Increasing Adoption of BIM in Indian Construction Industry

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Abstract:
In recent times the increase of people and documents involved in the construction industry has led to a much more complex industry. In this environment of unstructured data, BIM is a relatively new promising tool to the Architecture, Engineering and Construction (AEC) industry which enhances huge construction projects to be realized virtually before it takes actual construction on site. The Indian construction industry is currently facing enormous technical and institutional advancements. A survey conducted has shown results that the awareness and adoption of BIM has gradually increased over the years and there is more scope to still increase its adoption. Although India has been technologically slow and it has shown no difference in adoption of BIM in the AEC industry. An overall analysis proves that BIM has been beneficial for those using it for majority of their projects and have incurred huge savings in name of cost, time, labour and materials. Risk has been mitigated due to certain extent by the use of BIM. It has indicated to be an advantageous tool to from information models about the construction projects which support in the designing, operation, planning and maintenance phase of the project. It has been utilized for life cycle analysis, sun path analysis and various kinds of energy analysis. Its adoption has resulted in significant efficiency by increasing quality of work, accurate quantity take off, better planning and scheduling. The visualization has optimized and has aided in delivering projects with minimum wastage. This paper studies the various aspects of BIM application in Indian Construction industry, while considering methods to act as a catalyst to increase BIM adoption while evaluating its status and future impacts in India. A survey was conducted among various construction and architectural professionals in the city of Mumbai and a total of 140 responses were collected. The data was further analyzed and the result is portrayed in this paper.

Keywords: Building information Modelling (BIM), India, Data Analysis, Construction industry.

I. INTRODUCTION

The global construction industry has the characteristic of having each development genuine, unique and ephemeral. With the advent of technology, other industries have modernised and improved their processes by updating with the latest technologies and methodologies but the AEC industry is still labour intensive and follows the same traditional process of generating CAD 2D drawings and constructing building. This data represents only graphical information like line, circle and shapes with respect to length and breadth.

Graphical Plans, sections and elevations are distinguished in a way such that visualisation demands for manual modification in all other view making it excessively hectic and error prone. BIM represents each of the elements of building component like walls, beam and column in three dimensions by adding depth. This Building model thus created gets updated in every view with modification in any one of the view which saves time and minimises errors. BIM as a process is primarily focused on creating different models by adding time, cost and energy analysis in the existing 3D model. BIM when integrated with time gets to be a 4D model with time as the fourth dimension and when it is connected with money it gets to be 5D model with cost as the fifth dimension and this can go up to "nD" where "n Dimension" will be one of the important factor for development of a project. Building Information Modelling is primarily a dimensional tool which catalyses the construction of projects virtually before actual construction begins on field. BIM consists of the information models of different phases of any project as design, planning, operation, facility management and maintenance. Construction project is quite complex in nature, it internally depends on precision and quality of information. BIM aids in creating and managing this information of crucial importance for a project, from the very beginning. It is therefore understood that using of the various software under BIM canopy, can eliminate conflicts and save time and money in any construction project. India can majorly saves billions of rupees only by implementing BIM.

II. NEED OF BIM IN CONSTRUCTION INDUSTRY

As per the Planning Commission, the contribution of the Indian built environment sector to the GDP has increased from 6.1 percent in 2002 to 6.9 percent in 2006 and has been above 8 percent since 2007 despite the global slowdown. Over the next decade, India should continue to be among the fastest growing countries in terms of construction output [1]. Currently, the Indian construction sector is faced by many challenges due to low adaption of technology and lack of construction standards. The major problem faced by the construction industry unlike other industries is due to the constant criticism faced for its conventional methods. Clinging with its traditional methods of construction and has been one of the main reason for causing various time as well as cost overrun. There has been a serious need to have a technological and methodological shift in the construction sector for gaining a better result and a more efficient product. Innovations in technology such as cloud-based collaboration, wearable technology and the continued dismissal of hardware constraints have opened many ways for creative ideas. All industries in this era are becoming increasingly dependent on technology to explore their hidden potential. The construction industry lags a bit in this case. It seems that the construction

industry is more resistant towards the technological changes, especially in the developing countries. The construction sector is revolutionized with BIM as a major factor. Before the emergence of BIM, the construction industry generally worked in an environment where each member of a project team worked merely for their own wellbeing and the project was pushed back in their priorities. BIM promises to build a structure virtually advance to physically constructing it. This allows project stakeholders to analyze, design, schedule, and explore a project through an environment which is totally digital, where it is comparatively less expensive to make changes than in the field during construction, where changes are drastically more costly. There are a number of BIM software and mobile applications in global market presenting results that alleviates construction risk. The majority of challenges in building construction is that many teams fail to realize that the integration of team members creates significantly better outcomes. Integration enables a team of architects, structural engineers, construction engineers, project managers to work together toward a common goal, allowing construction in a more efficient manner. It is this project-focused approach, working in collaboration that allows teams to function more efficiently and use BIM model to get work done even faster. The construction community by optimizing the 3D aspect of BIM workflow, can to solve the real world construction problems. The adoption of BIM into construction management practices can transform the way of looking at how work is done.

III. STATUS OF BIM IN INDIA

The Indian construction industry contributes a substantial part in the country's infrastructure and economic progress. With inadequate infrastructure services and ineffective construction approaches, India is still an evolving country. Construction practises that are used in India are not up to the mark and result in cost and time overruns and also quality degradation.

To mitigate these issues, Building Information Management (BIM) based construction is recommended for implementation. BIM is an innovative mode of construction emerging in the construction sector along with the digital revolution all over the world. In India, BIM based construction is at a intermediate level. Only large construction companies' use BIM based construction management system for large projects for marked benefits but at a very high cost. Small scale industries does not seem to use BIM.

Many engineers, project managers, architects and other project stakeholders still lack the knowledge of BIM. Indian construction industry has been showing unwillingness to adopt this new technology for a long time. The main reason for not using BIM is the lack of awareness of this methodology in small cities. The cities where the professionals are aware of this technology, BIM is not implemented due to lack of technical expertise. A survey conducted by us in the city of Mumbai exhibited the reasons for using BIM as shown in figure 1 and also the reasons for not using BIM as shown in figure 2.

The unrestrained misconceptions about BIM usage and the ignoring attitude of the professionals are keeping the firms away from accepting the BIM technology. The AEC firms are too comfortable with the traditional methods and are unwilling to change the methodologies. Unlike many other countries, Indian government is also not involved to encourage BIM

usage in construction industry. There is the need to implement BIM in Indian Construction for improving the construction quality in India.
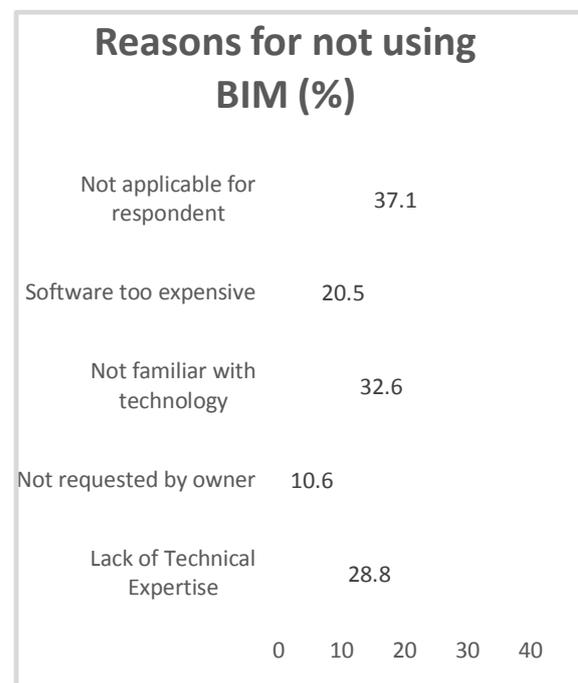

Figure.1.Reasons for adopting BIM

Figure.2.Reasons for not using BIM

IV. METHODOLOGY

The study was conducted through personal interviews and also a questionnaire survey was designed and shared among the construction professionals at various different projects in Mumbai. Being the fastest growing city in India, the Mumbai city was agreed upon for the study.

The survey data was collected over Google Forms, abiding by only one response per mail, a total of 140 responses were collected and analyzed. Out of the 140 respondents, There were a total of 39 students, 12 professors, 3 architects, 15 construction site engineers, 14 structural engineers, 21 BIM professionals, 2 Contractors and 17 Project Managers. The size of the firms where the respondents worked is described in figure 3.
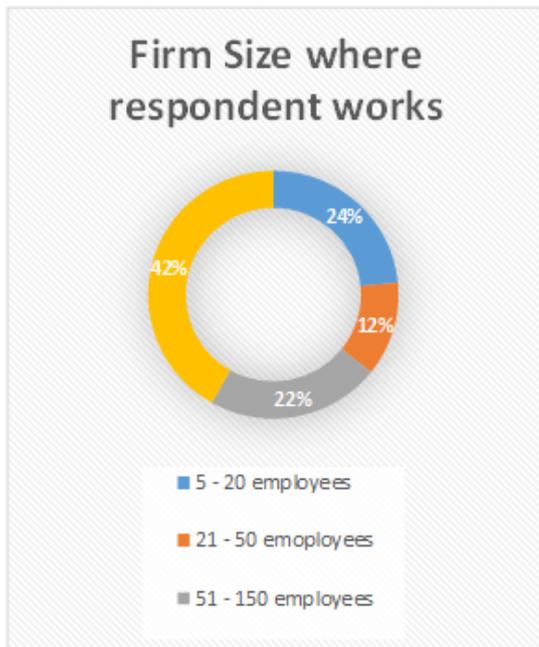
Figure.3.Firm Size where respondent works

V. DATA ANALYSIS AND RESULTS

The first question asked was to know the level of awareness among the people who are related to construction industry. Though BIM is used worldwide in many developed countries, it was found that only 55% of the respondents were aware about BIM, 25% were somewhat aware while 20% had not even heard about this emerging technology. We can looking into the details from figure 4. , at the top position of the hierarchy, only 64.7% of project managers are aware of this technology. Professors who teach students are not able to teach them about the latest trends in construction industry as they themselves are not familiar with BIM. Students who are going to join the industry in few years are also less aware about BIM with only 51.3% awareness. The awareness rate is seen lowest among the architects and the contractors. Though awareness of BIM is still considered low, the awareness has been increasing over the last few years.
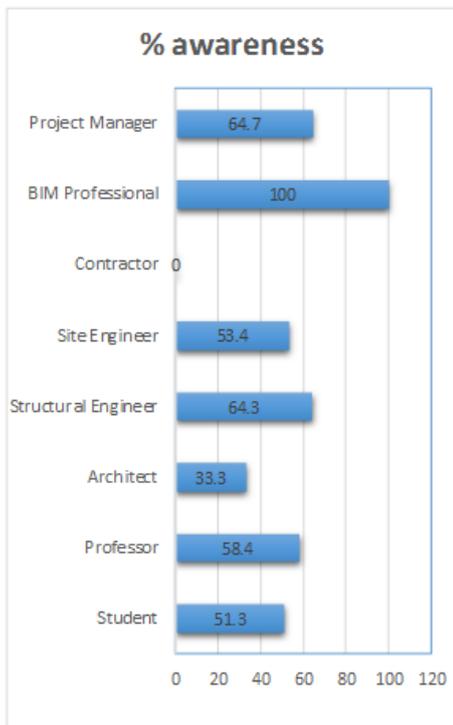

Figure.4.Percentage Awareness

Questions were asked about the software which are currently used in the construction industry. Autodesk Revit was among the most popular software with a 78.6% of awareness among respondents, as depicted in figure 5. Whether to implement BIM or not is a decision made by higher authorities. If the authorities themselves are unaware of the working technology, this process cannot be used for construction. We can see in figure 6 that 27.6 % of the respondents think that the higher management is unaware about it, 32.8% told us that they are planning to use BIM while 14.9% said that BIM was actually used.
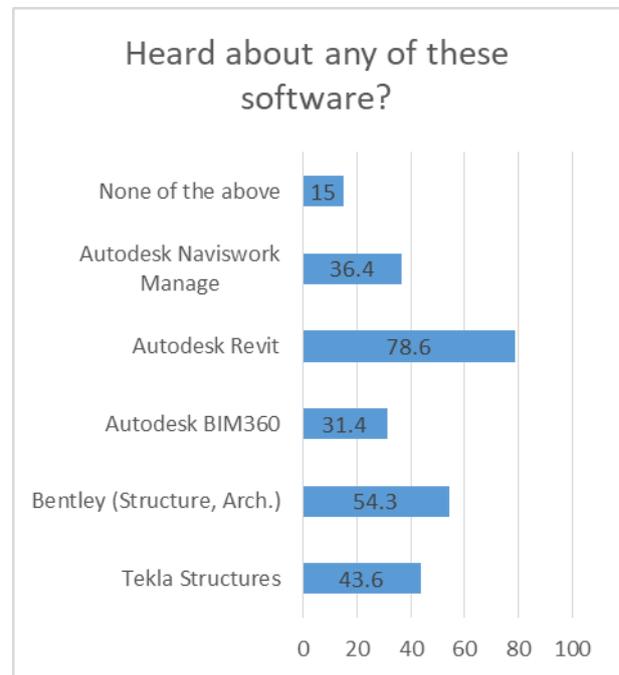

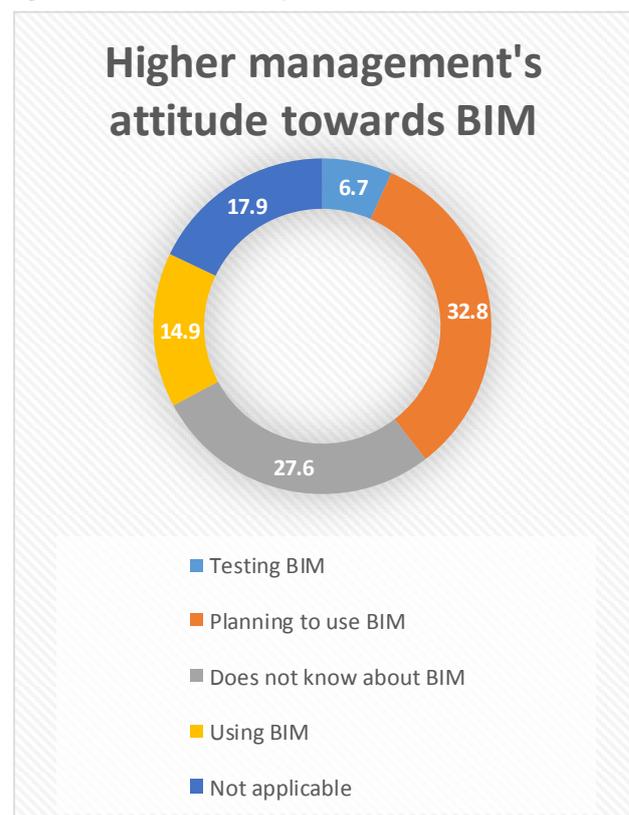**Figure.5.Heard about any of these software?**

**Figure.6.Higher management's attitude towards BIM**

Technology is considered effective if it has the potential for faster development keeping in mind the economy and

additional benefits. As seen in figure 7, Majority of the respondents say that BIM is a better tool for design purposes while 40% believes that BIM saves cost. In this competitive industry where each company wants contract to be awarded to them, 32.1% respondents think that BIM provides a competitive advantage.
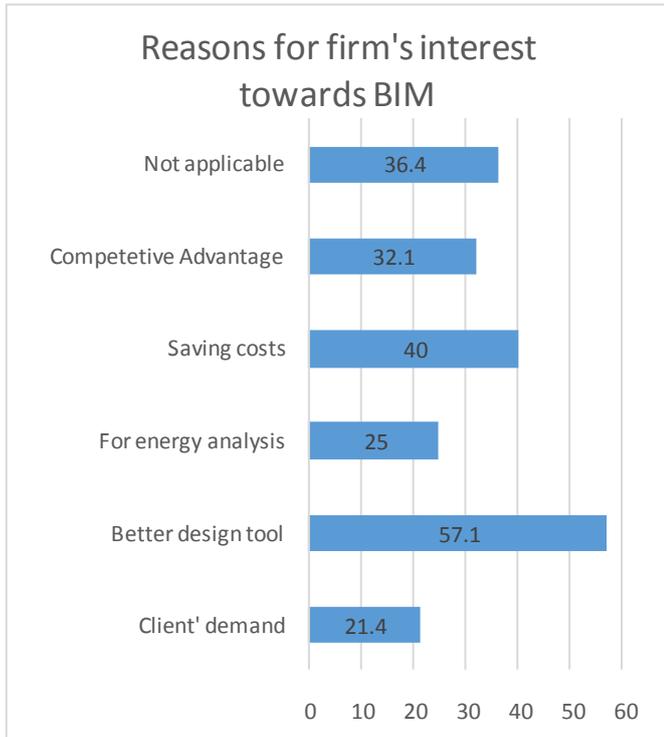
**Figure.7.Reasons for firm's interest towards BIM**

BIM has various features which lures the professionals. Visualization, enhanced planning, reduced wastage, enhanced work, better design, structured data and documentation were some appealing aspects. Figure 8 shows the distribution of the appealing features of BIM among various participants.
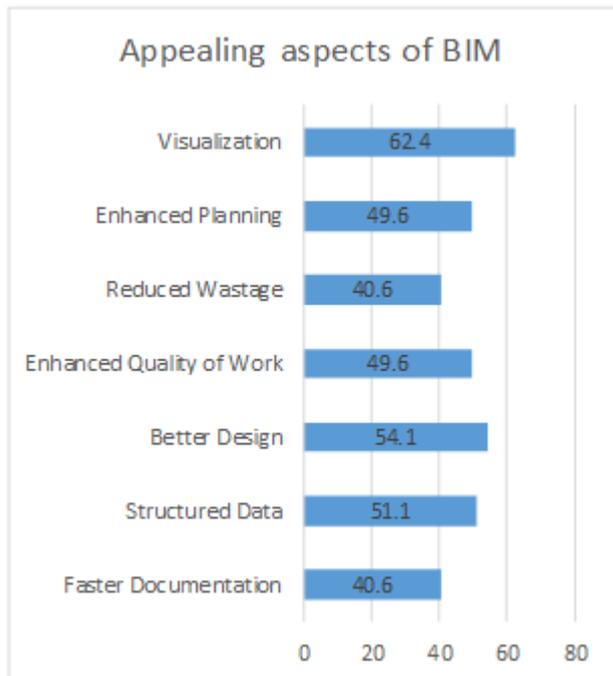
Figure.8.Appealing aspects of BIM

In the engineering academic curriculum we come across many traditional methods of construction being used in the industry. Due to innovation in technologies, we need to be aware of the current techniques and methodologies used by the industry for better results. 71.1% of the respondents wanted amendments to be made in the curriculum for inclusion of BIM as shown in figure 9.
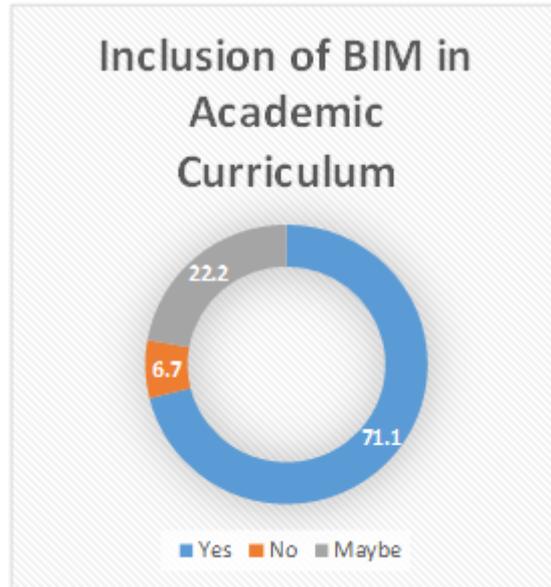
Figure.9.Inclusion of BIM in Academic Curriculum

VI. ACKNOWLEDGEMENT

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