Gaining competitive advantage through BIM: strategic positioning of BIM

GAINING COMPETITIVE ADVANTAGE THROUGH BIM: STRATEGIC POSITIONING OF BIM

Building Information Modelling (BIM) has been well recognised for its potential to reduce cost, improve efficiency, improve quality, and provide further productivity and performance benefits. In response to the recent hype of BIM processes and workflows, together with government mandates and client's demands, more companies are starting to implement BIM based strategies in their delivery process to improve their business. However, there is still a question of what happens when all the surrounded competitors have similar level of access to all stated benefits of BIM. In the innovation management literature, it has been widely accepted that the early BIM adopters possess more advantage compared with early majority or the late majority. As a result of this dynamism, the architectural, engineering and construction (AEC) industry is likely to reach a tipping point with a BIM-saturated market. A BIM-saturated market is a sign of a transition from the stage where the early adopters are taking the lead to a position where BIM is becoming a norm within the industry. This paper explores how this dynamism can be managed at an organisation level to be able to gain competitive advantage. Semi structured interviews from industry professionals were employed to gather data on how BIM can be strategically positioned to ensure competitive advantage in the market. The paper concludes with a recommendation on how companies could strategically position BIM within a BIM saturated market which will essentially be useful in an uncertain market condition.

Keywords: building information modelling (BIM), BIM implementation, competitive advantage, strategic positioning.

INTRODUCTION

Building Information Modelling (BIM) is a digitally-driven approach that encourages collaborative working methods that allow the entities in the built environment to unlock more efficient methods of designing, creating, and maintaining the built assets (BIS, 2014). BIM has come a long way and currently receiving a well-deserved recognition from around the globe. As a result of this recognition, BIM has been extensively used by many companies in recent times. Scrutinising the pattern of BIM adoption, especially in the UK, there is certainty that BIM is here to stay for a long time. Although, there may be a lot of new variants evolving through time. BIM has been a subject of discussion both in academia and the industry for its ability to reduce cost, improve schedule, improve quality, and other known productivity benefits. The UK's BIS BIM Strategy initiated by the HM Government has expressed its ambitions in taking on a global leadership role in BIM exploitation, BIM service provision and BIM standards development (HM Government, 2017). To this end, Cabinet Office and BIS have collaboratively introduced a long-term programme (more of a mandate) to

embed the use of BIM across all centrally procured public construction projects (Cabinet Office, 2011). As a result of this mandate, public construction clients are now adopting BIM in increasing numbers as they also see the benefits derived from data-enabled ways of working. Triggered by this government support to drive BIM implementation process, the construction industry as a whole is rapidly and positively moving towards large scale BIM adoption. However, the paradox of encouraging more firms to progress with BIM adoption is the dynamism created when the majority of companies have easy access to that same level of capability.

One way of looking at the above paradox is the opportunities that early adopters hold. Early BIM adopters often have the advantage of building closer relationships with the tech companies, giving them more influence over the development of the technology itself (Thasarathar, 2012). However, as more companies transform their traditional delivery methods to BIM-based delivery, either through choice or in response to client demands or Government BIM mandate, the industry will undoubtedly reach a crux. The early adopter benefits are not seen as a luxury, because they have made extra efforts to deal with trial-and-error process while pay more for the BIM related product than later adopters. Nonetheless, one thing all BIM adopters generally agree is that the premium of using the product improves efficiency, reduces cost, increases market penetration, or raises the early adopter's social status (Ullah et al., 2019). Therefore, the issue worth discussing is how this stage will be managed and how BIM could be implemented by organisations to gain added advantage in a BIM-saturated market. The efficiency and productivity benefits offered by BIM will always remain the same, however, to gain sustained competitive advantage, BIM must be used more strategically by competing organisations.

REVIEW OF EXISTING LITERATURE

BIM implementation in AEC industry

The construction industry is well known for its slow pace in adopting new innovative solutions and has been criticised for the inefficiencies in its method of delivery. Over the years, the industry has recognised a need for better working practices due to the complex nature of construction projects and the need to deliver better values due to increased pressures from customers and stakeholders. For instance, many countries have mandated the use of BIM for public sector projects for participating organisations. Public sector projects encompass a substantial amount of building and infrastructural projects in the construction industry globally (Jones, 2016) and its expectation is continually increasing thus leaving the industry with no choice but to modernise its approaches (Farmer, 2016).

Building information modelling (BIM) has proven to be a key facilitator in this transition from document sharing to a more structured information sharing through automating processes and workflows (Smith, 2014). BIM is defined as a data-rich, object-oriented, intelligent and parametric digital representation of an asset that can be used to extract information in the project delivery phase to support decision making (Azhar, 2011). The intelligent model serves as a way of managing an asset through the life cycle of a project (Eadie *et al.*, 2013). The use of BIM has evolved from the well-known 3D object oriented modelling of a building to include the automation of more construction processes such as 4D (time modelling) 5D (cost modelling) and 6D (facility management) in the BIM delivery workflow (Smith, 2014). Consequently, there has been a global increase in BIM adoption as seen in some European countries: 23% in Poland, 25% in Czech Republic, 78% in Denmark etc. (Ullah *et al.*, 2019). In

the UK, four years after the 2016 government mandate, there has been an increase in BIM adoption from 54% in 2016 to 73% in 2020 based on the national survey (NBS, 2020). With the approaching BIM saturated market, this leaves the question of how organisations (particularly SMEs) can stay competitive and use BIM strategically to their advantage.

Strategic use of BIM towards gaining competitive advantage

The UK is at the forefront of a significant change in how buildings are designed, built, and maintained. This change has proven to bring improved efficiencies and profitability to the construction sector and better facilities to clients and the end-users. As purported by many seminal authors, improving efficiency and profitability are two of the main determinants of competitive advantage. Competitive advantage is an important concept in management studies, especially in the discussion of business strategy. The precise definition of competitive advantage is still elusive, however, the common theme with this is 'value creation' (Rumelt, 2005). This leads to some other important questions of what value means to different stakeholders of a company, and what benefits a company can gain by comparing the different values and valuations of a company to other companies within the same industry. This understanding could help with determining strategic investment opportunities and thereby improve competitive advantage. It is very often that the analysis of competitive advantage is related to performance. The core hypothesis is that competitive advantage produces sustained superior performance (Powell, 2001). When a company is able to deliver the same performance or benefits as competitors but at a lower cost, or deliver performance or benefit that exceed competing products, a competitive advantage exits (Wang *et al.*, 2011).

According to Barney (1991), there are conditions necessary for a company to generate its own competitive advantage. Four attributes must be present: i) it must be valuable, ii) it must be rare among its current and potential competition, iii) it must be imperfectly imitable, and iv) there cannot be strategically equivalent substitutes for this resource. Different sources which suit these four attributes, could be used to generate competitive advantage for a company, including technology and innovation, human resources, organisational structure (Wang *et al.*, 2011). Thus, a company can seek competitive advantage through (i) delivering at a lower cost to competitors (cost advantage) or (ii) delivering benefits superior to those of its competitors (differentiation advantage) (Wang *et al.*, 2011). In relation to BIM, while most companies are now using BIM based workflow and roadmaps, there is inevitable different implementation strategies, and choice of technologies that can be used to suit each company's goals (Arayici *et al.*, 2011).

In a BIM saturated market, businesses have to start considering strategies such as cost and differentiation to remain competitive. It is argued that managerial and digital competencies could impact on a company's competitive and economic advantage (Huang et al., 2015). Therefore, businesses will have to prove to customers certain characteristics such as product quality, technology innovativeness, customer service, marketing and advertisement, reputation and image etc. (Wang *et al.*, 2011). However, yesterday's competitive advantage may become today's albatross unless strategists attune themselves to changes in underlying condition (Christensen, 2001). Thus, how to enhance temporary competitive advantage to sustainable competitive advantage is very important (Huang *et al.*, 2015). There is thus the question of how exactly BIM needs to be positioned within an organisation strategy to retrieve these competitive

advantages, and this is an under-explored area in previous research studies. Building upon this notion, the following sections investigates how BIM can be strategically placed to enhance the competitive advantage within a BIM saturated market.

METHODOLOGY

To address the research question, a qualitative research method has been adopted in this study with the aim of collecting some 'how' and 'why' data on how companies are implementing BIM in their processes. The philosophical standpoint of this study supports the explorative research strategy rather than explanatory approach so as to allow the researcher to capture complex, intricate, and contradictory relationships that prevail in the real world (Chang and Hughes, 2012)). The data in this study was collected using semi-structured interviews in order to use a pre-defined list of questions while still providing the interviewee with some flexibility to elaborate on their responses. Open-ended questions were selected to allow for a discussion with the interviewee as opposed to straightforward question and answer format. The researchers employed a purposive sampling strategy in selecting the AEC professionals in order to capture the rich data closely related to the research question. First, the sample population was selected to provide a good balance between all sizes of organisations. The firms were categorised as per Standard Industry classification (SIC). The reason for the selection of firms in all sizes is that it is generally accepted that the ‘competitiveness’ which is the heart of this research does not always come from the big players. Random sampling was not a feasible option given the newness of the subject areas and the existence of specialists in the areas of inquiry. Therefore, non-random, or non-probability purposive sampling, stratified before sampling is applied here. The sample population consisted of construction professionals who are directly involved in the operation/ tactical decision making/ strategic decision making of BIM. All interviewees were from companies located in the United Kingdom. A total of 25 participants who closely work with BIM at different levels of the organisation were interviewed as a part of the data collection process. In terms of the demographics, 9, 12 and 4 professionals participated in the interviews at strategic, tactical, and operational levels respectively. Also, the participants represented a mixture of organisations at different sizes. However, the majority was employed by large companies in the UK. The job roles of the interviewees ranged from Quantity Surveyors to BIM managers, BIM coordinators to engineers and Project Managers as well.

To analyse the data collected, thematic analysis was employed using an open-ended approach. This allowed the researcher(s) to investigate how participating organisations were impacted by BIM implementation. This method is considered the most suitable for this study due to the need to identify common themes and patterns of meanings from the responses of the interviewees (Bryman, 2001). This required the transcription of interview recordings followed by several coding stages. Initially, the author(s) read through the transcripts several times to identify potential themes and to gain richer insights from diverse data. Also, NVivo qualitative data analysis software was used to improve accuracy in the process. These questions were raised when analysing data in the first step- open coding. The first step- 'open coding' was conducted so that the codes reflect the essence of emerging ideas rather than simply a narration of the theme. Second, 'focused (or selective) coding' was carried out to summarise the pre-identified open coded themes into categories. 'Axial coding' was the third step followed to develop themes of higher abstraction level. Finally, core categories were created by scrutinising the content of underlying categories and the codes which

emerged from axial coding. Since the researchers in this study are more interested in professional's stated opinions (semantic) rather than what their statements reveal about their assumptions and social context (latent), semantic (data-driven) codes were used in the data analysis. Table-1 summarises the semantic codes derived from the transcripts.

DATA ANALYSIS, FINDINGS AND DISCUSSION

In analysing the data, the questions have been classified into two main variables of inquiry namely (i) 'BIM realisation strategies' and (ii) 'how BIM has given a competitive edge to the organisations'. The interview responses have thus been mapped with these 2 main variables. As summarised in Table 1, the data based on the first aspect on "how BIM implementation has been realised in your company?" has been coded into the various coding types. The participants expressed different ways that their organisations have realised BIM (see Table 1). More than half of the participants who represented the construction industry mentioned that the main purpose of BIM adoption/implementation in their organisation is to meet longer-term goals. Nowadays, BIM has been widely implemented in the construction industry, especially in the UK, due to the HM Government's initiation to take on a global leadership role in exploration. It is supposed to be helpful for the companies to achieve their long-term goals and gain their own competitive advantages. This has been proven to be true based on the interview results in this study, which is also consistent with the results from the previous studies (Arayici et al., 2011a, Takim *et al.*, 2013, Garcia *et al.*, 2018).

Irrespective of where any company sits on their own BIM journey, it is believed that there are some key strategic aspects to be considered in order to implement BIM in a way that it will drive value for project teams. This is the 'strategic positioning' intended to be explored in this paper. Considering the limitations of this paper, only the first strategic aspect of BIM implementation is explained here. The level of management is one such essential strategic aspect that must be established on the outset (See table-1 first data row). The incentives and motivations at each level must also be identified in order to better manage the workflow. For example, the project level BIM strategy should comply with the departmental and/ or the business unit BIM strategy. Individuals working at each level must have a clear understanding of their level requirements and motivations. This encourages a more centralised structure where business decisions are made at the top of the business and distributed down the chain of command, supporting centralised decision making. In favour of the same aspect, since BIM is a change in the way companies will be operating, the full support from senior management and stakeholders to implement it is necessary. In the afore-cited literature, it has been widely accepted that businesses with a centralised management style can often hamper the efficiency of workflows (Auh and Menguc, 2007). Further, a highly centralised structure makes it challenging to implement changes in the business environment. For that reason, the next immediate aspect worth consideration in a strategy is to create working groups and subgroups. To be able to create such working groups, the task force must be strengthened with the skills they require to possess.

Table 1: Coding for the strategic implementation of BIM

Open code	Focused/ selective code	Axial Code	Core category
'How BIM has been strategically implemented.'	'Targeted Goals.'	'For what reason(s)' (Higher-order)	'what emerges from that.'
Implemented and managed at the business unit and departmental level	Identifying incentives and motivations at each level	To promote organisation-wide engagement from stakeholder investment to the everyday BIM application of the workforce	Centralisation Senior management support
Strengthening the skills needed to work with BIM	Creation of working groups	Improve the organisational capabilities to cater to client requirements	Attract more clients
Bridging the gap in the integration between tech in the office and on site	Data management and data deliverables	More collaboration	Ease of business
Standardising a BIM Execution Plan	Standards and protocols	Accreditation	Client recognition
Project Lifecycle outlook	Vision and mission	Support sustainability agenda	Reduce waste and improve value
Integrating and Streamlining Tools and Data	Increased productivity	Return on Investment	Gain more profitability
Setting BIM-specific goals instead of blanket benefit' in all areas	Aims and objectives	Climb the ladder of maturity levels	Business growth
Constant reviewing of the adopted BIM process and adapting the approach where required	Adopt and/ or adapt	Collate any lessons learnt, the successes and the challenges	Continuous improvement

The strength and diversity of value opportunity within BIM means that there is a need to focus on specific BIM goals instead of trying to achieve 'blanket benefit' in all areas. The former should naturally align to business interest and service provision with an initial effort to construct a foundation to build on. From the above, it is clear that, as much in the medium term as long term, the construction sector, in general, must adapt to the directions of sustainable strategies when implementing BIM, aiming at the ways in which an organisation could maximise their favourable business position in other words, achieving competitive advantage.

In response to the second question: "Does employing BIM provide a competitive advantage to your company over your peer competitors?", participants were in the consensus of agreement on many themes (see Table 2). When implemented correctly, BIM provides an enhanced design, better quality, a clearer view of the project programme and an opportunity to see a greater return on their investment. Many discrepancies exist within a standard design, construct and operate lifecycle. When facilitated correctly, BIM can reduce some of these discrepancies and convert them into strengths.

'Safe by design' is something all project teams must feel responsible for. When facilitated correctly, BIM can provide better visibility of safety risks (design, construction, operation) and provide the digital record for use during the operational phase of the asset.

Table 2: Coding for the impact of BIM implementation towards competitive advantage

Open code	Focused/ selective code
'What is it in BIM that has put you in a favourable position.'	'how this links with a competitive advantage.'
The ability to demonstrate your understanding experience in BIM Journey in digital	Winning more work in tenders
Demonstrate the capabilities and Spirits in them	Bit more weight in scores when analysing tenders
Evidencing the application of BIM in projects	A plus point in the prequalification questionnaire in bidding
Extract quantities directly from the model faster and with greater accuracy	Outbidding the competition and ensures the project is not underbid
improvements in productivity	Higher profitability in the long run
Increased efficiencies	
Risk Minimisation	
Reduced Wastage	
Making informed decisions on correct data	Client Satisfaction
Better co-ordination of construction information	
Offering better insights into projects	
Better communication and collaboration	
Transparency in sharing data	
Providing a regulative and standardised process and a workflow	Accreditation
Improved agility	Speedy response to market conditions
Making fewer mistakes	The less mistakes they make, the less the client must pay for them

One of the key advantages of using BIM is that construction projects could run on a shorter life cycle with greater efficiency. All aspects of the pre-construction and planning phases become easier to manage and faster to complete. This in-turn provide higher profitability in the long run. However, the question here is, what happens when the majority of companies (competitors) all have easy access to that same level of capability? Moreover, to remain competitive in a BIM saturated market, an organisation requires factors that make them stand out from all BIM using crowd. Indeed, the future strategy for competitiveness in the construction sector is called upon to be environmentally sustainable and, in parallel, must focus on the social challenges formed on the European and world level.

Figure 1 presents an illustration that encompasses the various aspects related to BIM saturation and will be used to explain the overall strategic positioning of BIM. According to the interview results in this study, the potential competitive advantages for a construction company to generate through using BIM include: (i) winning more work, (ii) higher profitability in the long run, (iii) client satisfaction, and (iv) accreditation. Among all the four discovered competitive advantages based on the interviews data in this study, higher profitability in the long run is to generate cost leadership, while winning more work, client satisfaction, and accreditation are for generating differentiation compared to other competitors in the industry. Thus, the potential competitive advantages generated by using BIM fit the same framework

from the previous studies in competitive advantages (Arayici et al., 2011a; Powell, 2001, Wang et al., 2011)

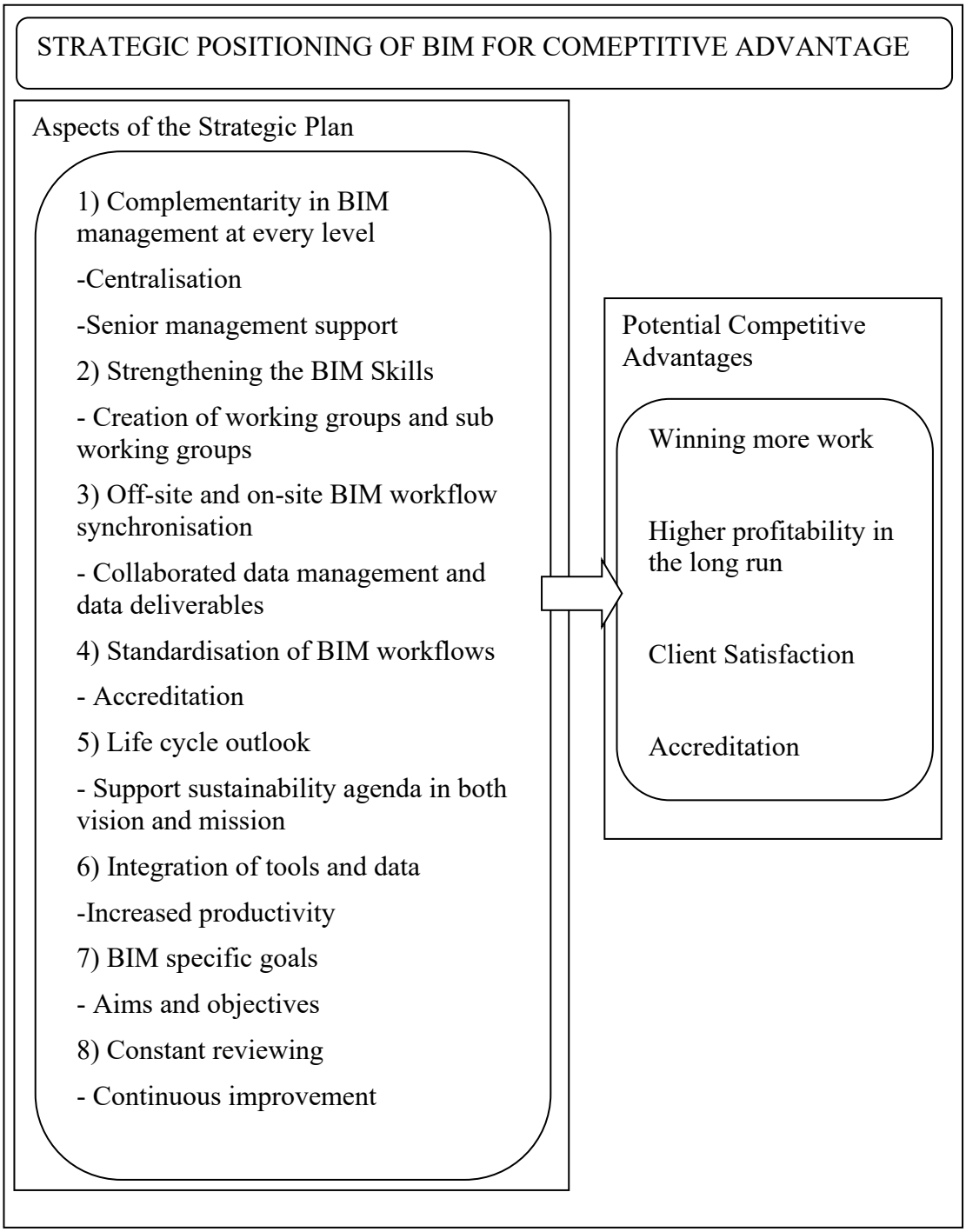

Figure 1: Aspects needs to be considered when strategically positioning BIM and how they relate to potential competitive advantages

According to Mintzberg (1987), a strategy is a plan of action designed to achieve a long-term or overall aim. Therefore, it makes a clear point that most companies possess a strategy that enables them to reach long-term goals by implementing BIM. What varies is the approach they chose to operate that strategy. In fact, most of the organisations interviewed had implemented BIM for every reason that allows them to

grow within the built environment; increase overall brand awareness; increase the organisation's share in its market, make the organisation geographically widespread and develop their capabilities to attract more clients (see Table 1). However, although it is a small amount, a couple of interviewees acknowledged creating/ improving their profile within the market and offer more value to their clients as the main reasons why their companies decided to implement BIM. The latter causes can be classified as short-term or medium-term goals.

Thus, it is very important for a construction company to break down the competitive advantages, which they want to gain, from a general and abstract level into very specific and detailed sub-levels so that it is easier to achieve it. It is also helpful to do the analysis of how BIM would help in these processes. For example, if a company wants to gain cost leadership as a competitive advantage in the industry, it could think of reducing the management and production cost, and/or increasing efficiencies, and/or reduce wastage, etc. Then the next step is to think how BIM could help in these plans. In order to reduce the management cost, for instance, BIM could be used for providing senior management support and increase centralisation in governance. Then, detailed implementing plans should follow after this analysis. Another example is, if a company wants to gain differentiation as a competitive advantage, it could think of building an outstanding image of being a reliable contract bidder with ability to extract quantities directly from the model faster and with greater accuracy so that the project is not underbid.

However, it is very much worthy to notice that the behaviour of implementing BIM in a construction company is not the competitive advantage itself. BIM is only a source that could be used by a company to develop and generate their own competitive advantages. According to Barney (1991), in order for a source to be used for generating competitive advantage for a company, it must have the following four attributes, including 1) it must be valuable, 2) it must be rare among its current and potential competition, 3) it must be imperfectly imitable, and 4) there cannot be strategically equivalent substitutes for this resource.

As the architectural, engineering and construction industry is likely to reach a tipping point with a BIM-saturated market (Smith, 2014), BIM is no longer a rare source among current and potential competition in the industry any more. However, it doesn't mean that it is not possible for a company to generate their competitive advantages by using BIM at all. For instance, customer-data capabilities could be used to gain an unbeatable competitive advantage in such a highly digital society (Hagiu and Wright, 2020). BIM could be very helpful for generating such customer-data capabilities for a construction company so that it can provide different products and/or services compared to their competitors. BIM could also be adopted to increase the knowledge management in a construction company throughout the whole project life cycle since knowledge management is critical to increase the productivity and efficiency of a project, which in return will generates competitive advantage for the company at the end (Hagiu and Wright, 2020).

KPIs should also be consistently checked compared to the stages without BIM to make sure the value of the BIM implementing (Arayici *et al.*, 2011). The implementing process of BIM is so important that even the process itself could help a company to generate competitive advantage by reducing the cost of implementing BIM since every company is trying to implement it at the moment (Takim *et al.*, 2013). Many actions could be taken during the three implement phases, which are

initiation phase, stabilisation phase, and progression phase. These actions could be preliminary BIM adoption by setting up external and internal support, and/or retention of in-house BIM experts improved through business practices, etc (Garcia *et al.*, 2018). A huge potential to generate large cost leadership by implementing BIM in a better way is clear and certainty among companies in the industry.

It is worth noticing that there are issues in implementing BIM in practice, including: different quality of the BIM model, automated quantities with accuracy difficult to check, lack of standards/software incompatibility, lack of sharing cost data information, unpredictable business changes, and legal/contractual/insurance issues (Smith, 2014). A good implementation of BIM needs to take all these issues into careful consideration. For these companies in the construction industry who adopted and implemented BIM in an earlier time, they need to enhance their temporary competitive advantage to sustainable competitive advantage (Huang *et al.*, 2015). For the rest of the companies in the industry, they shouldn't wait until anyone requires them to do so. BIM provides enormous opportunities for them to generate their own competitive advantages as well. They could exceed their competitors, who adopted BIM earlier than them, by implementing BIM in a better and more efficient way.

CONCLUSION

The two preliminary inquiries used in this research study include: 'BIM realisation strategies' and 'the ways in which BIM offers a competitive edge to the organisations'. The interview responses have thus been mapped with these two primary inquiries and the key findings revealed that organisations could strategise their BIM implementation process differently to ripe the intended competitive advantages. The strategies that could be used include: 1) complementarity in BIM management at every level, 2) strengthening the BIM skills, 3) off-site and on-site BIM workflow synchronisation, 4) standardisation of BIM workflows, 5) life cycle outlook, 6) integration of tools and data, 7) BIM specific goals, and 8) constant reviewing.

It is also found that complementarity in BIM management at every level is first and crucial when strategising the BIM implementation process. To this end, a centralised workflow with the support of senior management is more beneficial as a centralised information repository is expected to mitigate potential disputes among contracting parties proficiently. Also, this could help to synchronise off-site and on-site BIM workflows. Upskilling the BIM workforce is another part of the company's BIM strategy. Raising knowledge and practice of digital engineering across an organisation could help reach the maximum potential of BIM and thereby improve client satisfaction. Finally, meeting with the most up-to-date standards helps to achieve relevant accreditations thus upholding the integrity and transparency of information across the life cycle of built assets, and thereby makes BIM-enabled projects more productive, predictable, and profitable.

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