International Journal of Civil and Structural Engineering Research ISSN 2348-7607 (Online)
Vol. 7, Issue 2, pp: (55-61), Month: October 2019 - March 2020, Available at: www.researchpublish.com

How Building Information Modelling/Management can contribute to achieving one or more goals of 'Construction 2025'

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Abstract: **The construction industry in the United Kingdom, though seen as having a competing advantage when compared to that in most parts of the world, was still suggested to be operating way below its full potential and capacity (HM Government, 2012). The Construction 2025 document acknowledges this and has outlined targets to increasing the operating capacity of the industry.**

This paper reviews how the Building Information Modelling/Management system, can be strategically used to achieving one or more of those targets set out by the Construction 2025 documents. Additionally, the text explores works done by other researchers on this topic matter and draws conclusions based of their findings.

It is hoped that at the end of the text, the construction industry especially those in the private sector would appreciate the real importance of BIM to the increasing of its industrial capacity and revenue.

Keywords: **Building Information Management (BIM), Construction 2025. Economic Growth, Construction Industry.**

1. INTRODUCTION

In 2013, the coalition government formed by the Liberal Democrat and the Conservative government in Great Britain, published a document widely known as Construction 2025. This is a document which contains strategies, that expresses the long-term vision of the government to work together with the construction industry to make Britain a pioneer of the new wave in the construction industry worldwide (HM Government, 2013). The need for this was discussed in (Rhodes, 2015), which suggested that the state of the economy at that time which was badly hit by recession and had terribly affected the construction sector, prompted the government to draft out the document. (Gov.uk, 2018).

(2011), is one of the documents that the Construction 2025 builds upon. The document suggested strategies which urges a healthy relationship between those in public/government office and the construction industry to ensure that the government receives great deals which would in turn help in building the economic and social amenities and infrastructures needed by the nation.

(HM Government, 2012), puts forward that the construction industry is at the moment, operating below capacity and was therefore not contributing to the wider sustainability of the country's developmental objectives. Construction 2025 recognises these worries and has equally geared towards the volume, value and virtue of the industry, therefore, putting forth construction as a strengthening sector within the industrial strategy. In reference to the diversified nature of the construction industry with its sub-sectors and large supply chains, the long-term contribution of the industry to the economy, can be measured in terms of employment, social and economy advancement. The UK has proven to have a highly competitive advantage in some construction services as was acknowledged in the Construction 2025 document, predominantly in the engineering, architecture and other construction activities associated with low-carbon engineering environment (HM Government, 2012). Bearing these worries in mind, the Construction 2025 industrial document has clearly shown, sustainability, ambition, international advancement and efficiency. The document outlines the following targets for the industry to strive towards achieving them.

- **Reduction in Carbon Emission:** As stated earlier, Great Britain is one of the pioneers in reduction of carbon emission. The document outlines 50% reduction in the greenhouse emissions in the construction industry when compared to that of 1990.

- **Faster and more Effective Delivery:** The document suggests a reduction in the time a project last for, from time of agreement to completion, it suggest a reduction of about 50% which builds on the industry standard of 2013.

- **Improvement in Internal Trades:** It outlines a 50% increase in bridging the gap between the imports and export for the construction industry in terms of its products, materials and services.

- **Cost Reduction:** It outlines a cost reduction of about 33% which includes both that of construction and the entire asset. (HM Government, 2013: 5).

Without any doubt, one could tell easily that the goals set out by Construction 2025, is one that would be evident after a long term. The question now is, are those targets attainable? The answer to that would greatly depend on the advancement the industry would experience in terms of technology and other wise, and equally on development within the government. Therefore, the following action plans were set out in the document to properly guide both the government and the construction industry on steps to take towards achieving the set targets. These action plans include:

- **Low Carbon and Sustainable Design:** This involves applying technological advancement in reducing the destructive environmental and ecological impact construction has had on the country.

- **Digital Design and Smart Construction:** Compared to most countries of the world, the UK can be seen as a country which greatly encourages digital design. Therefore, this would build on that strength.

- **Development of Skills and Capacities:** This would promote apprenticeship irrespective of any economic or market instabilities. To come up with establishments with a common entrance and goal for construction skills development and qualifications. Finally, to upgrade the construction skill certification program so it becomes recognised nationwide.

- **International Trade:** This would utilize the healthy trade relationship the UK has with the rest of the world to promote more investments and create new opportunities.

- **Prospective Work opportunities:** This is an indication of futuristic demands, which will be provided through filtering of the infrastructure channel by the government. Design a demand projection for the construction industry, which will include construction and regional data types to show possible area where shortcomings could occur.

- **Image of the Construction Industry:** To actively engage the younger generation to help tackle conventional issues. Thereby, maintaining and sustaining a high safety standard in the industry.

- **Research and Innovation:** To collaborate with and make available funding avenues for researchers and businesses in those areas determined to be of high importance in achieving the target. To come up with better ways of sharing information and evaluation of projects. (HM Government, 2013).

To a great extent, in attempting to achieve a construction industry that is prosperous, highly efficient and sustainable, there must be a system in place which promotes and adopts Building Information Management (BIM). This goes beyond just modelling, since Building Information Management Model, details the processes, tools, technologies and manpower which gains speed through tools such as CADs and other machine-readable documents which contains information of the building, its planning, performance and operation, (Ciribini, Bolpagni and Oliveri, 2015). This management system is a wider concept which covers effective management of stakeholders' behaviours and relationships, network for sharing of knowledge and project information throughout the lifecycle. (HM Government, 2013) suggests that BIM is revolutionary information and communication technology for the industry. (Westminster, 2015) added by suggesting that it uses a systematic and strategic view to bring together the delivery of projects that covers and stretches the forces of market which are demand and supply. Truly, BIM coupled with modelling makes a comprehensive and highly integrative approach, which brings information and data management/exchange at the forefront of the entire industrial process.

A brief introduction has been made into Construction 2025 and quick discussion of the BIM system/approach has been put on the table, the rest of this essay, is aimed at giving some information as to how the BIM modelling/management can contribute in achieving one or more goals of construction 2025 goals.

2. BUILDING INFORMATION MODELLING/MANAGEMENT (BIM) AND CONSTRUCTION 2025

(HM Government, 2013), indicated that government and indeed the industry has in the Construction 2025 document, identified a major challenge that do not only affect the construction industry, but the engineering community as a whole, which is high cost of production. Therefore, making cost reduction of up to 33% percent one of the major targets of the document for both the initial construction and the entire lifecycle of the property/asset. In the UK, high cost of construction has been seen as a weakness when compared to competitors in other developed parts of the earth, which is a direct effect of poor procurement and other processes and not due to material input cost. The Construction 2025 documents suggests that there are great avenues of reducing cost such as; using of technology, innovation and ultra-modern material for construction. As with any challenge in life, this weakness, presents the construction industry with an opportunity to work towards utilizing its capability of delivering jobs at an extremely lower cost, through use of greater technology, increasing efficiency and faster means of information sharing for example the use of Building Information Modelling (BIM), would greatly help in achieving the set target. (HM Government, 2013). The BIM on its own is not able to lower cost, it greatly depends on other construction processes involved which includes design, final construction and other things. (Bradbury Architects, 2014), identified that the basis, is to direct the entire design and construction information from the different discipline into a central management system. Thereby reducing clashes which could be easily identified and other extra services such as maintenance, can be integrated into the modelling/management system early enough. According to Zghari (2013), it is the entire cost of the project comprising the different issues that brings about cost overruns. With regards to this challenge and the likely use of BIM, Gerber and rice (2010), suggested that Building Information Management process carried out in a proper manner with a rolling, real-time and accurate information sharing amongst all stakeholders is the way forward in resolving and preventing conflicts, increases the process of finding solutions and finally, accurately tracks projects timing and keeps it within budget. The use of BIM may in the long run mean saving cost according to Zghari (2013) from:

- Using a unified Building Information Management/Modelling system, to gather information from both contractors and members of the project team, so that all documents agree with each other at all times. Hence, clashes would be identified beforehand, thereby bringing about a reduction in waste, conflicts, delays and rework.
- Use of 3D and other CAD tools for space use simulations and visualisations to enable clients visualise spatial needs, thereby reducing variations requirements.
- Proper application of the BIM system and swift mobilization of plans to guarantee that construction documents are coordinated in an on-time manner, easily accessible and containing agreements on possible deliverables to properly monitor the progress of the work.
- To accurately integrate components design, manufacture and tolerance into the overall design development plan.
- Identification of the most efficient and reliable construction arrangement and placement of key elements/equipment such as cranes, drainage, sewage, waste management systems and access.
- Stronger alliance with contractors which would eventually lead to the reduction of premiums, claims, variations and insurance cost.

Combining all of these features related to the BIM systems and the tools, standards and protocols associated with it, mistakes and deficiencies are most probably to be limited since they could be detected early in the design, planning and initial construction stages, therefore, would not percolate down to the operation sites or disrupt later construction stages. In addition to early identification and rectification of error and deficiencies, identifying and rectifying would be done while it is still very cost effective to do so. From all of the above points, one could see that the initial stages of the construction process, is where the usefulness of the Building Information Modelling/Management system can be felt and seen more, by identifying problems on time and hence, reducing the number of problems that may arise later in the project, that said, BIM can be seen to greatly rely on accurate and quality sharing of information for its effective and efficient use. By deliberately working to improving the accuracy, quantity and quality of data/information and also, growing the trust and unity amongst stake/shareholders, which comprises of suppliers, should undoubtedly mean a reliable Building Information Modelling/Management system that is highly predictable. Hence, with the construction process and the projects at large being very predictable, mistakes and/or errors and unforeseen challenges which comes

with the ever-increasing complex construction process could and can be reduced to a very manageable level, hence, making construction more cost effective.

It is very important to note as was pointed out by Allison (2011), that BIM is not solely or only concerned with the initial/planning and/or early stages of the project, but the entire lifecycle. Building Information Modelling/Management, deals with the effective sharing and management of information all through the process from concept to planning and to operation.

'Building Information Modelling/Management implementation, is a continuous process, from conception to completion, with all stakeholders involved contributing to it in real time. Those on-site contributing and interacting with the system, with the help of held hand devices either specially designed for it or through general purpose devices such as mobile phones, tablets etc. Hence, providing contractor not on-site, with real time information of how the project is progressing. In some cases, on-site contractors build for themselves, a temporary BIM tent, to enable them to view the model on a wider screen. They could equally, interact with the system, by including copies of warranties within the model. Also, they could in real time verify the as-built project, monitoring any modifications made and including any approval documents to that regard, therefore, maintaining and preserving the checks and review pathway far long even after the project has come to a completion.

Watts (2012), pointed out that the BIM system, comes with some possible added benefits in the form of an included smart decision-making methodology, arrangements less prone to hazards, proper utilisation of energy which would in turn lead to a reduction in carbon pollution and also, gives a clearer view and focus on the entire life cycle of the infrastructure/asset, (Watts, 2012). These added benefits can of course only be realised, when there is enough provision of information, the efficient management of the provided information, and proper utilization of it. Since, the overall model would be updated based on other auxiliary models associated with the design, creating a sub management of the project, everyone stakeholder, would be able to access, monitor and with high precision estimate the end result of the work at hand. Hence, equipping them with all needed information to make educated decisions resulting from the comprehensive and well detailed documents at hand. Without any doubt, this ultimately means transparency, accountability and fairness would be greatly promoted, of which end result would probably mean more responsible attitudes within the construction industry.

Allison (2011), pointed out that BIM, comes with an included cost of its own, as stakeholders need to be trained on how to use the model, and contractors needs to find ways of adopting it into their design system etc., This has perhaps contributed to the slow migration to a fully BIM system industry-wide, despite the fact that BIM has been around for a very long time but yet has not hit its full capacity and potential, as was suggested by (Gerber and Rice 2010). HM Government (2012), describes the BIM system as a "Game Changer" in the industry, nevertheless it requires a basic migration and/or advancement from the legacy way the construction industry designs and carry out projects. (Bjork, 2013), proposed a way of encouraging more people in the industry to adopt the BIM system, and that is to provide more financial information. Since for most if not all professionals are only really motivated to adopting to new technology when they see how it directly benefits them and their business financially speaking. It is then apparent that stating only the potential benefits, is simply not good enough to convince and encourage more professional to use the system, but presenting actual fact figures of how the use of BIM can significantly cut cost and greatly improve the quality of work done. It is therefore, necessary that research is made, that presents an objective data that shows the benefits of using Building Information Modelling/Management. Of a truth, a lot has been written about BIM and its application which comprises case studies in the form of research (Khanzode et al., 2008; Eastman et al., 2008; Khemlani, 2004; Kymmell, 2008; Gerber, 2007; Kam et al., 2003). Current studies on Building Information Management, shows that the use of it, results in a more efficient and reliable process. Making reference to good timely collaboration, high accuracies and consistencies in architectural drawings, early clash detection, 3D model-driven fabrication, better use of components, trimmed chain of supply management. Despite the fact that much research activities have taken place about BIM and the above-mentioned benefits noticed through those research analysis, the benefits are mostly confined to those research results and barely are real and quantitative values given, therefore, limiting more generalisation of assessment and preventing any form of benchmarking. This lack of qualitative and quantitative evidences of the entire benefits, could account greatly for the slow complete migration to a fully BIM system industry-wide. Currently, the use of Building Information Management is mostly if not completely restricted to those construction firms and engineers working on or within the public sector especially on government projects, (Ciribini, Bolpagni and Oliveri, 2015). The European Commission (2015), has forwarded a statement that 'for any public contracts, design contest and works, all member

country, may have a need to use electronic based tools, like that of the BIM system', This statement was released despite the lack of enough evidence of the benefits of Building Information Management has on projects and to the corresponding stakeholders, (European Commission, 2015). Mordue (2015), suggested that, declaring Building Information Management policy a necessity would not just encourages members of the commission to come up with a digitalized construction industry, but would encourage collaboration between the members of the union. It is expected that as at 2016, members of the union have supposed to have included BIM into the legislation. The UK, has been a pioneer in the use of a Building Information Modelling/Management system especially, for most if not all government contracts, maybe they are at the forefront due to its economic benefit of encouraging a healthy competition. No wonder in the Construction 2025 document, the UK government advocated for a construction industry that is technologically advanced and highly efficient, (HM Government, 2013). The chase towards achieving such goal, has warranted the use of BIM with it being a necessity starting from inception to conception and to design, implementation to construction and even after the project is completed and the building is in operation.

In as much as the use of Building Information Management is encouraged in order to reduce cost and for quick delivery of projects, the British government clearly points out its importance, in reducing carbon emissions. These emissions are the main contributors to the accelerated climate changes and the included economic, social, environmental and other negative effects we experience in this modern time. Beyond any doubt, buildings are believed to be major sources of energy consumption, starting from the construction stages down to their operations and entire life cycle, therefore, making buildings major contributors to carbon emissions and climate changes. (Intergovernmental Panel on Climate Change cited in Li et al., 2012), suggested that buildings alone in the developed parts of the earth consumes about 40% of energy resources, thereby accounting for 36% of carbon emissions. It therefore, does not come as a surprise that the UK government encourages the construction industry to seek to develop buildings with low carbon emissions as a way to improving the climate change situation. To this note, BIM is of great importance as it facilitates engineers, designers and 3D visualization of a structure (Eastman *et al* 2008). Furthermore, as was stated in previous paragraphs, it makes possible the integration of different discipline information into one unified model, hence, promoting the incorporation of sustainability measure into the overall design and construction mechanism, most especially during the design process (Kriegel and Nies, 2008). This in the long run, makes possible the proper assessment of energy performance (Schueter and Thessling, 2008). This notwithstanding, great audience has been given mostly to design, Gerilla *et al* (2007), pointed out the need of keeping proper track of carbon emissions during the construction process and later when maintenance starts taking place. In addition to that, Li *et al* (2012), suggested that the carbon emissions by buildings are through power, steam and fuel consumption by heavy and light duty machineries, transportation, waste management in the construction stages. Therefore, attention needs to be given to these supply process, practices and materials. At the end of the day, Building Information Modelling/Management deals with the entire life cycle of the construction process and through qualitative recording of the energy consumption and carbon emissions during the process, alternative ways of sourcing materials, construction practices and techniques and an optimal low carbon emission process maybe actualized. Wong and Fan (2013), noted that there are indeed different complicating factors. As an example, there is barely any accord for a generalized definition of sustainable construction and furthermore, until only such a time when a unified measurement scope of carbon emission is clearly agreed upon and specified, would the integrity, relevance and accuracy of the calculations involved with carbon emission be assured (Li *et al*, 2012).

3. SUMMARY AND CONCLUSION

This report has so far given some insight into Building Information Modelling/Management and how it could greatly add to the UKs' strategy in the advancement of the construction industry. The main targets of the Construction 2025 documents were pointed out and elaborated upon and also, presented were actions needed in actualizing those goals. Associated with the purpose of migrating towards a sustainable, more efficient, economical and prosperous industry is the implementation and use of computer-based tools such as BIM, which was earlier defined as the 'design, development and application of an all-purpose computer software model to simulate building construction, later operations of modern facilities/equipment and documentation of designs and procedures'. This would in turn result to an object-oriented, database rich and smart portrayal of the building/facility, from this, all users can have a clearer view of the project design and the various needs can be extracted and properly looked into to bring about feedbacks and further improvements to speed up the entire process (Wong and Fan, 2013). In all of this, it is worth noting that BIM in its entirety includes; proper information management, integration of all facets and encourages a better collaboration and effective working together of stakeholders and better sharing and transfer of knowledge. Overall, the behaviours of stakeholders, including the

qualitative and quantitative sharing of information and the proper utilization of it, making of educated decisions which leads to reduction in cost of construction, speedy delivery and less greenhouse emissions is key to Building Information Modelling/Management. Albeit, this report has basically, focused its attention on three main targets of the Construction 2025 document, the migration to and adoption of BIM, as it is most probably to result in a smarter decision making, increase transparency and improve on construction methodologies, which also, includes more benefits as it relates to advancing other aspects of the construction industry, like, being competitive both locally and internationally, health and safety etc., additionally, it is indeed worth putting in mind that the adoption of Building Information Management, would equally increase productivity, growth of high skill jobs and provision of more job opportunities. Finally, it is worth pointing out also, that although the UK government has made the Building Information Management mandatory on all public-sector projects, for the Construction 2025 targets and full potential to be fully realised, it must be adopted beyond just the public sector but by all levels, hence a wider public and private sector push is needed.

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