Direct RESEARCH JOURNALS

Direct Research Journal of Engineering and Information Technology
Vol. 7(4), pp. 77-81, August 2020
ISSN 2354-4155
DOI: https://doi.org/10.26765/DRJEIT29087657011
Article Number: DRJEIT29087657011
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Review Paper

A Review on how Building Information Modelling can be used to Enhance the Management Building Life-Cycle Information

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Received 3 July 2020; Accepted 26 August, 2020

ABSTRACT: The construction industry is large and complex as such the flow of information tends to be slow and sometimes difficult, and this can slow the progress of the industries activities which are based on pressure and tight schedules to meet the target delivery, on time, on cost and of quality standard. The industry is characterized by adversarial relationships among the different parties and stakeholders within; effective flow of information among the parties can enhance this adversarial relationship which tends to be an obstacle to the industries progress. Therefore this paper has highlighted how Building Information Modelling (BIM) can be used to enhance the flow of information to the stakeholders within the construction industry. This paper also discusses how BIM could be use to enhance the collaboration and performance of tasks carried out by individual project teams for the realization of project goals and objectives. In addition, the paper also highlighted the importance and the expected benefit to be derived from using (BIM) to stakeholders in the construction industry.

Keywords: Adversarial relationship, building information modelling, construction industry, stakeholders

INTRODUCTION

Greater achievement can be realized by implementing building information modelling (BIM) in all phases of the building processes. Some scholars have defined (BIM) "as a process of generating, storing, managing, exchanging and sharing building interoperable in reusable way" (Vanlande et al., 2008). The use of BIM in construction projects can bring efficiency, effectiveness, and greater benefits to the whole project lifecycle giving the stakeholders the opportunity to achieve the desired project objectives, although understanding the benefit of BIM depends upon a proper execution and integration at the organizational level and industry level. Research has shown that "both business directors and IT directors of UK's largest contractors and consultants are fully aware of the benefits of advancement in information and communication technologies, and the main barriers to implementation relate to organizational readiness to change" (Alshawi, 2008). Scholars have given accounts about the benefits to be derived by implementing BIM in construction projects, "it provides a combined platform for the building design and as well, supports construction and project managements (Bryde, 2013). Use of BIM can also influence investment in the purchase of software and personnel training for the application of the (BIM) software. "The process uses a computer created design to produce the planning, designing, and

building and performance aspects of the scheme" (Azhar, 2008). If BIM is employed in construction processes it will help greatly in flow of qualitative information among the designers, contractors, stakeholders and manufacturers which will help in decision making due to its collaborated usage in the process. The objectives of this paper is to review the use of BIM, its contributions to design and construction processes and the usefulness and/or otherwise of using it in the processes and to provide recommendations on the effective use of the process in the management of constructions.

Understanding building information modelling (BIM)

Building Information Modelling (BIM) is termed as collaborative team building oriented model which is used to develop a project model for use by the project managers. Apart from supplying diagrammatical information, a BIM model contains inserted knowledge related to the useful behaviour of its components. In today's technology, a lot of project groups are collaborating and accessing project models for the harmonization purposes at different phases of the construction processes.

Although, there are 4D and 5D but the software system used is mostly 3D model for buildings where all the group members are familiar with its usage and harmonization process for achieving better results. The use of this particular coordination only, can reduce project cost over runs or even eliminated, which are mostly resulted from variation. A greater portion of design errors can be noticed earlier ahead of the start of work on the site which may reduce variation.

With the advance in technology, the use of information technology (IT) such as (BIM) in the developmental process of projects lifecycle will bring an efficient progress at different phases of the projects. In recent years the innovation in virtual design and construction (VDC) has given a unique perspective to design and construction by allowing 3D-based presentation of design information which eventually improve project and design collaboration in the processes.

The use of BIM for different activities during the lifecycle of a project can be seen during building design, structural design, and cost estimating and property management. According to Eadie, (2013) "there was a survey carried out on BIM usage which shows that it's frequent usage was, at the design stage (55%), construction stage (35%), feasibility stage (27%), and operational and maintenance stage (9%)". The use of BIM allows error detection in design which will add to human ability in the process of detecting errors. Figure 1 shows the interlocking field activities when using Building Information Modelling (BIM); it shows that both activities overlap which means the integration of the activities to achieve a project desired objectives (Figure 1).

(i) Policy Field: this consist the embedded policy in relation to the use of (BIM)
(ii) Technology Field: this contains the components and software's needed for the successful implementation of (BIM).
(iii).Process Field: this shows how BIM is being operated among the stakeholders in the industry.

The implementation process in project integration delivery

The building industry is facing a lot of enormous problems in terms "waste, delays and inefficiency", which are fundamental concerns to all and sundry. According to Autodesk Revit's White Paper (2005) "inefficiencies, mistakes and delays accounted for $200 billion of the $650 billion spent on construction in America annually, which means almost one third of the total spending is lost to waste". By implementing BIM in the project lifecycle it will help in the preparation of Project Execution Plan (PEP). With BIMPEP maximum benefits may be accomplished while programming, modelling, building and handling of the construction. The process give an integrated schedule for ensuring effectiveness in the arrangement of design and construction, at the same time groups are totally aware of their obligation in relation to putting BIM effects in the building progress. Once the schedules are developed then advancement versus the model are checked to obtain maximum benefits from BIM. Proper management of BIM can help in delivering higher levels project performance which is critical for most organizations (Figure 2).

Figure 2 shows that design and documentation process are continuous process and needs continuous refinement. Information are being exchanged and harmonized within the whole building group and each building stakeholder allows modification to his portion of the building when the needs arise. On the other hand process of setting up a collaborated flow of information in project delivery system is a complex process; it takes multiple step by step processes in a project and the Data Management Server (DMS) provider. The provider conducts a series of intensive educational program to stakeholders and teams prior to the start of the operation. "A lot of collaborations are required in the processes and within activities and the personnel required before the start of the operation" (London, 2009). The difficulty in establishing a BIM-server for a collaborated flow of information for project development is very high since the design based information conversion will demand a lot of harmonization due to the multiple degree of the information set, with different file design and tool compatibility issues. However, taking firm step in establishing the scheme that will promote identification of the dependencies can importantly minimize the amount

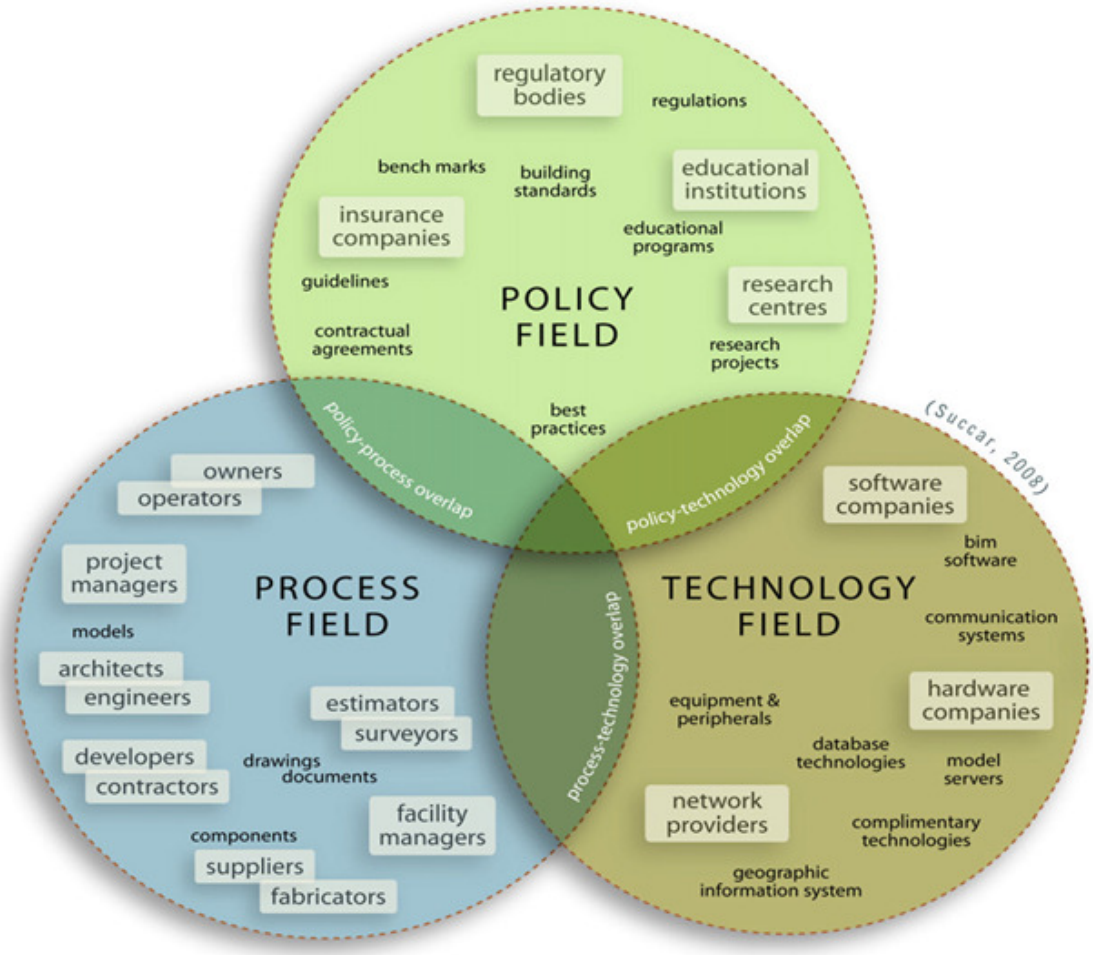
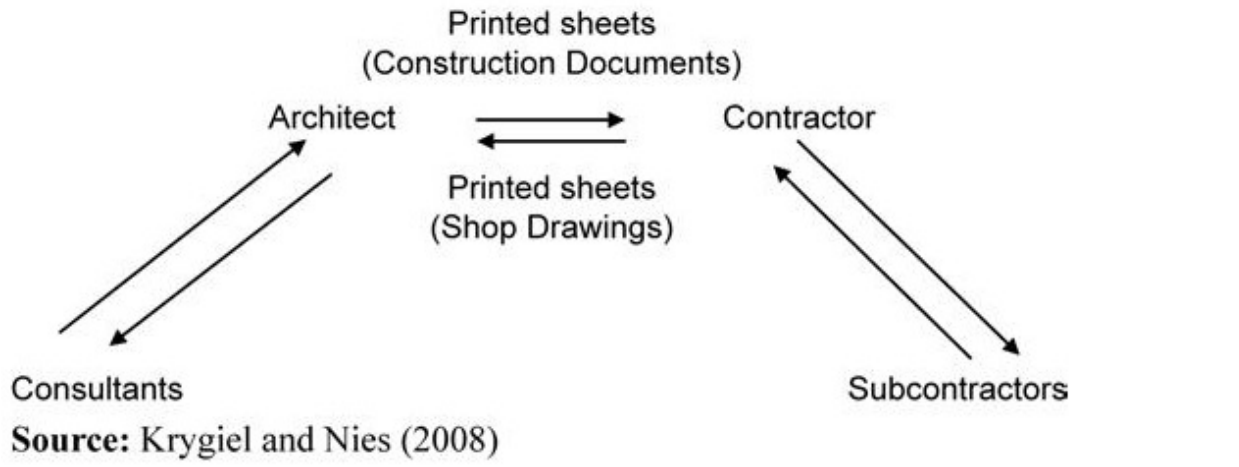


Figure 1: Three Interlocking BIM Activities - Venn diagram. Adopted from B. Succer/Automation in Construction 18 (2009) P 361.



Source: Krygiel and Nies (2008)

ADOPTED FROM Emerald Insight. Building Information Modeling (BIM) for Sustainable Building Design P. 142

Figure 2: The traditional method of design review.

of budget and time in setting up the process. In the current dispensation some industries have, customized their project documents to be use as a source of information in the execution of their project. Hence this provides confidence in the project development and the teams, terminologies and the procedures to be followed by all participants.

In general, there is need for the industry manager to cooperate with the project manager to have an in-depth knowledge about the document for proper information distribution as well as fundamental arrangement and internal user need on the DMS, as information is a crucial section of the DMS servers. The DMS provide numerous access types of information such as instant messages, texts massages, emails and voice information. The DMS synchronize information, and can be used for numerous purposes, in the project industry such as documentation, sending notifications, reminders and clarifications.

Design principles of building information modelling (BIM)

Construction projects consist of many stakeholders at different levels and stages and each project have different aim and different objectives and different project modes. Baskerville, (2000) put a recommendation that "Building Information Modelling systems should be highly flexible and adoptable to all situational stages of the project". This means that the systems should be dynamic and adoptable in order to cater for the customer needs and expectations of different stakeholders so as to promote the processes of choosing the possible function module. A good design takes into accounts the nature of the construction project users which is multi dimensional and diverse in approach. "The system also should be easy to operate in order to allow non professional to be able to master them" (Akintoye et al., 2012). "Due to the fact that project lifecycle Information Management encompass different personnel from different project stakeholders, an effective security control for access and management are designed and in cooperated into the system software to enhance the security of the Information Modelling System" (Schmitt, 2002).This assist organization to protect their databases from being operated by unauthorized or illegal operations.

Modifications of functions using BIM application

Building information model (BIM) consists of ICT support and device that help in building a united cooperation on the basis of developmental design access. "It is a computer presentation of functional parts of a structure and function as a shared information resource about a structure giving a specific basis for making decisions throughout its lifecycle from inception to operation" (National Institute of Building Sciences NIBS, 2007). Effective use of BIM promotes self-sufficient cooperative working condition. BIM is effective collaboration at distinctive levels of the development of a project it helps to insert, extract, and update or to exchange communication so as to encourage and express the function of the project stakeholders. "The eventual use of BIM, as a distributed digital description can transform a virtual information ideal to be guided from the drawing team, to the contractor, to the subcontractors, and to the client" (Sebastian et al., 2009).

The use of BIM have gone far than the use of digital (2D or 3D) drawings (Bratton, 2009). BIM as a model consist of all the project system and process information which are amalgamated, carefully planned, and allocated to all related project stakeholders as a principal plan for the project stakeholders during the building lifecycle which grows and manifest as the building advances. The use of BIM in the model process extends to multi-dimensional involving: 3-D envisages and specify, clash detection, planning, and material work plan, estimating cost, assembly and information as-built useful evidence. While in the building stage, BIM can help in enhancing information among the project site, the industry and the model office which is critical for an impressive and effective project procedure also solving problem related issues from unforeseen error. At the time the structure is being use, BIM can be employed together with the project procedure to deliver and sustain current information about the execution of the building together with the life-cycle costing.

The applicability of BIM to sustain a maximum, difference and cross-phase collaboration has lead to a fresh perspective in the function and association among the project stakeholders. The most related problems are: the new function of a plan manager; the payment arrangement in accordance with the type of contract procurement method; and the utilization of international model as well. Cooperative working and mode of action using BIM demand new function from a design manager with knowledge on ICT and construction knowledge. The model managers work with the methods likewise the stakeholders. The manager uses his expertise to give technological solutions expected for proper function of BIM by managing the flow of information, and encourage the ICT skills of the project stakeholders.

Benefits to be derived by using BIM in delivering building projects

(i) When 3D is used it will promote the harmonization of information between the project players, and the stakeholder involvement in the scheme.
(ii) It will promote maximum flow of accessible information as well as exchange for a greater standard of the drawings and control in all the phases.

(iii) Coordinating the architectural design with structural analysis, estimating, and planning.
(iv) Collaborate evaluation and design against the programme and specifications.
(v) Minimizing redesign costs during planning and building process.
(vi) Maximizing the management of the structure and operation.
(vii) Getting rid of waste.
(viii) Intensify response.
(ix) Securely express.
(x) Inherent honesty;
(xi) Bestow authority on the team.

CONCLUSION

The review has shown the use of Building Information Modelling (BIM) has given opportunity to account for a precise and perfect documentary storage of project information in the entire project plan and building process. It highlighted that in the early stage of its development, architects and the contractors using BIM in a collaborative project environment can reduce the information deterioration which sometimes occurs in between the planning and building phase of the project, as long as the database and potential ability of BIM are totally put to practical use. The paper has also identified some benefit to be derived by using (BIM) in a collaborative project delivery. Even though some countries have started imposing the use of Building Information Modelling (BIM) like UAE which started in January 2014 and UK in January 2016, it will take time for the building and project team members to acquire the software, hardware provide training to personnel to be conversant in BIM and 3D harmonization. The project owners will also be required to expend money in the same technical methods and process in giving extensive drilling to their personnel in maintaining the model.

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