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Research Article

Scope of Building Information Modeling (BIM) in India

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Abstract

The design communication is gradually being changed from 2D based to integrated 3D digital interface. Building Information Modeling (BIM) is a model-based design concept, in which buildings will be built virtually before they get built out in the field, where data models organized for complete integration of all relevant factors in the building lifecycle which also manages the information exchange between the AEC (Architects, Engineers, Contractors) professionals, to strengthen the interaction between the design team. BIM is a shared knowledge about the information for decisions making during its lifecycle. There's still much to be learned about the opportunities and implications of this tool.
This paper deals with the status check of BIM application in India, to do that a survey has been designed to check the acceptance of BIM till date, while this application is widely accepted throughout the industry in many countries for managing project information with capabilities for cost control and facilities management.

Keywords: Building Information Modeling, digital interface, Survey.

1. Introduction

Building Information Modeling (*BIM*) is the documentation process consisting of information about different phases of any project like design, construction planning, construction, facility management and operation. It is one holistic documentation process beneficial for operational visualization, and construction application such as estimating, scheduling and design coordination. Main advantage of implementing BIM application is the visual coordination of the building systems such as MEP (Mechanical, Electrical, and Plumbing) systems and it also identifies the possible conflicts between the building systems. By detecting the conflicts, problems can be resolved before actual construction which in turn saves money and time invested, (*Damian, Han Yan and Peter* (1)). The National Institute of Standards and Technology (NIST), reported (*NIST, 2004* (2)) that the lack of adequate interoperability cost the U.S facilities industry about $15.8 billion per year. In India, the BIM application is not widely practiced till now has scope to use this technology in a much wider scale.

2. Structures Architectural Documentation

With BIM, Architectural Documentation process has reached maturity. Systematic documentation can be traced back during Renaissance, when Filippo Brunelleschi represented the plans for Santa Maria del Fiore in Italy in the drawings' format to make the patrons understand how the building would look like. Through ages, Architectural Documentation has evolved. Availability of computers opened scopes for creating a data model for a complete design process starting from conceptual phase to the operational phase. In the following section a brief sketch of the evolution has been depicted.

I phase – Till early 1980s: Before 80's design documents are made traditionally by drawing lines to represent a building. These documents like plan, section and elevation are the main source to describe the building to be built. In these traditional drawings each line meant to convey design so that a building can eventually be constructed.

II phase – 1980s to Late 1990s: With the introduction of computers, the major switch over started from manual drafting towards the computer aided drafting, which helped in producing drawings faster. As buildings became more complex, specialization in the design and construction process emerged, which in turn lead to more elaborate forms of information. Use of computers, especially for 2D drawings and reports are revolutionary changes into Architectural Documentation.

III phase – Beginning of the 2K: In the present day, buildings are much more complex than ever before. The numbers of people

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involved in producing drawings are too large. With the growth of technology, the building systems are also many. Today, buildings have more security, electrical, HVAC (Heating, Ventilation, and Air Conditioning), and energy requirement. Computer based technology has been updated in order reduce errors, but in the end, they are still collections of manually created, non-intelligent lines and text.

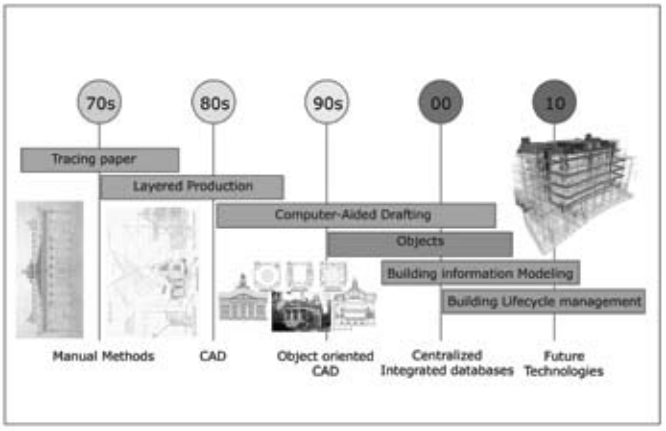


Figure 1. Schematic diagram represents the Evolution process of Architectural Documentation.

3. BIM Concept

A shift in process and expectation is happening in the Indian construction market following the economic bloom and gloom, and architects are stepping up to the challenge. The focus is shifting from traditional 2D based to a practical reality with respect to functional, economic, energy, etc. All disciplines involved with a project can share a single database. Architecture, structure, mechanical, electrical, infrastructure, and construction are tied together and challenge to coordinate them is unprecedentedly possible. Energy analysis can be done at early stage of design, and construction costs are becoming more predictable.

BIM allows use of a parametric 3D model to auto generate traditional building documents such as plans, sections, elevations, details, and schedules. Drawings produced using BIM supported software's are not of manually coordinated lines, but interactive representations of a model. The changes made in this Model are automatically coordinated throughout the project, which eliminate the coordination mistakes, improve overall quality of the work.

There are many modeling software packages in the fields which have excellent application for conceptual level models, but these models don't have the ability to document a building design for construction.

4. BIM and CAD

The main differences between BIM and Computer Aided Design (CAD) are that CAD system is usually 2D document, which are created separately and have no intelligent connection between separately created documents. In CAD, two lines represent a wall. In BIM, wall is created in the form of an interactive tool, which has its own properties like width, height, bearing or non load bearing virtue, demolished or new, interior or exterior, fire rating, and materials (such as boards or brick) etc.

The BIM platform assembles all information into one location and cross-links that data among associated objects. There is no linkage between the data created by CAD. Efficiency of BIM in comparison to CAD is being referred in Table 1.

Table 1. The efficiency difference between CAD and BIM applicationsfor a particular project in different phases

Task	CAD (hours)	BIM (hours)	Hours saved	Time savings
Schematic	190	90	100	53%
Design development	436	220	216	50%
Construction documents	1,023	815	208	20%
Checking and coordination	175	16	159	91%
Totals:	1,824	1,141	683	

Source: (Rick Rundel (7), 2007)

5. Acceptance Level of BIM in India: Survey Methodology

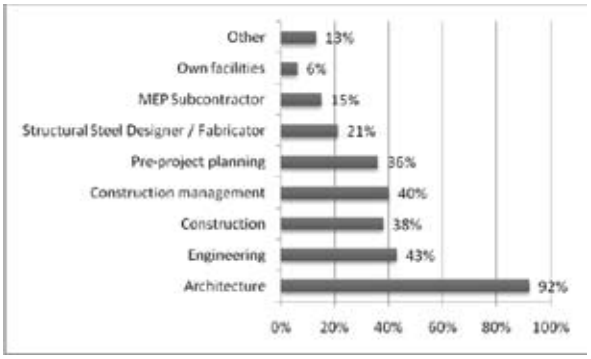
BIM application has received different levels of acceptance in different countries. In US this is not only accepted but also made compulsory to large extent. The General Service Administration (GSA) of US has initiated a requirement in 2007 for the planners to produce a BIM model for spatial program validation as an open standard if they are applying funding for their projects, (*Holzer, Dominik* (4)). Despite being new to the Indian construction scenario, BIM has shown strong acceptance potential here. To establish this claim quantitatively, survey methodology has been adopted.

A Questionnaire with twenty one questions has been designed to be a current "status check" on BIM. The questionnaire was sent to AEC industry practitioners in different parts of India, (*Lachmi Khemlani , Ph.D, 2007* (3)).

Objectives: There are two main objectives of this questionnaire. The first objective is to identify the percentage usage of BIM among Indian AEC companies. The second is to record the benefits of BIM as comprehended by companies using this method. The barriers to adopt this technology have also been explored.

Analysis of Responses: The survey questions listed a number of criteria to evaluate BIM solutions. For each of these criteria, respondents indicated their preference by rating it on a 5 point scale, where 1 indicates "strongly agree" and 5 indicates "strongly disagree." Respondents are supposed to identify any additional important criteria/comment that is not mentioned in the questionnaire. In the following section the responses have been analyzed and presented through diagrams and pie-charts. (*Lachmi Khemlani, 2007* (3)).

Fig. no. 2(a), (b), (c) and (d) provide base information about the respondents.



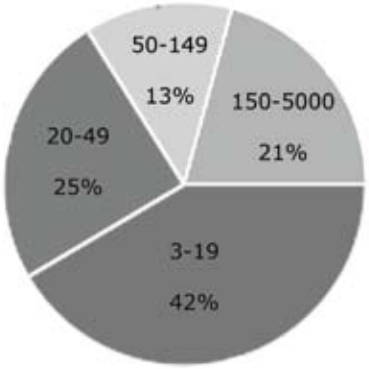
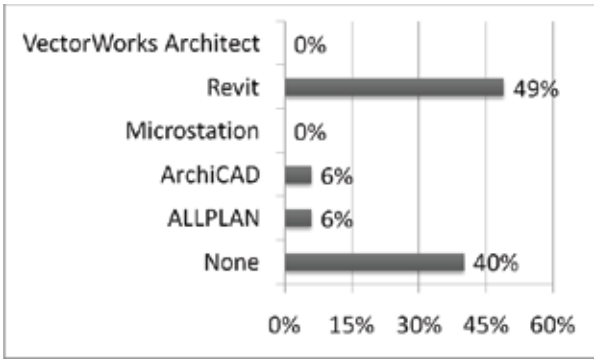


Figure 2 (a). Disciplines practiced by the respondents Firm.
Figure 2 (b). Firm Size of the respondents.



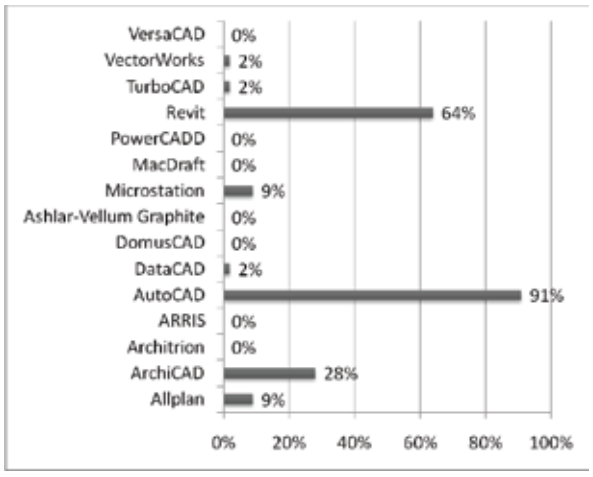
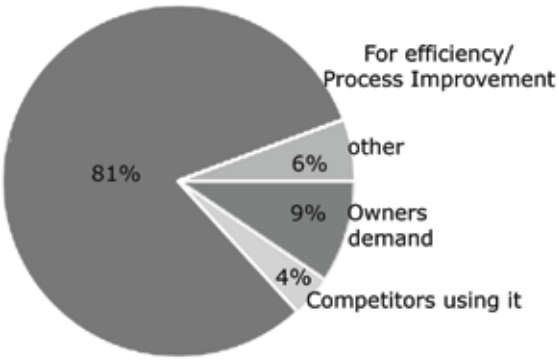


Figure 2 (c). BIM Application used in the Firm.
Figure 2 (d). Primary CAD Application practiced in the firm.

Fig. no. 3(a), (b), (c), (d), (e) and (f) provide information on reasons for non-adoption of BIM at present.



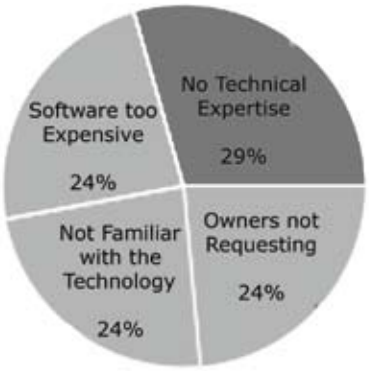
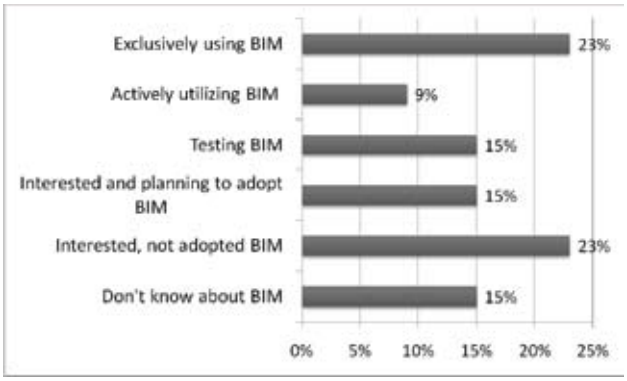


Figure 3 (a). Causes for starting BIM.
Figure 3 (b). Reasons for not using BIM.



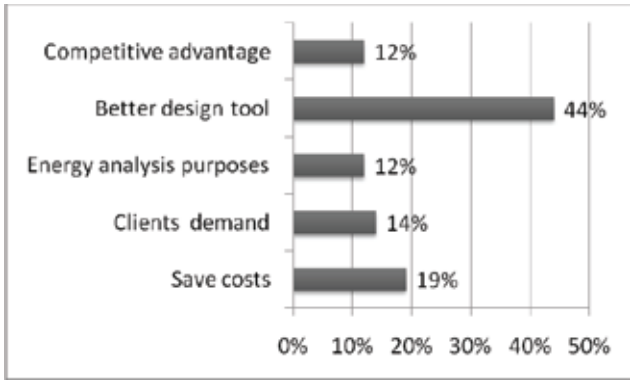


Figure 3 (c). Firm Leaders interest towards BIM.
Figure 3 (d). Reasons for the interest towards BIM.

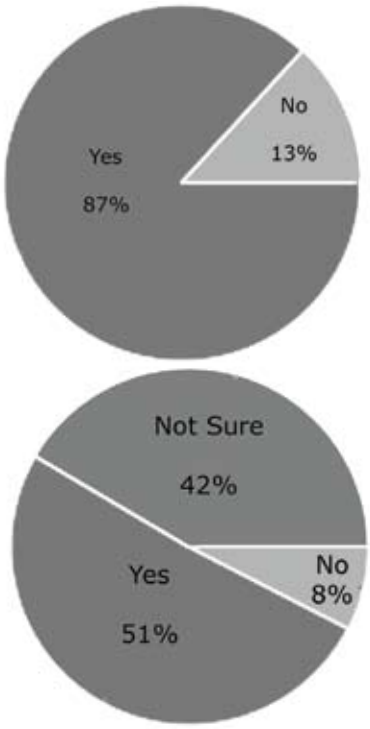
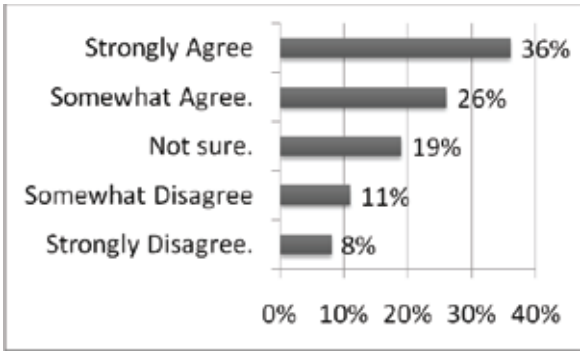


Figure 3 (e). Interested in adopting BIM workflow.
Figure 3 (f). Adopting BIM in Architecture field leads to better pay.

The main reason for not using BIM here, is the lack of technical expertise, the proffessional who has heard about this doesn't know how to use it, and most of them is not even aware of this methodology.

Fig. no. 4(a), (b), (c), (d), (e) and (f) provide information on BIM user's reasoning's behind the preference.



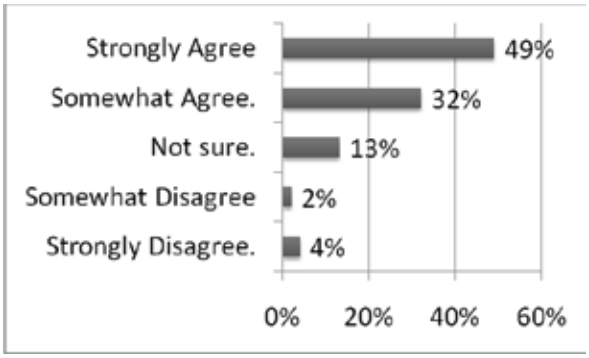
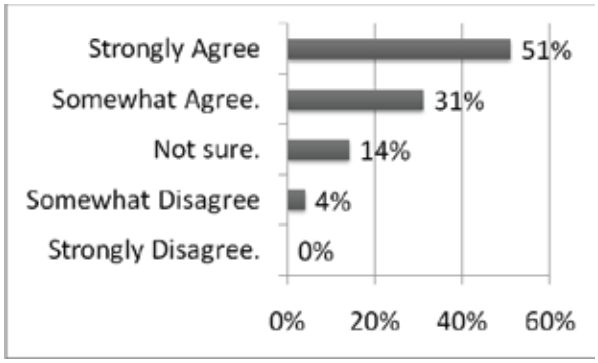


Figure 4 (a). Adoption of BIM in architecture will increase societal value for architects.
Figure 4 (b). Adopting BIM workflow will lead to better architectural works.



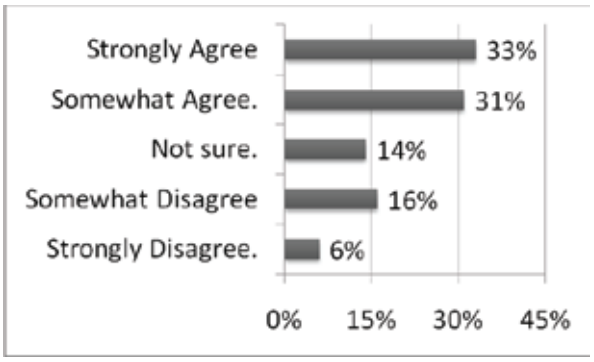
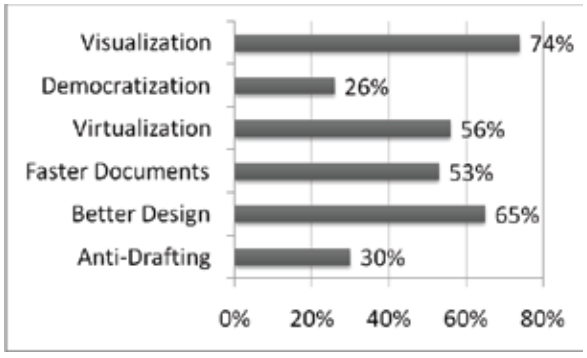


Figure 4 (c). Adopting BIM leads to greater efficiency.
Figure 4 (d). 2D is inefficient to true BIM workflow in the working drawing phase than 2D CAD.



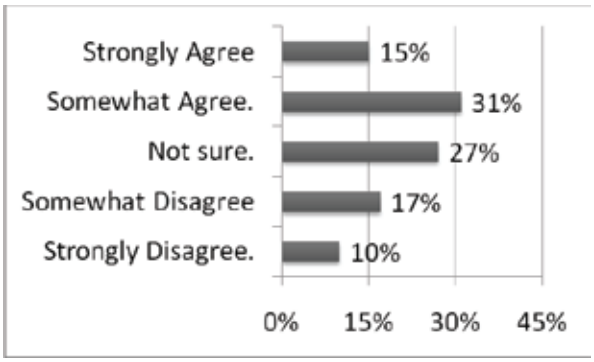


Figure 4 (e). Aspects of BIM that appeals most.
Figure 4 (f). BIM is too complex and should make it simpler.

The survey respondents also identified the barriers to incorporate BIM in their firms, like complexity of BIM, inertia to explore new technology, lack of support from clients and contractors, unwillingness to change the traditional practice, and uncertainty about BIM platform (Revit, Bentley or something else). Finally,

about 87% of the survey respondents volunteered that, at their respective firms, they are interested in adopting BIM.

6. Remark

In India, Revit is not practiced widely in many firms as a primary CAD application, but it is incorporated as a BIM application. The survey reported that 49% of the respondents use Revit as a major BIM tool.

7. Conclusion

The BIM is a new and promising approach in India which is gradually gaining acceptance by the owners, architects, engineers, and builders. The survey explores the BIM potentials when used in the field to better communicate and integrate construction information across different trades, allowing for efficient work processes and better decisions. More specifically, the study concentrated on the deployment of the model to support planning, scheduling and tracking of the job site operations in India. The survey has supported the authors' expectation that BIM has remarkable acceptance potential among the AEC firms in India.

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