

The Importance of Implementation and Collaboration of BIM in the Indian Construction Industry

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Abstract: Building Information Modelling is an upcoming digital portrayal of physical and working characteristics. BIM is a digitalized sequence for Creating 3d visualization, coordinating for planning, designing, estimating, and scheduling. The BIM software enhances us to use the latest virtual reality tool to perceiving construction peculiarity. The expediency of effectuating BIM is to upgrade the foresee part of the building structure, and MEP systems. The conventional organization structure can be replaced by Building Information Modelling. This paper oversees the overall execution of BIM in India at different stages of the construction process and hurdles in successive implementation of it.

Keywords: Building information modelling, BIM Implementation, BIM in India, BIM Status in India.

1. Introduction

In the construction industry, Building Information Modelling comes to light as forefront technology. The BIM concept emerged during the 1970s. BIM software enhances us to use the latest virtual reality tool to perceiving construction peculiarity. The expediency of effectuating BIM is to upgrade the foresee part of the building structure, and MEP systems. And it also recognizes the potential dispute between the building systems. A large amount of time and money can be cut back at the pre-construction stage by recognizing these disputes. [1].

Effective planning is one of the most important aspects of a construction project and influences the success of a project. The construction industry suffers from a lot of problems comparing with other industries. Construction projects are unique and a prototype within themselves. Involvements of multi-disciplinary teams often disagree among their methodologies (e.g. working process, design review, constructability, etc.). Moreover, errors and omissions in paper-based design documents, communication gaps with other stakeholders; schedule conflict, delays, and unanticipated field costs are also a primary concern for lower productivity of the industry [2].

2. Awareness in BIM

researchers create awareness of the BIM execution process, its advantages, and its disadvantages are emphasized. It is an

important aspect to encourage the construction industry to embrace it as a new method for delivering the projects. Effective planning is an important aspect of a construction project and influences the success of a project.

3. BIM Implementation in India

A. BIM Implementation

In India, the AEC industry (Architecture, Engineering, Construction) is the second largest industry after the agriculture industry. 3.5 crore people are employed in the AEC industry in India and has 2nd highest FDI (Foreign Direct Investment). Its handout about 11.1% of India's GDP [4]. There many colossal projects taken up recently, for are Example, sophisticated roadways or expressways, Metro train projects, and the put forward bullet train project between two cities of India. Countries like the USA, The United Kingdom, Netherland, Singapore, Japan Australia, and a few other countries have Authorized the use of BIM in the Public sector [3]. Many countries have a high proportion of BIM users for their AEC Projects.



Fig. 1. BIM adoption on worldwide from public sector

Worldwide, BIM recognition increase in a good way for the added advantages it is brought to the AEC industry. Currently, 65 countries are doing research work in BIM.

BIM has been endorsed in the higher education system in more than Twenty-five Countries. And several national-level

organizations back BIM adoption and application in more than 31 countries are shown in fig. 1.

1) *BIM Implementation areas*

BIM ranges from very limited in scope, concentrating entirely on the technology aspect, to very broad, surrounding other organizational and functional aspects such as governance, processes, standards, and people.

1. Governance - The basis of a BIM application is the organized management of its deployment, service, acquiescence, and presentation.
2. Modeling & Deliverables - At the core of BIM are modeling workflows and deliverables standards that specify the asset model and its downstream use in other lifecycle phases.
3. Collaboration & Data Management - A collaboration and accompanying data management framework solution to control the sharing of relevant and accurate information to all project stakeholders.
4. Integrated Analyses – During each lifecycle phase people need to analyze integrated asset models. Analyses span 2D to 3D, 4D (time), 5D (cost), and greater complexity.

2) *Questionnaire Survey*

IBIMA (India BIM Association) has conducted a questionnaire survey to know the barriers for BIM diffusion in the world market and prepared the questionnaire to understand the problems that Indian Construction industry stakeholders are confronted with using BIM technologies and progress in AEC projects.

From February to September 2019, India BIM Association collected Data from Indian AEC Stakeholders. From 26 locations IBIMA has received one hundred and forty responses are shown in figure 2 within India and six other locations abroad i.e. Australia, Hong Kong, Singapore, Abu Dhabi, Qatar, and Dubai.

Other places from which considerable responses received were Hyderabad, Pune, Ahmedabad, Mumbai, Chennai, Bangalore, and Kolkata.

The Respondent's locations are 1.Srinagar, 2. Jammu, 3. Ludhiana, 4. New Delhi and Gurgaon, 5. Jaipur, 6. Udaipur, 7. Gandhi Nagar, 8. Ahmadabad, 9. Ranchi, 10. Durgapur, 11. Kolkata, 12. Nagpur, 13. Aurangabad, 14. Pune, 15. Nashik, 16. Mumbai, 17. Hyderabad, 18. Bangalore, 19. Chennai, 20. Coimbatore, 21. Nagercoil, 22. Thrissur, 23. Kochi.

3) *Respondent's answers*

Q1. Which type of company are you belong to?

Here, we noticed that most of the answerer were from the design organization (forty-six percentage of respondents). Around twenty-three percentage of the answerer was from an engineering/developer company. And, twelve percent of the answerer was from the construction company are shown in figure 3. Rest i.e. eighteen percent of the answerer was vendor or suppliers, a professional or industry company, academic institution, and other's category. This shows that the majority of

the survey answerers who were dealing with BIM in project workflow are from a Design company. Showing that BIM maturity in India is most probably falls under the design stage. BIM diffusion in construction and operation stages is yet to mature in the coming days.

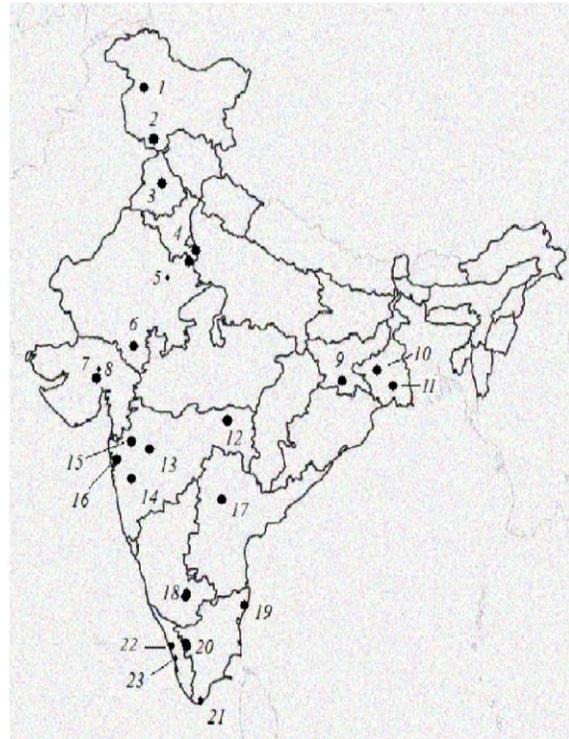


Fig. 2. Questionnaire Respondents location India's BIM Project

It is very much essential to educate and train construction and operation stage stakeholders with BIM technology and processes. It is necessary to make them realized that BIM diffusion will benefit the construction and operation team more than a design team. Fig. 3. The type of company in India Construction Industry.

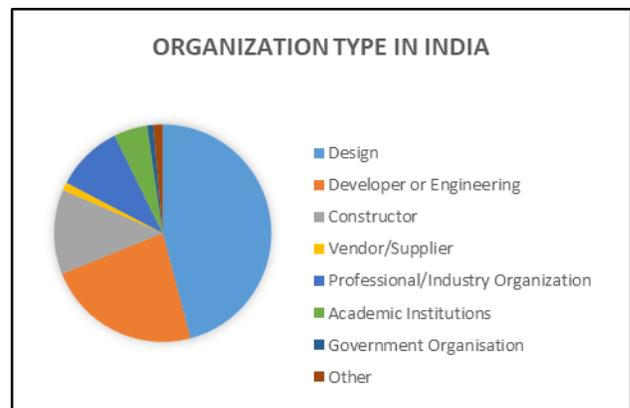


Fig. 3. The Type of Organization in India Construction Industry

Q2. About how many BIM-related employees work at your company?

Here, only one 130 answerers were obtained out of 140 answerers. Here, half of the answerers informed that more than 20 BIM employees in their company. And, more than a twenty-five percent of the answerers' organizations contains lesser than 5 BIM employee. From the Results on the pie chart, we can understand that close to all the Indian AEC companies have a large number of very low BIM employees. It is our take away that most of these companies either deal with larger and complicated projects or with very little projects.

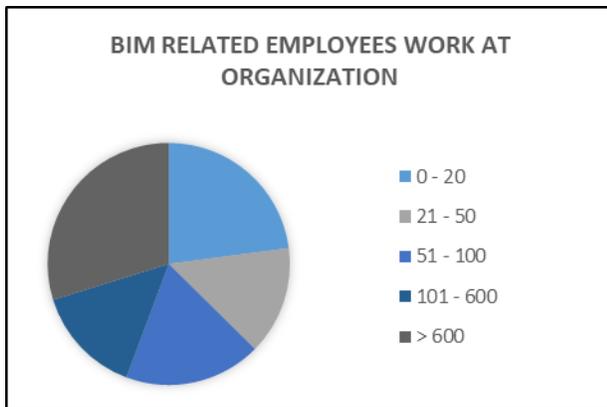


Fig. 4. No. of BIM Employee Work at Organization in India

Q3. Which number of BIM associated projects is your company presumed in?

Here, we received only a hundred and thirty-four answerers from a hundred and forty answerers. 40 % of the answerers' company was presumed with no greater than five BIM project distributions. however, throughout 34% of the answerers' companies were presumed in distribution greater than twenty BIM projects.

This gives up an intimation that Indian AEC companies are insistent sufficient in the world market to distribute BIM projects. And, it is an effective line known to the world AEC company that India is also named as BIM cooperative space for its ability to distribute building information models at an acceptable price in the world market.

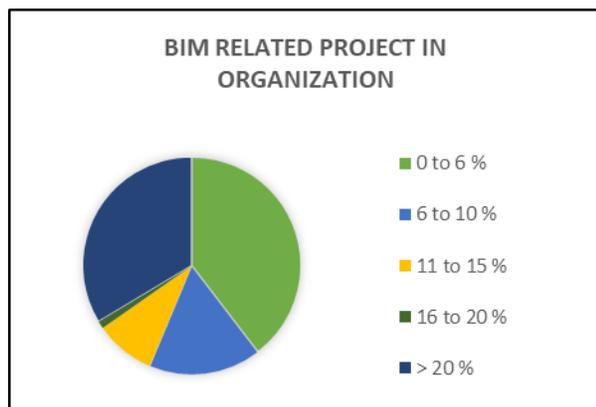


Fig. 4. No. of BIM Project in Organizations of India

The extraordinary BIM projects and their places in India. From figure 3, we can pictorial the twelve great profile projects. Further BIM projects are undertaken in India.

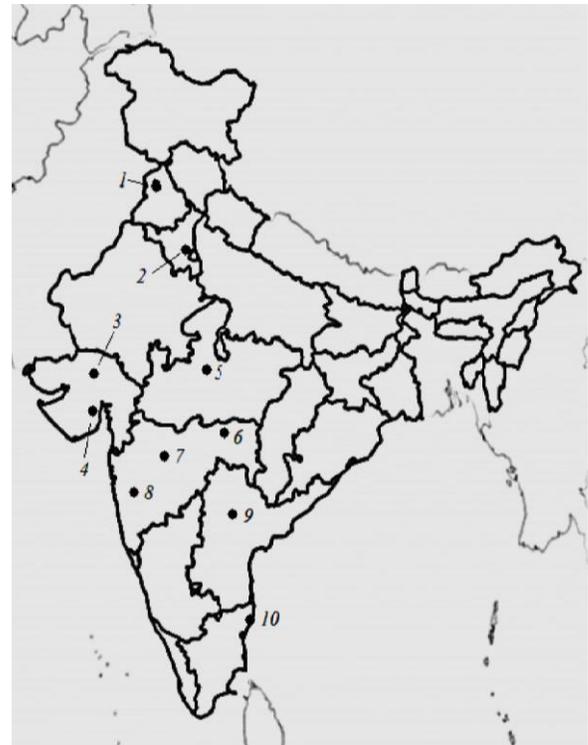


Fig. 5. High Profile BIM Projects in India

The Project name and location are,

1. Redevelopment of Proguthi Maidhan Complex, 2. Medical College of Dr. BSAM Hospital Complex, 3. Gift Gold City Project, Gandhinagar. 4. Dholera Smart City, 5. Bhopal Smart City, 6. Nagpur Metro, 7. Aurangabad Industrial City hall Building, 8. Student Welfare Center at Savitribai Phule Pune University, 9. City Police Commissioner Head Quarters Building in Hyderabad, 10. Central Square, Chennai.

Respective Indian AEC companies' distribution BIM projects to the regional and worldwide Clients. some of leading India's BIM infusion contributors: AECM; Atkins; Ramboll and Neilsoft: Arup; RSP; Larsen & Toubro; Hochtief; Mott MacDonald. There are more than sixty other BIM infusion contributors in India.

4. BIM Collaboration

BIM Collaboration is the process of identification of different BIM phases for a given project and defining the process of data and information sharing between these different phases. In this case, 'data' refers to the data generated by different software used in the different phases of the BIM project. The data and users could be located in the same or different geographical location offices.

BIM Collaboration process can appear complex with so many things to think about Data creating, Software tools to use,

Data management solutions, Information sharing, Permissions, Data replications, etc.

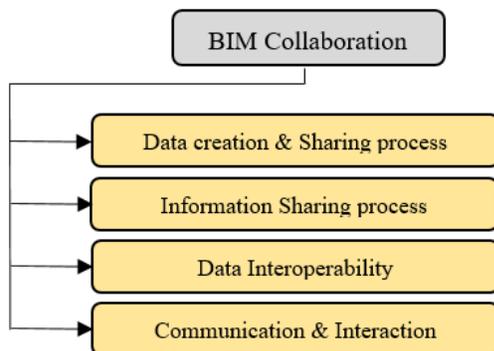


Fig. 6. Flow chart for BIM Collaboration phases

Data Creation and Sharing relates to defining and organizing data, developing data management solutions, and defining a workflow to share the data.

Information Sharing involves defining the different stages when information is shared within the same design discipline and with the other design discipline, the permissions level status and version information of the data shared, etc.

Data Interoperability deals with the different data formats involved in the project and defining workflows to bringing them together, including and data migration that might be required.

Communication & interaction relates to the notification and communication process through which the user is aware of the latest status of project and design data artifacts. These could include the dashboard, email notification, use of social media tools for instant two-way collaboration, etc.

5. Benefits of BIM in Construction Industry

A. Design and Planning

BIM plays an important role over the whole life process of projects to the demolition of building from scratch of conceptual design. The make use of BIM in the project organizing permits the project team to analyses place and realize the complexity of place standards and land pronouncement which saves schedule and provides them with the options of effecting high worth activities [6]. 3-D models can be produced from the structure model at any phase in the process. These can extend from uncomplicated wireframe drawing to multiplex photorealistic portray [7].

This offers constancy in data produced from the realistic model. This supports designers to conceptualize and authenticate their design. The stakeholder can extract advantage of BIM usage at various stages of project design namely representational design, elaborative design, and assembly detailing [6].

BIM can model the structure virtually before realistic construction. therefore, investors can recommend the modification preliminary in the planning and design session as per their demand. Also, contractors can participate early in the

drawing section to contribute to his field experience.

B. Quantity Estimation

Give up with the potentiality for withdrawing a total of components, areas, and measurement portions and material proportion, Building Information Modelling quantity take-off tools allow a rapid withdrawal of additional detailed measurements and material proportion details [11]. As per the quantities withdrawal from the model is higher detailed, the homeowner is preserved from the over-budget project.

C. Clash Detection

Building Information Modelling-based clash observation tools authorize geometry-based clash detection to be collaborated with symbolic and rule-based clash examination for recognizing qualified and structured collision.

BIM-based clash observation software grants stakeholders to selectively examine clashes in the middle of the designation structure, like examine the clashes b/w mechanical and structural systems, since each portion in the model is correlated with a particular kind of system. Accordingly, the clash examines procedures that can be occurred at any level of detail and across any number of building systems and trades [1].

D. Productivity

With fifty percent of representative construction day being ineffective, BIM utilization can be making use to obtain a thirty-three-percentage increase by addressing late or inaccurate information, waiting on resources, multiple material handling, hold back on guide, and modify. This will have a considerable higher in the abundance for the civil industry, making it additional agreeable with abundance highs in other sectors like the agriculture sector, manufacturing industries, transportation facilities, etc. [2]. We found that Building Information Modelling is utilitarian to reduce the decay tariff of structural reinforcement and the consequence specify a high possible for financial savings [8].

E. Prefabrication

Building Information Modelling recommends manufacturers of construction components detailed and information-rich structures, which can be examined for manufacturing characteristics, can shrink information requests and better production quality. An investigation of the utilization of Building Information Modelling on a huge health protection project in the USA admits that it is workable to accomplish 100% manufacture for mechanical structure erections and no clashes in MEP fitting tasks. Like in turn, yielded 20-30% labor reductions for the MEP sub-contractors, and thus decreases beyond the utility chain [9].

F. Quality Management

Building Information Modelling-related to construction quality applying is acceptable and supportive in quality observance management. Since, data constancy, it is realizable and practically to concern Building Information Modelling for

quality management and to completely take advantage of design data through the imagination of the construction procedure. Second Building Information Modelling can be suitable for contemporary industry-standard exercise in quality management [3].

G. Facility Management

The information collected through a BIM process and stored in a BIM-compliant database could be beneficial for a variety of FM (Facility Management) practices, such as commissioning and closeout, quality control and assurance, energy management, maintenance, and repair, and space management [10].

H. Safety

In considering hazards and threats earlier: The higher functional form of safety process kicks off at the planning and pre-construction level. The supplemental the project advancement, the less occasion you have to dominate and control construction accidents [3]. BIM owns you to review and concentrate on hazards and threats preliminary within the design as data is allocated and synchronized between the project group, those who produce make fine you have appropriate clearance maintenance sections.

Render or simulate and check circumstance without anybody come into injury: In a virtual world, you can be and do whatever you like. Simulation in the construction sector grants you to test circumstances and frameworks without nobody getting injured [5]. This is especially convenient for field labor safety. Combine this with elevated reality, and you can begin to layered the imaginary model onto a real-constructive environment, creation your circumstance uniform reasonable.

6. Barriers for BIM Implementation in Indian Construction Industry

Execution of BIM has enlarged appreciably over the done tenner, and it qualifies the dissimilar stakeholders of a construction process to get together greater all over its life sequence and better the occasion to division information and reduce exhaustion.

Each hurdle can then be split up into subunits. Nevertheless, the execution of BIM owns you to review and concentrate on hazards and threats preliminary within the design struggle far beyond its probably because of the existence of dissimilar hurdle. Building Information Modelling execution in the Indian AEC professionalism has been constricted by many hurdles, which can be designated into six major sets: technical, legal, people, commercial barriers, educational, and training. Several hurdles can then be split into sub-groups.

To obtain consideration of the barriers that our Indian AEC institutions are fronting, we did a spacious literature survey and argumentation with industry shareholders to accumulate a feasible catalog of hurdles to come up with BIM projects.

Table 1
 Different Barriers in the Construction Industry

	Policy field players	Technology field players	Process field players
In Academia	Process of introducing BIM in the AEC curriculum.	Require for BIM IT laboratory facility in academics.	Need for revising existing incomplete BIM curriculum.
	Resolving key issues in delivering BIM curriculum.	Need for BIM technical officers.	An initiative to reduce weak ties between industry & academia.
	Initiative in producing trained BIM personnel.	The need for Std/guidelines aware of the BIM tool.	Teaching BIM as both tech and Process in academics.
In Industry	Technical barriers	People barriers	Education and training barriers
	Expensive Software	Client driven limitations	Absence of BIM education and training
	Hardware requirement	Less importance towards BIM adoption from other team members	Skill issues
	Standard guidelines	Lack of talented workforce to operate BIM tools	Organizational efforts
	Legal barriers	Work practices and process-related barriers	Commercial barriers
	Liability and Copyright issues	Roles and Responsibilities	Insurances
	National building codes	Changes in practices and use of information	Capital for investment
	Third-party dependence for accuracy of BIM models	Inefficient regulatory	Key adopters of BIM (designers) will not get immediate benefits

7. Conclusion

BIM creates competency and also helps users to get several benefits. It gives back the feature that customer of all levels realizes BIM as allocate them work greater, but rate reduction is feasible to be realized by professional users. The high rated professional conveniences are: perceptible access to construction Information, Enables Easy Conflict Resolutions, Helps to Schedule the Construction Process.

BIM needs a significant alteration in traditional project delivery methods by changing the authority of every individual in the organization in India. To accomplish satisfaction from Building Information Modelling to the whole stretch, each collaborator of the construction industry needs to incorporate it. The barriers like interoperability, allowable issues, deficiency

of recommendations or protocol, cost, etc. can be conquered.

This paper shows the Importance of Implementation of BIM Concept in Indian Construction and management Industry by Awareness of BIM, Implementation, and utilities in the building Structure and established industry in India. To sustain pace with enlarging technology and growing challenges, the AEC industry must embrace BIM at the earliest time as possible.

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