

GREEN INTEGRATING BUILDING INFORMATION MODELING (BIM)

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ABSTRACT

Green BIM" is a term that refers to the collaboration between Building Information Modelling (BIM) and green building. This collaboration aims to include environmentally friendly practices, particularly those that emphasize energy efficiency, into a structure from the beginning of its construction all the way through its lifetime. In spite of the fact that it does not have a suitable meaning in the academic world, this new word has been gaining popularity in the fields of architecture, engineering, and construction. This notion has to be adopted early on in the project so that better judgments can be made, which in turn helps any construction project operate more smoothly and effectively. As a result, it is becoming more evident that this idea needs to be applied. The Green Structure Information Modelling (BIM) system should not only be expanded to include the phases of construction, operation, maintenance, and demolition, but it should also be disregarded in the quest of environmentally responsible design.

Keywords: Green , Integrating , Building , Information , Modeling

INTRODUCTION

The most recent upheaval in the construction business may be seen as a paradigm shift, according to one point of view. The term "lean construction" (LC) refers to the process of applying the ideas, techniques, and practices of lean manufacturing to the building industry. When referring to this particular method, the phrase "lean construction" is used. According to Mossman (2018), Mao and Zhang (2008), Salazar et al. (2017), and Sacks et al. (2010), the stated objective of liquid chromatography (LC) is to give the desired service or product with the expected value while simultaneously decreasing waste. This objective is mentioned in the literature. Having a solid understanding of the value from the perspective of the consumer is very necessary in order to accomplish this goal. Building Information Modelling (BIM) is a collection of tools, processes, and policies that enable various parties to collaborate virtually on the design, construction, and operation of a building. Sustainability in construction can be defined as the commitment and consistency in the responsible use of resources (both in terms of quantity and quality) in building. BIM is also referred to as "BIM." This degree of dedication and dependability is necessary in order to achieve sustainability in the construction industry. We guarantee that the present generation will not have to cope with the negative affects that building has on their life by doing so. Additionally, we ensure that future generations will be able to build upon our accomplishments by leaving behind a clean and healthy environment as well as appropriate resources.

BIM TOOLS: Reduce Wastage and Excessive Resource Consumption

In order to reduce the amount of resources that are wasted and the amount of consumption that is excessive, project participants in the construction industry should adhere to the sustainable construction principle and the notion of sustainability. In addition, they should make use of contemporary techniques and methodologies such as building information modeling (BIM) tools.

Conventional construction projects often face a broad variety of challenges, which have an effect not only on the community that is around the project but also on the project itself. The neighborhood is often the one that suffers the most from these issues. The issues that have been cited in the past include, but are not limited to, cost overruns, resource depletion, waste creation, time overruns, excessive resource use, and all of the aforementioned concerns.

To produce modifications that are more effective, it is necessary to do research on the building techniques that are already in use. Having said that, it has been observed that inquiries into the procedures and activities related to the building business are required in order to make adjustments that are more effective. Nevertheless, these enhancements are attainable with the use of cutting-edge and established technical approaches, such as the implementation of Lean construction techniques, Value Engineering, Supply Chain Management, and the utilization of digital technology. On the other hand, in order to lessen the challenges that are linked with the conventional approaches to construction, it is essential to modernize and improve the processes that have historically been used. The reason for this is because it has been shown that the conventional methods are the ones that cause the greatest problems.

When combined with a sustainable design, the use of building information modeling (BIM) tools may make it possible to achieve sustainable construction. It is possible that this will begin from the preliminary phases of design or conception and continue all the way through the construction, operation, and ultimately the demolition of the structure. Because of this, it is possible to implement environmentally responsible construction techniques. As a consequence of this, this is especially beneficial for the enhancement and durability of the structure.

Construction and environmental protection using sustainable BIM model

In the realm of architecture, engineering, and construction (AEC), the practice of Building Information Modelling, which is also referred to as BIM on occasion, is garnering an increasing amount of popularity. The reason for this is that it makes the whole process of constructing more efficient, starting with the very first step and continuing all the way through to the very last step. It does this by providing a digital representation or model of the structure that is loaded with data. This allows it to do the same thing. Due to the fact that it provides support with decision making and helps to improve the manner of carrying out the process, this model is advantageous to a substantial number of the stakeholders who are participating in the process.

This presentation will concentrate on the development of Building Information Modelling (BIM) in the construction industry, as well as the reasons for its usage, including the technologies that are involved in the

production of these digital representations. Additionally, the session will discuss the reasons for its introduction. Examining the development of Building Information Modeling (BIM) is the purpose of this talk. Increasing one's degree of modeling is a complex subject that encompasses a great deal of legal and technical information. This knowledge was developed with the intention of standardizing the use of this strategy as well as the responsibilities that are associated with its execution. The process of standardising the use of this method was the motivation for the development of this expertise. Because it is presumed that the reader is already familiar with the material in issue, the standards and norms will not be required as a theoretical foundation for the purpose of this research. This is because the reader is already familiar with the information.

The overarching principles of sustainable construction place an emphasis on the methods of constructing or building a construction project using methods that are responsible for the environment, society, and the economy; and also in a manner that is resource efficient with regard to all phases of the project, including site selection, design, construction, and operation. This is because sustainable construction is considered to be the most environmentally friendly and economically responsible method of building. Construction Information Modelling (BIM) is an essential component in the process of achieving sustainable construction and protecting the environment through the implementation of sustainable design. This is due to the fact that sustainable construction is one of the construction practices that is the most environmentally conscious practices. One of the most significant benefits of using Building Information Modelling (BIM) is that it enables design teams to prepare for the most effective use of available resources. On the other hand, Building Information Modelling (BIM) may be characterized in a variety of various ways, such as a construction management system, as a model, and as a data design all at the same time. These are only some of the possible definitions.

OBJECTIVES OF THE STUDY

1. To study on Construction and environmental protection using sustainable BIM model
2. To study on BIM TOOLS: Reduce Wastage and Excessive Resource Consumption

Benefits of BIM in Sustainable Construction Projects

In accordance with the findings that Gourelis and Kovacic (2017) have uncovered, Building Information Modelling (BIM) offers a significant number of benefits to construction projects that are beneficial to the environment. There are a number of potential benefits that may be achieved from this, including the promotion of collaboration among stakeholders, the growth of efficiency, and the reduction of waste. The decrease of trash is another possible advantage that might be associated with this. According to Djuedja et al. (2018) and Chong et al. (2017), one of the most major advantages of Building Information Modelling (BIM) is its ability to generate three-dimensional models that are accurate and complete. This is one of the most significant benefits of BIM. BIM offers a number of benefits, but this is among the most important ones. As a consequence of this, these models make it feasible to integrate enhanced planning abilities and visualization capabilities. Because of this feature, it is feasible for project teams to identify potential design flaws at an early stage of the process. This is a significant advantage. As a result of this, the amount of time and money that must be spent on costly rework is reduced, and it is ensured that resources are used in an efficient way

for the purpose of achieving the desired results. In line with the conclusions of Nechyporchuk and Bašková (2020), it has been established that Building Information Modelling (BIM) have the potential to limit the risk of over-ordering and waste by allowing correct material quantification and scheduling.

As a consequence of this, this helps to contribute to the management of resources in a manner that is more kind to the environment. Building information modeling (BIM) is stated to offer a contribution to the enhancement of energy efficiency via its integration with energy modeling tools, according to Oladiran, Simeon, and Anyira (2022). This is an extra point of interest. Using these technologies, it is possible to simulate the performance of a building under a wide range of different situations as they occur. This is a possible outcome. When engineers and architects make use of this feature that is accessible to them, they are able to assess a wide range of design alternatives and make decisions that are well-informed, which eventually leads to an increase in energy efficiency. There are a number of options that might fall under this category, some examples of which are the optimization of insulation, the selection of equipment that is energy-efficient, and the inclusion of renewable energy sources.

According to Chen et al. (2017), projects that make use of building information modeling (BIM) have the potential to provide reduced operational costs and decreasing carbon footprints. This is especially true for projects that are environmentally conscious. This is in accordance with the results that were discovered by the researchers described before. Consequently, this results in an improvement to the building's long-term viability, which is in accordance with the goals of sustainability that are being pursued all over the globe. In addition to this, the use of Building Information Modeling (BIM) increases the likelihood that the building will be available for utilization in the years to come.

Implementation Of BIM

The adoption of Building Information Modelling (BIM) may be a decision made by the stakeholders of the project before it has even begun, specifically in relation to the reduction of costs or the enhancement of communication; however, it may also be a move that is imposed upon them, mandated by legislation or customers; the following are some of the primary reasons for the adoption of BIM:

- **Government pressure:** Since it has adopted legislation that compels the use of Building Information Modelling (BIM) on all projects that receive public financing starting in the year 2016, the government of the United Kingdom is regarded to be the best example of government pressure. This is because the law was enacted in 2016. These criteria were devised for no other reason than to facilitate the production of buildings that are not only good to the environment but also economical.
- **Client pressure:** The client will always have the expectation that the project will provide the best possible outcomes, which will eventually result in lower costs and will be finished ahead of schedule. Not only does an informed consumer require that the contractor be able to supply Building Information Modelling (BIM), but they also inquire about the contractor's competence in previous projects with which they have worked. Because of this, a significant number of professionals working in the

Architecture, Engineering, and Construction (AEC) industry are compelled to adopt BIM, even before the needs of the government oblige them to do so.

- **Innovation and competitiveness:** Since the inception of this technique, a segment of the construction industry has taken the choice to adopt BIM with the plain purpose of staying one step ahead of the competition. Other construction industries have also made this decision. This choice was reached in light of the fact that the advantages of supplying the customer with the most current and most sophisticated capabilities were more than enough to outweigh the challenges that are associated with early adoption.

Green Integrating Building Information Modeling (BIM)

"Green BIM" is a term that refers to the collaboration between Building Information Modelling (BIM) and green building. This collaboration aims to include environmentally friendly practices, particularly those that emphasize energy efficiency, into a structure from the beginning of its construction all the way through its lifetime. In spite of the fact that it does not have a suitable meaning in the academic world, this new word has been gaining popularity in the fields of architecture, engineering, and construction. This notion has to be adopted early on in the project so that better judgments can be made, which in turn helps any construction project operate more smoothly and effectively. As a result, it is becoming more evident that this idea needs to be applied. The Green Structure Information Modelling (BIM) system should not only be expanded to include the phases of construction, operation, maintenance, and demolition, but it should also be disregarded in the quest of environmentally responsible design.

In a variety of different ways, Building Information Modeling (BIM) has the potential to provide strategic assistance for environmentally responsible design. You can find strategies to reduce energy costs among these, such as selecting the appropriate orientation for the building, optimizing the building envelope through form analysis, analyzing day-lighting and water harvesting to reduce the amount of water that is used, modeling energy consumption to find ways to reduce it, and analyzing materials to reduce the amount of waste that is produced.

Despite the fact that day lighting and energy analysis tools have been available for quite some time, team members seldom make use of them while they are engaging in the design process. The reason for this is because these programs need complex calculations, specialized expertise, and significant financial investments due of their nature. However, in the early phases of a project, when resources are limited, it is frequently not feasible to get data on the project's energy performance until after it has been completed. This is because large projects may have the means to engage an outside business to undertake the study. Green building information modeling (BIM) has brought about a shift in this regard since it provides sufficient data for the BIM tools that are now being used to conduct studies at an early stage in the design cycle and on a regular basis in order to revise the design choices.

Technological advancements in the areas of energy modeling and analysis have gone a long way over the years. Integrated Environmental Solution (IES-VE), Ecotect, EnergyPlus, eQuest, and Green Building Studio are some of the applications that fall under this particular category. As a result of the fact that energy analysis has an impact on both the efficiency of the design and the total cost of ownership inside a facility over the course of its lifespan, adoption of energy analysis at the early phases of a project is now regarded to be of utmost importance. Building information modeling (BIM) software, such as Ecotect and the Integrated Environmental Solution (IES-VE), has the capability to simulate a comprehensive assessment of the performance of a building. Building codes, resource management, solar energy, lighting, acoustics, temperature, ventilation, and circulation are all components that are included in these models by their very nature. These simulations are able to become operational as a result of their connection with modeling programs such as Revit.

Additionally, previous debates on modeling programs such as Revit and ArchiCAD will get a greater amount of attention in this article. These environmental analysis approaches will be investigated in more depth as part of the project.

It was abundantly evident that including Green Building Information Modeling (BIM) into the project from the very beginning would result in a significant difference. A further way in which sustainability may be accomplished is via the choices that are made right from the beginning of the design process.

Building information modeling (BIM) guarantees that software simulations and analyses be used to their full potential throughout the lifecycle of the facility when it is utilized extensively throughout the design phase. In the next section, we will discuss the many phases of the lifespan, as well as the ways in which Green BIM may be included from the very beginning in order to accomplish sustainable practices.

Building information modeling (BIM) has previously been discussed in terms of how it might assist with the planning and design of a project; now, let's take a look at the most typical advantages of using BIM. These documents address a broad range of themes, such as the orientation and massing of the structure, daylighting, water harvesting, energy efficiency, material sustainability, site management, and the energy performance of the project.

- **Building construction process:** Several studies are now being carried out in order to investigate the on-site monitoring of carbon emissions that is being carried out with the assistance of BIM tools. In order to optimize the usage of building processes such as concrete truck mixer routes in order to decrease carbon emissions, one example of this would be the use of Building Information Modeling (BIM) in combination with the integration of Geographic Information System (GIS) technology.
- **Building operation:** It is feasible that the benefits of adopting BIM from the beginning stages and being able to continue with the methodology throughout the utilisation phase of the facility might aid in the attainment of efficient sustainable practices and operations. The increase of user comfort, the decrease of the frequency of crises linked to maintenance in the building, the enhancement of safety

performance, and the reduction of resource waste are some of the benefits that are included in this category.

The analysis of the requirements for heating and cooling, the evaluation of daylighting in order to minimize the amount of lighting loads, and the selection of suitable building equipment that may successfully reduce energy consumption are some of the applications that may be used.

Building destruction: a facility that employs BIM from the beginning to the finish might accomplish a totally sustainable process, including demolition, by using BIM tools. This would be possible since BIM is used throughout the whole process. These technologies are able to, for example, compute the precise information on volumes and materials to estimate trash, which helps with the forecast of the amount of transportation that is required for disposal fees.

It is crucial to understand that Building Information Modelling (BIM) is always accomplished using a variety of tools or apps, despite the fact that it might be present in each and every step of a building's lifetime. For this reason, it is of the utmost importance to design a building information modeling (BIM) tool that is capable of providing management of the environmental sustainability of a structure from the very beginning to the very end. Certain software producers, such as Autodesk, have started working on the development of these essential tools in response to the incorporation of cloud-based technologies into energy analysis tools. Nevertheless, in the not too distant future, there need to be a program that incorporates cloud computing and the administration of additional aspects that are associated with green building information modeling (BIM).

CONCLUSION

The study was carried out in four distinct stages: The data collection and empirical analysis of the questionnaire survey was carried out using the PLS-SEM analysis (a quantitative approach) in order to gain an understanding of the current state of BIM adoption, its enablers, inhibitors, and implementation benefits within architectural firms in India. Additionally, semi-structured interviews and focus groups were conducted in order to study and identify native functions of BIM, as well as the inter relationship between various BIM capabilities, using the ISM analysis (a qualitative method). Extensive secondary research was carried out in order to formulate the lean and green outcomes (a qualitative method). Finally, case studies analysis was carried out using the QCA technique in order to validate the framework (a qualitative and quantitative method). This led to the synthesis of the results of the four phases. After coming to this realisation, the hybrid way of research methodology finally resulted in the construction of a framework for BIM-based organisational capacities. This framework was comprised of three unique hierarchical levels, which were the technology layer, the process layer, and the outcomes layer. Using the ISM approach, thirty-three native BIM functions and fifteen BIM capabilities were built. These were all successfully implemented. Further evaluation of these skills was conducted to determine their nature, and MICMAC analysis was used to reach a conclusion. Lean advantages and green benefits of using green and lean principles on construction projects were determined with the assistance of a thorough literature research.

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