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BARRIERS TO IMPLEMENT BIM IN PAKISTAN

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Abstract- Building Information Modeling (BIM) is a 3-D Model-Based process of creating and managing data, which assists designers, contractors and engineers. Moreover, contemporary technologies are assisting engineers to fulfill the expectations of customers in an effective way, as the demands of designs are getting complicated with every passing day. As a result, by utilizing the theory of BIM, engineers can build, design and handle infrastructures and buildings in a facile way. The implementation of BIM in Pakistan is very low as compared to the gulf and other developed countries. In Pakistan, the ratio of BIM is only 11% [1] because of using traditional methods, which can easily be handled with the help of BIM. BIM is more economical than using traditional methods of construction in terms of cost and time. The implementation of BIM in Pakistan faces many barriers, for instance, awareness issues, shortage of BIM professionals, problems of investment in new technologies, etc. This paper aims to identify the problems that hinder the acquisition of Building Information Modelling (BIM) in Pakistan. Also, we highlight the solutions to implement Building Information Modelling (BIM) in Pakistan. Furthermore, we have suggested a roadmap to improve the implementation of BIM in Pakistan.

Keywords- Building Information Modelling (BIM), Barriers in BIM implementation, Solutions, Road map.

1 Introduction

Building Information Modeling (BIM) is a 3-D Model-Based process of creating and managing data, which assists designers, contractors and engineers. Moreover, contemporary technologies are assisting engineers to fulfill the expectations of customers in an effective way, as the demands of designs are getting complicated with every passing day. As a result, by utilizing the theory of BIM, engineers can build, design and handle infrastructures and buildings in a smooth way, as it assists professionals having better collaboration by yielding vital insights of the under considered project. BIM is not only a 2D or 3D modeling process of visualization, but it is more about providing details and information about how buildings will function effectively. The model components are correlated, and design parameters are defined with the help of the data in the model. By varying the parameters of the model, whole window gets updated with respect to the variations in terms of elevation, sheet views and section. The management of building design and project data in digital form across the course of a building's life cycle is now possible thanks to the new approach known as BIM, which also allows for information sharing and interoperability among stakeholders. Construction industry players have adopted it and are increasingly implementing it in a variety of fields due to its potent benefits for reducing costs and time while enhancing production and efficiency [2].

BIM is very popular in the world because, in BIM based software's like Revit, we can collaborate with Structural, MEP (Mechanical, Electrical, and Plumbing), and Architectural. When we open a file in Revit, then Structural, Architect, and MEP can access the file and start their working. Since its release in 1997, Revit has been revolutionizing the field of architecture and construction. Contrary to other software's that are dependent upon one thing, in Revit, we can perform Structural, MEP, and Cost Scheduling work simultaneously, and in fact, Interior, Exterior, and landscape views are also visualized in Revit through BIM. In BIM software's, we can quickly generate a design during the planning by automatically

generating the view in 3-D on an alternate window. The main and the most important feature of BIM is collaboration and communication, so that builders and architects can do their work on the same project without any disturbance. Also, the model gets updated when one work is done, while others who are associated with the project can access it. BIM is significantly vital in terms of improving efficiency, particularly during the time intervals of construction and designing, as it assists in decreasing the required time without compromising on cost and efficiency. Furthermore, better clearness can be achieved, if we opt for BIM from starting to the completion of a construction project. It enables important stakeholders to view digestible, day-to-day pictures of development on the construction site, in addition to the benefits provided for subcontractors.

These real-time summaries aid communication and reduce the amount of rework that a project requires overtime. Because all subcontractors on the project have access to the same centralized BIM designs, they can communicate with one another and share critical information. If someone is making a change in the project, then everyone who is associated with the project can see it. By using old methods of construction, there are lots of chances in terms of materials wastage like cement, sand, bricks. A BIM based 3-D model can also assist in reducing the quantity of the required materials. With the help of BIM, we can know the material quantity by cost scheduling during the pre-construction. For example, if we want to construct a wall of building, then we will already have the estimations such as how much bricks and mortar are required to construct the wall, as we already have visualized the wall in 3-D. Actually, BIM can be applied in variety of disciplines in terms of construction life cycle, from conception to implementation of the finished structure. Kreider & Messner used BIM 25 times during the project, from start to finish. Because of many factors such as cost, time, and resources, the specific usage is dependent on the project's goal [3].

In the planning phase, we create the 3-D of the project and then we move to the existing condition modelling in which we create the 3-D model of the present situation of the site along with the available facilities on the site. This model can be created in many ways like by conducting surveys depending on which method is suitable for the present condition. We can make cost estimation more accurately and in a detailed way using BIM. It has ability to attach information about materials and their cost, and we can make changing for the future. We then move to the phase planning stage in which we make the scheduling (4D) that tell us the start and the finish time for our project. The site analysis for that BIM/GIS tool is then utilized to compute the parameters in the desired region to compute the most favourable site region for the upcoming experiments. The design phase involves scheduling and estimation (4D&5D). The scheduling ensures the building will be ready within the time and the estimation gives the idea about the cost of the materials. We then analyse our structures to establish the distribution of internal forces, moments, stresses, and displacement on the building to investigate the stability of the structure. Energy analysis can also be done to calculate the building energy performance. After completing the design process, the next step is to start the construction. As we have already computed the estimated cost and scheduling, we will have the idea, such as which and how much required amount of materials are needed to be purchased from the market. BIM assists to manage price and schedules, improving accuracy, efficiency and quality during the construction. In terms of operation, it involves the building maintenance scheduling, which proves to be quite beneficial in maintaining buildings along with their working functionally. The building system analysis then assesses how well a structure performs in comparison to its design. This entails how a building's mechanical system works along with the power consumptions. We then come to the asset management and disaster planning of the building [4]. The purpose of this paper is to identify the barriers that Pakistan is facing in way for the implementation of BIM, its solutions. At last provided a road map to implement BIM in Pakistan.

2 Literature Review

Building information modelling (BIM) is a procedure that turns the building industry's fragmented, antiquated methods into a seamless, modern one. To collect, generate, analyze, and manage the digital representation of the produced project model, many tools, technologies, and contracts are used. Scheduling, costing, and facilities management are just a few of the applications of BIM, a well-known n-D modelling platform for effective communication and cooperation. The construction sector benefited greatly from the deployment of BIM across the project life cycle [5]. BIM has demonstrated its ability to increase productivity and efficiency during the design phase. BIM can combine automatic scheduling and cost analysis during the construction stage, allowing for improved project delivery coordination and quality [5]. BIM's origins may be traced back to the 1950s, when computer-aided design, or CAD, was first used. During 1960s, Hanratty created the first commercial Computer-Aided Machining (CAM) in 1957. In 1963, Ivan Sutherland created CAD software by

developing a Sketchpad, which is a graphical user interface. Actually, Sketchpad was an application that allowed the user to create drawings. Interface with the application graphically using a display, a light pen for drafting, and a pair of tabs on which the designer could input settings and limitations. In 1970s, during the transition from two-dimensional (2D) to three-dimensional (3D), CATIA was created by the French Aerospace Company. CATIA is a well-known software program. Actually, the creation of BIM takes us to the era of 1970s, when AIA journal published a paper, written by Charles M. Eastman, related to the prototype functioning which debated on the vital parameters that collect information from facades, maps, sections, and viewpoints. Moreover, instead of entering changes many times, all the relevant drawings get updated with merely a single change, which helps in the computation of cost with the aim of having the desired supplies and tools being accessible rapidly [6].

2.1 Barriers in BIM Implementation

Most people in our country do not know about BIM because there is a lack of awareness. They complete their projects without using BIM. The ratio of BIM used to complete projects in Pakistanis is quite low due to using old methods of construction which enhance both cost and time. Also, the initial investment cost of BIM software and Hardware is quite high, as the training is also expensive and there are not enough resources available to install BIM in system hardware. It is expected that BIM will yield crucial advantages to industries (AEC), but its adoption and execution demands price as with contemporary devices. The implementation of BIM technology requires a lot of financial resources in terms of training, education, administrative and initial investments, and costs during the transitional period. Due to the requirements of high financial resources, mostly large industries opt for BIM. Also, we require high storages devices and certain software's for the execution of BIM, which further enhances the required amount. These high-cost issues enhance the distance between professionals and BIM in terms of its adoption [7&8]. There are less experts in Pakistan who can implement BIM in the construction sector because of the BIM software issues in terms of learning and complexity among the engineers, and they prefer the old method to complete the project. The construction firms of our country are also not affiliated with BIM, and they complete their construction projects without using it. In fact, clients also don't know about BIM; therefore, they do not demand to complete their projects by using BIM [9]. The lack of skilled or well-trained BIM professionals is one of the main obstacles in terms of adopting BIM in the development section, since productivity of BIM is completely dependent on the qualification of the person using the BIM tool. For the successful implementation of BIM, the project team members must be skilled in their respective specific field regarding BIM. Implementation of BIM has the barrier of several legal aspects. One of the most important aspects is related to the ownership of data. There is always a conflict of interest among the owner and developer, but sometimes the claims are also made by architects and designers. There is no universal solution to this problem, but can be managed by case to case and project to project depending upon the circumstances of each project. Another important problem in this field is related to the rights of accessing and controlling the data, as every partner claim to possess access and rights to keep, modify and control the data. In case of multiple accesses, the issue of inconsistency, inaccuracy, and irregularity of data may happen, and no one will be ready to take responsibility of that issue [10].

2.2 Solutions

The top three strategies for increasing the adoption of BIM in Pakistan are Workshops**,** Lectures**,** and Conference Events [11]. To familiarize people with BIM, it is required to conduct workshops, arranging seminars, and group discussions to spread awareness of BIM among people. The advantages of BIM should be emphasized to the organization's decision-makers, so that they support and set up seminars, conferences, and workshops on BIM for their staff. By providing incentives and compensation, businesses should keep their skilled and knowledgeable workforce. The next step is to open coaching centers to teach about BIM with no or minimum amount of fees. Top management should train workers on contemporary advancements in the field to overcome conventional ways of thinking.

By overcoming the reluctance to co-operate with other BIM professionals [12], clients should be informed about the benefits of BIM technology so they can better understand its uses. A standardized approach should be taken by the government when deploying new technologies. Consistent policy should be followed and legal difficulties should be resolved [13]. It is essential to equip students with the theory of BIM in educational institutes with the aim of improving the skills of upcoming young generation. Conference events should be organized to enhance public awareness.

2.3 BIM in Pakistan

Undoubtedly, the development sector is considered as the backbone of Pakistan's economy. It is one of the most employment-producing sectors in Pakistan. From 2016 to 2017, Pakistan has witnessed a growth of approximately 9.05 % in the development sector [14]. Unfortunately, the percentage of using BIM in Pakistan is only 11% [1]. This is because we are still using traditional methods of construction which enhance the cost and time. Also, the development sector of Pakistan is experiencing serious issues due to inadequate organizing, misconduct problems, alternations in the design and scope, and quality problems [15]. Moreover, in addition to the above discussed issues, other issues, such as improper designs, time problems, delays in terms of accepting projects, disputed between the organizing staff members, insufficient actions, and the communications issues between the required organizations [16].

Meanwhile, BIM is utilized in many developed nations, such as in Germany, it is 90%, in the U.S.A, it is 79%, in Canada, it is 78%, in the U.K, it is 74%, in China, it is 67%, in Europe, it is 42%, in the Middle East, it is 25%, in India, it is 22%, and in Pakistan, it is only 11% [1]. We can see the difference in terms of implementing BIM in developed countries and other developing countries like Pakistan. It is pivotal to resolve the issues of development sector by introducing national polices at the government level. It is essential to make action plans at the national level along with taking all the required steps in terms of resolving the issues of the construction industry [17].

3 Future Frame Work

The Higher Education Commission (HEC) may start BIM as an academic course in colleges and universities to aware people about BIM. In Pakistan, most of the clients do not want to create their house or building in a 3D model because they do not want to spend money creating 3D models, as they are unaware about the benefits of BIM. Therefore, the benefits are required to be discussed with customers with the aim of raising awareness related to BIM applications.

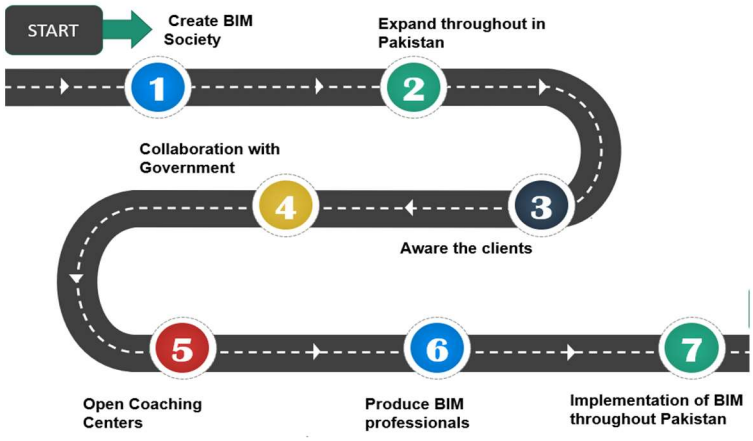

Fig 1: Proposed plan to improve the implementation BIM in Pakistan

The Implementation of BIM in Pakistan is only 11% [1], which is extremely less by comparing it with other developed nations. To increase the implementation of BIM, we will have to initiate some important steps ourselves by creating a BIM society and engage with people which are interested in BIM like architects and engineers working in different firms of Pakistan. After creating the society of BIM, we can possibility expand it towards different major cities across Pakistan where the construction ratio is high like Islamabad, Karachi, Lahore, Peshawar, and Quetta, and also advertise it on social media platforms as possible. People in developing countries like Pakistan do not know BIM. They complete their construction project without BIM because the implementation of BIM is quite low. Furthermore, the people of the society like architects, and engineers working in different firms should share the advantages of BIM with their clients, so that the maximum number of people get interested to complete their construction project by using BIM. In addition, the BIM society should collaborate with the government and raise our concerns about the implementation of BIM. For its implementation, we should open coaching centers to teach about BIM. BIM society which is working across Pakistan should conduct more workshops, and conference events on a domestic level and also some lectures in the universities, so

that people have better information about BIM. Conducting workshops, and conference events will help to deliver our message to more people, allowing more interest of people in this field along with helping to create more BIM professionals. As the number of BIM professionals increases, there will be more chances of increasing the implementation of BIM in Pakistan.

4 Relevance of Research

The purpose of this paper is to implement BIM practically in those regions where the ratio of BIM is very low. So, the results of this paper will prove useful for them to implement BIM practically in their field.

5 Conclusions

The following conclusions can be drawn from the conducted study:

1. BIM is a suitable platform for the AEC professionals because it helps to eradicate communication gap among various stakeholder's communication, collaboration, and reduce fragmentation. As a result, understanding the concept of BIM is required to assist stakeholders in the AEC industry in adopting and implementing BIM.

2. There will be less wastage of time and materials in construction, as BIM aids in finding the exact material quantity, cost estimation and scheduling during the pre-construction phase. BIM is helpful in detecting the clashes amongst various models of any construction project prior to the real execution. Thus, it reduces the design and execution complexities.

6 Recommendations

Following recommendations can be drawn from the conducted study:

1 Workshops, seminars, lectures, and conferences on BIM can help spreading awareness about the benefits of BIM. They will also help in bringing the professionals at different levels in contact with each other.
2 A dedicated society of BIM can play a vital role in the implementation of BIM at gross levels even in developing countries.
3 Collaboration with BIM professionals at national and international levels can help in capacity building of developing countries.

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