
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<td>Be <strong>confident as to where data is hosted</strong>, who has access, what kind of access (viewer, editor etc.), and for how long.</td>
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<td>Should be considered as <strong>decision support tools</strong> (i.e. rich data libraries) and platforms for collaboration for better team integration.</td>
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<td>Complement existing approaches and <strong>add ‘dimensions’ to safety assessment</strong>: tangible+intangible; reactive+proactive; quantitative+qualitative.</td>
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<td>Maintain <strong>data quality throughout</strong> a long and scattered process, lifecycle, and supply chain – become an ingrained habit.</td>
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### Context and perspective (2/2)

*It is important not to forget that:*

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<th>Use of such tools should be accompanied by contracts to promote their use, protect interests, and set standards (e.g. quality, new procedures).</th>
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<td><strong>It’s a team effort</strong> – policy makers, educators, technology (i.e. software and devices) providers, researchers, end-users etc. should come together.</td>
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<td>They are <strong>not one-size-fits-all</strong>. Be mindful of the project specifics.</td>
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<td><strong>Seeing is believing</strong> – target and share successful case studies but be transparent, run pilot tests, look globally, be generous in the beginning.</td>
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<td><strong>Policy and practice</strong> need to go hand in hand – inform regulatory regime so that it can keep up with technology.</td>
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<td>Contribution in <strong>social/public value</strong> (e.g. upskilling, reskilling, unlearning) even in isolated communities.</td>
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Thank you!

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