Balancing the Business Case for BIM in Project Environments[1]

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According to research by McKinsey & Co (2016), construction projects are typically delivered late and over budget. Large construction projects have a 20% schedule and 80% cost over-run. McKinsey also highlight that since the 1990s construction productivity has declined in some markets, often resulting in relatively low financial returns for construction firms. They have identified that one of the main reasons for such problems is paper based processes, which don't allow teams to collaborate in real time (Imagining construction's digital future, 2016).

In the digital age, paper-based processes are a detriment to sharing information with stakeholders. We have all experienced first-had the confusion of version control and that sinking feeling during a project review when it becomes apparent, we implemented a redundant revision. Some construction companies have moved onto digital formats of drawings, documents and reports but the information is held in different forms, versions and locations that are not structured and centrally co-ordinated. This leads to conflicts of information and risks of inconsistency and incoherence in data (AECOM, 2012).

In contrast, BIM as a digital database creates, manages and operates information in a centralised area, making it available for sharing. It facilitates the participants to cooperate more efficiently and to integrate their processes, leading to less chance of losing information (Autodesk, 2002).

Building Information Modelling (BIM) is seen as one of the processes and tools which can help to digitise and manage information and improve collaboration between stakeholders in construction projects throughout the project lifecycle

Autodesk (2106) explains how collaboration and project information is managed using the BIM process:

"BIM is not one technology but instead introduces a data-driven, rather than drawing-driven, approach to enable practitioners to execute work more efficiently and effectively; integrate contributions from others; make changes; explore alternatives and deliver more suitable solutions that address needs from all stakeholders".

Thus BIM can enhance the process of generating, sharing, integrating and managing project information among project phases. It can act as an information bridge between different disciplines in a project.

BIM definition

The definition of BIM is often misinterpreted and misunderstood by people (Aubin 2012, p44). It is often understood as a 3D model but it offers much more to project teams. The "information" component has more importance. It is more the harnessing of data for information sharing, regardless of whether it is presented in a graphical model or not.

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BIM is a widely accepted tool to overcome many hurdles currently facing the Architecture, Engineering and construction industries (Morlhon, Pellerin & Bourgault, 2014) but it is prudent to note there are different interpretations of BIM:

BIM is a rich information model, consisting of potentially multiple data sources, elements of which can be shared across all stakeholders and be maintained across the life of a building from inception to recycling. (NBS, 2012)

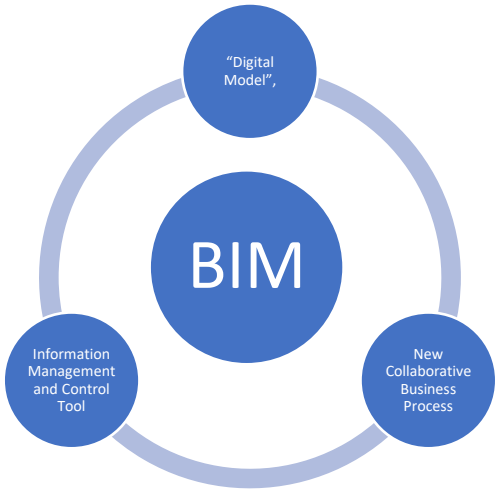
Eastman, Teicholz, Sacks & Liston (2008, p.1) explains that: "BIM accommodates many of the functions needed to model the lifecycle of a building, providing the basis for new construction capabilities and changes in the roles and relationships among a project team. BIM facilitates a more integrated design and construction process that results in better quality buildings at lower cost and reduced project duration."

"BIM is a paradigm shift in the architectural, engineering and construction industries which transforms processes to achieve greater efficiency and effectiveness" (Wong, Wong and Nadeem, 2011).

The aim of BIM is to improve the overall project process following the slogan "Better! Faster! Cheaper!" (Saxon, 2013).

While the development of the 3D BIM model is an important component, BIM should also be understood as a process change, not just a new tool or technology. The model has the capacity to act as a Single Source of Truth for all project participants. BIM also enhances collaboration resulting in improved information management and an overall leaner process (Computer Integrated Construction Research Program (CICRP), 2013).

From the various definition of BIM, we propose a three-pillar approach to defining BIM: (1) "digital model", (2) "new collaborative business process" and (3) "information management and control tool".



BIM Benefits

There are various benefits in adopting BIM. It can have both economical as well as technical benefits. Eastman (2011) says that BIM technology helps to improve many business practices within the organization. The main benefits of BIM for asset owners or construction clients are a reduction in document errors and omissions, rework, construction cost, project duration, and claims and litigation.

Stanford University's Centre for Integrated Facilities Engineering (CIFE) (as cited in CICRP, 2013) reports that BIM provided a 40% reduction of unbudgeted changes, provided cost estimates within 3% of the traditional estimates, contract savings of up to 10% with the use of clash detection, and reduced project time by up to 7%.

The most commonly reported benefit in literature is related to the cost reduction, time savings and control throughout the project life cycle. Some of the benefits may be disputed. There are many diverse views on the benefits of BIM as there is no straight forward methodology to measure benefits of BIM (Barlish and Sullivan, 2012).

McGraw Hill Construction (2014) research in UK shows asset owner or construction client's rating of benefits of BIM in their organizations. They are as follows:

- BIM Visualisation enables better understanding of proposed design - 89%
- Use of BIM has a beneficial impact on control of construction costs – 72%
- Beneficial impact on project schedule – 85%
- BIM analysis and simulation capabilities produce a more well-reasoned design – 92%
- There are fewer problems during construction related to design errors, co-ordination issues or construction errors – 85%

BIM is a driver of benefits realisation in project environments and supports overall information management for their organisation.
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The benefits of BIM in project environments is shown below Figure 1.

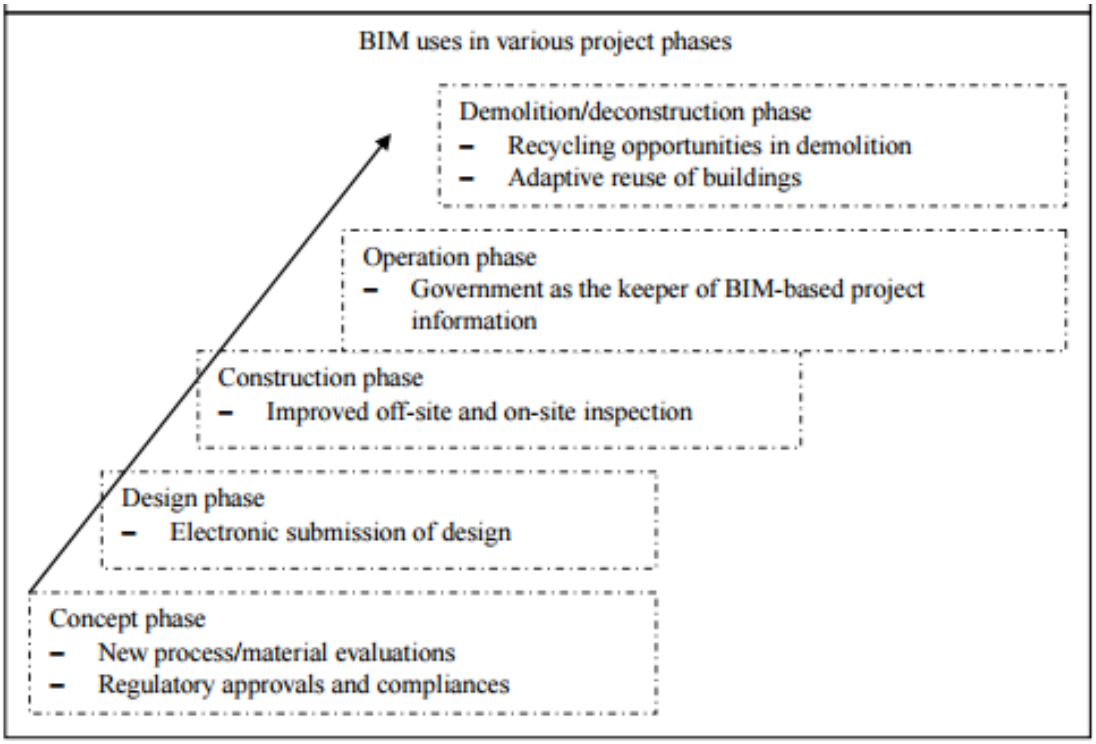

Figure 1: BIM uses in various project phases

Source: Government roles in implementing building information modelling systems: Comparison between Hong Kong and the United States, Wong, Wong, Nadeem (2011).

- **Concept phase**: The use of BIM could enhance and simplify the introduction and adoption of new building materials and methods to a project in the concept phase. The project team would benefit from using BIM to convey information to government agencies to shorten the compliance processes prior to final design.

- **Design phase**: Up to date information can be readily made available during the permit issuing process. The need to physically take documents to a project board can be eliminated by sending the documents electronically for immediate inclusion in the design.

- **Construction phase:** The governing body or oversight committee's role during construction is mostly that of inspection. The use of BIM both in the office and on the construction site increases the inspectors' knowledge and ability to compare the plans with on-the-ground practice.

- **Facility management phase:** Even if the project team disbands after the initial construction is completed, the benefits of BIM still exist. The information obtained by a client can be made available to other suppliers involve in the full life-cycle of the asset. The ability of an emergency response team to access this information in the event of a fire, accident or attack could substantially reduce risk to the responders, building occupants and the general public.

- **Demolition/deconstruction phase:** BIM will aid in identifying which elements can be recycled, reused and land-filled. It will also provide quantities and sequencing to facilitate safe deconstruction. BIM will help with the redesign, component reuse, and time and cost reduction.

BIM Challenges and risks

Organisations should also consider the risks and challenges emerging from the process of implementing BIM. As BIM is a developing methodology, implementing such a system is complex and challenging, as there are no acknowledged standards and procedures, though they are slowly developing. The challenges can range from commercial, legal and technical McAdam (2010).

There are challenges on interoperability, as different contractors in the supply chain use different BIM software products (NBS, 2012). There is also argument on whether the BIM model could stand as a legal document, as there are various stakeholders contributing to the model, there are issues on copy right, intellectual property, licensing of the shared data and ownership of the final BIM model (NBS, 2012). So there are more grey areas in the BIM implementation process that need clarity.

One of the effective ways to deal with these barriers and risks is to choose the right type of contract and to employ collaborative procurement (Azhar 2011, McAdam 2010). The usage of methods like integrated project delivery methods can help to share the risks of using BIM among the project participants, along with the rewards.

Some other factors include the stubbornness of people who keep to the old way of working and who don't want to change to BIM. They can be resistant to the introduction of BIM and unable to understand the importance of adapting existing workflows in a lean oriented manner (Morlhon, Pellerin and Bourgault, 2014).

A report published by Daedal Research (as cited in McAuley, Hore, West, 2017) reveals that the global BIM market is expected to reach almost $8 billion by 2020, at a compound growth rate of 13% between 2015 and 2020. USA and Singapore are more advanced in using BIM in their public projects. UK, Hong Kong and South Korea have taken aggressive steps with BIM initiatives in recent years. Scandinavian countries like Norway, Denmark and Finland have been working in this area for long time now (McAuley, Hore, West, 2017).

Leadership

It is imperative that government agencies take a leadership role to encourage BIM and digital transformation of the industry. BIM can provide significant benefits to publicly funded projects, public value for money and be a driver for growth and competitiveness (EU BIM Task Group, 2017).

The BIM process is growing within the construction sector and BIM will become the standard for delivering the world's public infrastructure projects (EU BIM task group, 2017).

The adoption of BIM across the wider construction sector is still at an early stage. Success lies in both a change in culture and technology. Organisations and project teams need to be open to innovative approaches which can improve project outcomes. They play a critical role in information management and knowledge management in projectized organisations.

There is no silver bullet approach to BIM implementation. The foundation stone involves assessing the current state of organisation planning and BIM readiness fooled by small steps on the ladder such as implementing BIM processes in the CAD or drawing control department and slowly target other departments in the organisation.

There is a need for a more collaborative approach amongst stakeholders to tackle cultural, contractual and legal challenges. BIM has a huge potential to improve project success in the construction industry, saving both time and money and the time to act is now!

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John McGrath has over twenty years' experience teaching, coaching and consulting on project management issues. His track record includes over 250 global companies, government agencies, state enterprises, Engineers Ireland, the United Nations, the London and Rio Paralympics, and the World Bank. John has a particular interest in developing PPM competency within organisations and gaining true visibility of the project/program pipeline, a process that he commonly refers to as "searching for a Single Version of the Truth". 20+ years of experience has taught John that excellence in project execution rarely happens without first achieving excellence in project planning. He develops master schedules for large programs of work and acts as an expert witness for forensic schedule analysis and delay claims. He has deployed Microsoft Project and Project Vision for projects in excess of €100 million. John is now a full-time project management consultant and lecturer at the Dublin Institute of Technology. John McGrath can be contacted at john.mcgratrh@dit.ie

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