# Chapter 19
# BIM and IoT for Facilities Management:
## Understanding Key Maintenance Issues

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## ABSTRACT

*The AEC industry is facing a digital transformation that is improving the efficiency of services involved in designing, building, and operating assets and the users' well-being. Such a transformation towards sustainable smart cities is underpinned by two disruptive technologies: building information modelling (BIM) and internet of things (IoT). In this chapter, the authors present a review of studies that have focused on the identification of BIM and IoT technologies applicable to AEC industry processes, describing suitable strategies for data collection, storage and sharing, and fields of application. They also present data from two case studies that help us to understand how BIM can support better facilities management. From the literature, it was found that process improvements are a predominant research focus, reinforcing that successful BIM and IoT adoption goes beyond the acquisition of technology. The case studies revealed that a framework for prioritising areas is still needed for giving direction to researchers and practitioners concerning where to start the digital transition.*

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## INTRODUCTION

Facilities management, much like everything else is undergoing a digital transformation. Technologies that heretofore were restricted to digital products are permeating the post construction building industry. Companies can now create *building data ecosystem grids* to capture and analyse data trails from building users and determine how to enhance their service provision and building performance, as well as their building maintenance practices. Such a transformation has been fostered by several disruptive Information and Communication Technologies (ICT), such as Building Information Modelling (BIM), Artificial intelligence (AI) and Internet of Things (IoT). Within FM, there is a shift towards data ecosystems built around service analytics platforms that ties the ecosystem together. However, the shift is still slow, leading to the creation of various dizygotic digital twins.

The arguments for why adopting disruptive technologies for FM vary. Adoption is often related to perceived economic gains, streamlined well-connected processes that reduce inefficiencies of building operation and maintenance. In this respect, short, medium and long-term gains are achievable due to buildings' long-life cycle. Implementation tends to be focused on technology selection rather than business or societal value proposition.

In terms of benefits to the planet, for instance, the value of digital transformation is immense. For example, the scenarios developed by New et al. (2009) and Buis (2019) predict a global temperature rise of up to 4 Celsius. These conservative models tell us that if we do not change, we will bear the consequences. Concerning global warming, building technology is assisting us to precisely understand building performance in terms of energy consumption and $CO_2$ emissions. More importantly, it enables to understand and act upon underlying causes of poor performance, being that related to construction materials and process, or user behaviour.

To address the issues related to the use and maintenance phase, previous studies have focused on the identification of BIM and IoT technologies applicable to buildings. These studies tend to describe suitable devices, tools and software for data collection, storage and sharing (Fialho et al., 2019; Ye et al., 2018). As explained later in this chapter, these studies promote digital ways to improve building efficiency and their point of departure tends to be the implementation of technology. This is often achieved through BIM-supported simulation tools that predicts the performance of newly designed buildings.

In this respect, considerably less attention has been given to the currently inefficient existing building stock. It is widely acknowledged in the literature that the volume of resources used during the life cycle of buildings worldwide is the largest of all sectors. Buildings still represent the largest energy-consuming sector in the economy, with over half of global electricity consumption being responsible for approximately one-third of global carbon emissions (Abergel et al., 2017). We also know that the operation phase uses roughly 80% of the cost and resources of a building during its life cycle. However, very little detailed information exists about the sources of inefficiencies within our building stock that can inform value-based digital transformation implementation plans.

The literature is silent with regards to priority areas for the implementation of BIM and IoT solutions. Thus, in this chapter, we advance our work focused on the establishment of contextual knowledge regarding challenges of BIM and IoT systems integration (Fialho et al., 2020) by exploring practical Facilities Management issues that require attention. In other words, this chapter addresses the value proposition of digital transformational within the facilities management field.