Evaluating the role of BIM in the UK Construction Industry and How the Technological Advancement can Enhance Subcontractor Sustainable Development. A Systematic Review.

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The UK Construction Industry relies substantially on subcontracting within its construction projects with around 80%-90% of its work being carried out by subcontractors, (Omotayo et al, 2022). However, subcontractors are smaller in both size and revenue which on reflection indicates that they would suffer with more constraints, (Dainty et al, 2001). Over subsequent decades numerous amounts of literature have focused on the downsides of this collaborative approach, which have identified common problems including low-level opportunities to innovate and align new ways of working, (Loosemore and Lim, 2021), which has acknowledged that there is a gap in how subcontractors can partake in the upcoming focus on technological adoptions in the project lifecycle, (Khahro et al, 2021).

Building information Modelling can be defined as ‘an integrated process tool that is built on consistent and reliable project information from design to construction and future operation’, (Sineko et al, 2020)

**Figure 1: Construction Project Information Flow using BIM**

Graphical user interface, application, Word

Description automatically generated(Wong and Lai, 2022)

According to Wong and Lai’s, (2022) study which focused on specific stakeholder involvement with BIM during the construction project lifecycle it can be articulated that BIM derives from the client initially which diffuses through the project then ends with final input from subcontractors (see figure 1). However, although this seems logical in its hierarchical structure studies have found that with late involvement of subcontractors in the BIM process eliminates further usage in smaller scale projects, (Waqar et al, 2023). A study carried out by Vidalakis et al, (2020) found that there is a low level of familiarity and knowledge of BIM within Subcontracting companies, which stems from the limited resources and demonstrates how the BIM implementation at a smaller level primarily highly relies on cost. Thus, further research found that there is a necessity for smaller players in the UK construction industry to be provided with a clear strategy and assistance to fully benefit from and incorporate BIM into their work culture, (Turnball et al, 2022). However, few will have the capacity to establish BIM independently without further research, (Sadeh et al, 2021).

Business Information Modelling (BIM) as an upcoming phenomenon in the industry has been identified as a tool and process that has the potential to solve the major challenges facing the construction industry, primarily low productivity, and fragmentation in the industry, (Saka and Chan, 2021). Currently there is identified potential for Construction 4.0, Industry 4.0, and BIM to contribute to sustainable development, but cross integration is still in its infancy and very limited studies focus on the individual subcontractor, (Chen et al, 2022). Alongside this, studies have shown that BIM has the potential to improve the impact that building have on the environment through digital technology, (Liu et al, 2022). Thus, augmented reality (AR) and virtual reality (VR) technologies are now increasingly being used to encourage the adoption of BIM, (Dionoisio et al, 2023).

The BIM concept has large potential to improve the construction industry’s performance, profitability, and sustainable development, (Moeilak et al, 2023). At present literature has narrowly focused on BIM and carbon emissions at the design stage of the building lifecycle with areas focusing on the use of energy and calculations of carbon emissions, (Lu et al, 2019). Recently BIM and Life Cycle Assessments (LCA) have been articulated as the most powerful tools with the potential to achieve the best outcome of sustainability in the built environment, (Khudhair et al, 2021). Although BIM provides advanced technology and innovation, it still has limited impact on the shift to green building processes, (Abdelaal and Guo, 2022).

Despite the growing trend in digitalisation and BIM in the construction industry there is clear under-representation of small firms in extant studies, (Poirier et al, 2015). It’s important to distinguish subcontractors are not a smaller version of larger contracting companies that do belong to the same ecological environment but belong to a different business niche, and thus would react differently to new technological advances, (Saka et al, 2020). Therefore, posing the aim of this paper which is:

‘To critically analyse how BIM can become applicable to subcontractors in the UK construction industry to assist in advancing them into sustainable construction practices’.

This study envisages to carry out a systematic literature review that focuses on a sample of most cited papers that have been published between 2010 and 2022 using the most highly regarded construction journal being the Journal of Construction Engineering and Management and the technological database IEEE covering specific keywords including but not limited to:

* BIM and Sustainable Construction
* BIM and Subcontractors in the Construction Industry
* BIM and Energy Reduction/Carbon Emission
* BIM and Technological Advancements in the Construction Industry

The systematic review aims to find the gaps within the literature that exists and contribute to the current literature surrounding this advancing area of research. Thus, aiming to understand the role BIM currently has and steps in moving towards smaller firm adoption in the Construction Industry.

**Keywords: Building Information Modelling (BIM), Subcontractor, Small Business, Sustainability, Technology, Innovation, Industry 4.0, Augmented Reality and Virtual Reality.**

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