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ADEQUACY ASSESSMENT OF BUILDING INFORMATION MODELLING FOR INFRASTRUCTURE PROJECT IN INDIA

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ABSTRACT

An infrastructure project consists of a multifaceted set of relationships, between peoples with different professional backgrounds working together to accomplish a very complex goal. Presently two-dimensional drawings on which conventional construction is based is very much time taking and cumbersome. This is the source of some major shortcomings in the construction industry. By transforming the quality of information used in building industry, BIM (Building Information Modelling) aims to change design and construction practice completely. To date, BIM is not widely utilized in infrastructure. Benefits achieved through implementation in vertical construction, however, suggest that BIM represents significant opportunity for gains in process, material and economic efficiency throughout infrastructure project lifecycles.The main purpose of this project is to describe how BIM applications can be used to achieve a more efficient construction process through the reduction of wasteful activities in infrastructure projects. Through this we aim to find ways to increase the level of efficiency in production, potential benefits and implications of using BIM for infrastructure. The BIM mainly focused on developing different models by adding time, cost and energy analysis in existing 3D model.

Keywords*: *BIM, 4DDesign, Infrastructure, design software, modelling

I.INTRODUCTION

A. BIM is an information-rich, model-centric process with the power to transform project delivery and add value across the lifecycle of infrastructure assets. Building information modelling (BIM) is one of the most promising recent developments in the architecture, engineering, and construction (AEC) industry. With BIM technology, an accurate virtual model of a building and other project elements is digitally constructed. This model, known as a building information model, can be used for planning, design, construction and operation of the facility. It helps architects, engineers, and constructors visualize what is to be built in a simulated environment to identify any potential design, construction, or operational issues. BIM represents a new paradigm within AEC, one that encourages integration of the roles of all stakeholders on a project. Building Information Modelling (BIM) has emerged as a new field within construction that has been attributed to many potential benefits. However, to this day, BIM has foremost been applied for house design in the building sector and has not yet been utilized to the same extent in the Infrastructure sector of civil engineering. Infrastructure

sector is a key driver for the Indian economy. The sector is highly responsible for propelling India's overall development and enjoys intense focus from Government for initiating policies that would ensure time-bound creation of world class infrastructure in the country. Infrastructure sector includes power, bridges, dams, roads and urban infrastructure development.

Mr NitinGadkari, Minister of Road Transport and Highways, and Shipping, has announced the government's target of Rs 25 trillion (US$ 376.53 billion) investment in infrastructure over a period of three years, which will include Rs 8 trillion (US$ 120.49 billion) for developing 27 industrial clusters and an additional Rs 5 trillion (US$ 75.30 billion) for road, railway and port connectivity projects. Foreign Direct Investment (FDI) received in construction development sector from April 2000 to December 2015 stood at US$ 24.18 billion, according to the Department of Industrial Policy and Promotion (DIPP).This has provided the opportunity to investigate how BIM applications can be used in infrastructure projects to increase efficiency through the reduction of wasteful activities and finding advantages while implementing it the case study of road design project.

B. Problem Statement

The design and construction industry is characterized by production processes that could be made more efficient if the occurrence of non-value adding activities were reduced. The reduction of wasteful activities is a valuable step for supporting sustainable production processes in construction. Building Information Modelling is a new way of working within the design and construction industry that has been attributed to numerous advantages of different kinds at different stages of construction projects. This thesis aims to investigate how BIM applications can be used in infrastructure projects to increase efficiency through the reduction of wasteful activities. Therefore, the research question that this thesis aims to answer is:

In what way can BIM applications be used to increase efficiency in infrastructure projects through the implementing BIM?

In order to answer the research, question the following sub questions are posed:

• What is BIM? Concept of BIM

• Why BIM is successful in Vertical Construction (Buildings) and not much used in Horizontal construction?

• How BIM will play important role in India?

II.LITERATUREREVIEW

A.

B. C. LIMITATIONS

This project report has been limited to investigate the BIM-related benefits applicable for the Infrastructure sector and implantation in detailed design phase of Road projects. Due to the limited timeframe for this project report, observations related to detailed design will be made only for surveying, geometric design of project described in the case study chapter.

C. BIM APPLICATION

Azhar, et al., (2008) This technology includes simulation planning, design, construction, and operation of building structures. The building information model is an intelligent parametric representation of the building or structure from which data can be extracted and processed in order to generate information that can be used as a basis for facilitating decision-making.

Eastman et al., (2011) BIM can also be looked upon as a modelling technology that can produce, communicate and analyse building models. In the area of BIM, buildingmodels are characterized by components represented by digital objects thatcontain data regarding graphics, attributes and parametric rules that allow them to interact in an intelligent way. The components carry data that describes object-related behaviour, which can be used for analysis such as quantity take-off, clash control and digital energy and performance testing.

Sarkaretal.,(2015) He stated that BIM is intelligent model based process that provides insight for creating and managing building and infrastructure project with fast speed economy and quality. A technology is really beneficial.

D. COCEPTUAL DESIGN

Eastman, et al., (2011): BIM can be used early on by designers for conceptual design, sketching, space planning, orientation on site, and ensuring program compliance with regards to site- related factors. In addition, the design information generated through the conceptual design allows for preliminary analysis and simulations of what is being built. By using design exploration tools, designers can create mass objects in free forms and shapes that can act as a basis for more detailed design in later stages. Compared to 2D sketching, this quick and easy form of 3D sketching can more easily communicate visual and spatial information between concerned project parties

E. BIM BENEFITS: VISUALIZATION

Eastman et al., (2011): Building information modeling has become central subject in the AEC industry. There is an ongoing transition that proceeds from basic 2Ddrawings towards the use of 3D and object based BIM models. These models, filled with project information, canbe utilized in many ways, by various stakeholders and in many areas throughout a project, all the way fromfeasibility study to the maintenance of the structure. There are innumerable benefits originating from the use of BIM and it is of out most importance to make them visible in order to promote further implementation of BIM in infrastructure. This section will address a number of important benefits that stems from the implementation of BIM.

Engelbart et al., (1962) He stated that, working with computer related system is working in an argument way which enhances the human intellect.

Azhar et al. He compared to working of 3D cad drawing with the 2D cad drawing, this enables for enhanced visualization such as, 1. Risk Reduction 2. Clash Detection 3. Better overview.

MacDonald (2012) states that: “integrating multidisciplinary design inputs using a single 3D model allows interface issues to be identified and resolved in advance of construction, eliminating the cost and time impacts

of redesign". MacDonald (2012), Strafaci (2008) and Autodesk (2011) are only a fraction of those who share the same opinion about BIM: that early decision making and more detailed planning and design is a great BIM-related benefit that results in a construction process containing fewer errors originating from design glitches. In line with this, Strafaci (2008) describes the differences in the ability of impacting the design of a construction between a project using BIM and one in which 2D drawings are used. This comparison is illustrated in Figure 3 below.

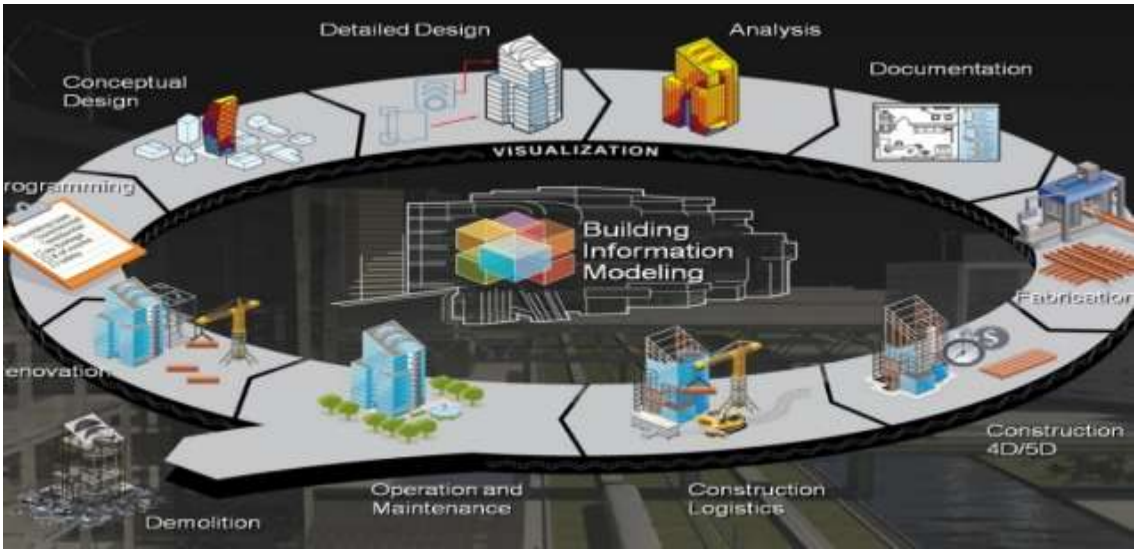

Fig1: Sketch showing the BIM Concept.

F. D .OBSTACLES AND LIMITATIONS FOR BIM IMPLEMENTATION

Yan & Damian et al.,(2008)*:* is considered as a collaborative tool but in reality most of firms are not multidisciplinary and in fact relatively small in nature. The size and complexity of the files that BIM systems create for complex projects, the scalability and manageability of a fully loaded central BIM project database represents a major challenge. BIM reveals limitations in the information collecting process in existing or age old buildings. Due to lack of information in existing buildings using BIM can be a difficult task. As the details of existing structure will be hard to get due to unavailability of structural data, the creation of model will not be possible in such cases. Also, due to multiple components in infrastructures, usage of BIM can be a tedious job. One of the largest barriers is that construction companies believe that BIM training would cost their company too much money and human resources.

Kaner, et al.,(2008) state the investment costs needed for training and software purchase is relatively high when implementing BIM.

Eastman, et al., 2011 There are also technical barriers that hinder the adoption of BIM in the construction industry. The issue of interoperability between software has been identified as an obstacle that hinders efficient

collaborative design. Moreover, the fact that the software developers need to assume the financial risk for developing specialized software is an obstacle that limits the available range of products on the market.

Coates et al., (2010) Architects major interests lies in providing means of representing the final form of the design while designers also need a continual stream of abstractions, advice and information to facilitate in the move from information to the distillation of knowledge. Apart from these limitations, implementing BIM in Indian construction industry can be difficult job due to lack of knowledge about it. Most of the companies who do not use BIM believe that BIM training would cost their companies too much time and human resource.

III.METHODOLOGY

BIM methodology has gained great importance in construction industry.

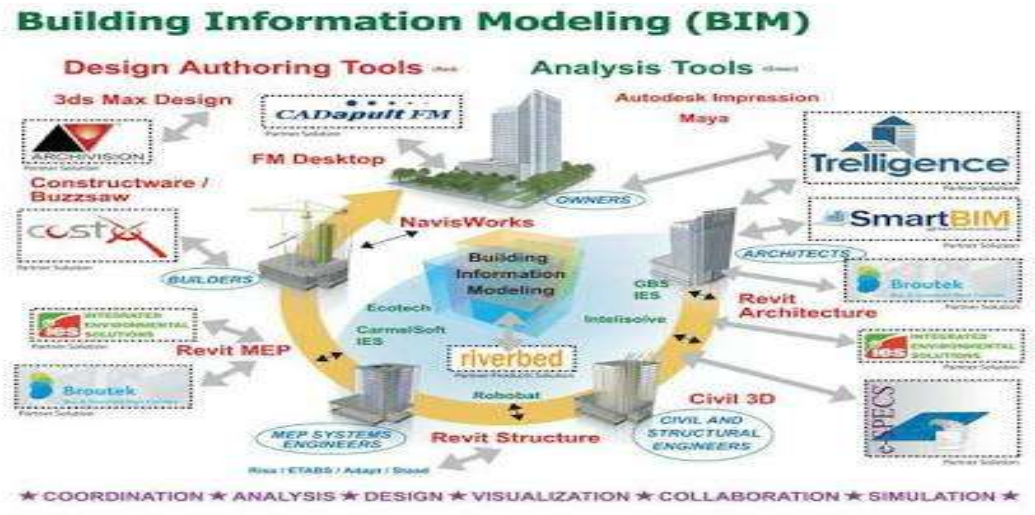

Fig2: Design tools and analysis tools.

Schematic design	Detailed design	Construction Detailing
• Options Analysis (to compare multiple design options) • Photo Montage (to integrate photo realistic images of project with its existing conditions)	• 3D exterior and interior models • Walk-through and fly-through animations • Building performance analyses (e.g. energy modeling) • Structural analysis and design	• 4D phasing and scheduling • Building systems analysis (e.g. clash detections) • Shop or fabrication drawings

Table 1 BIM Application in project design phase

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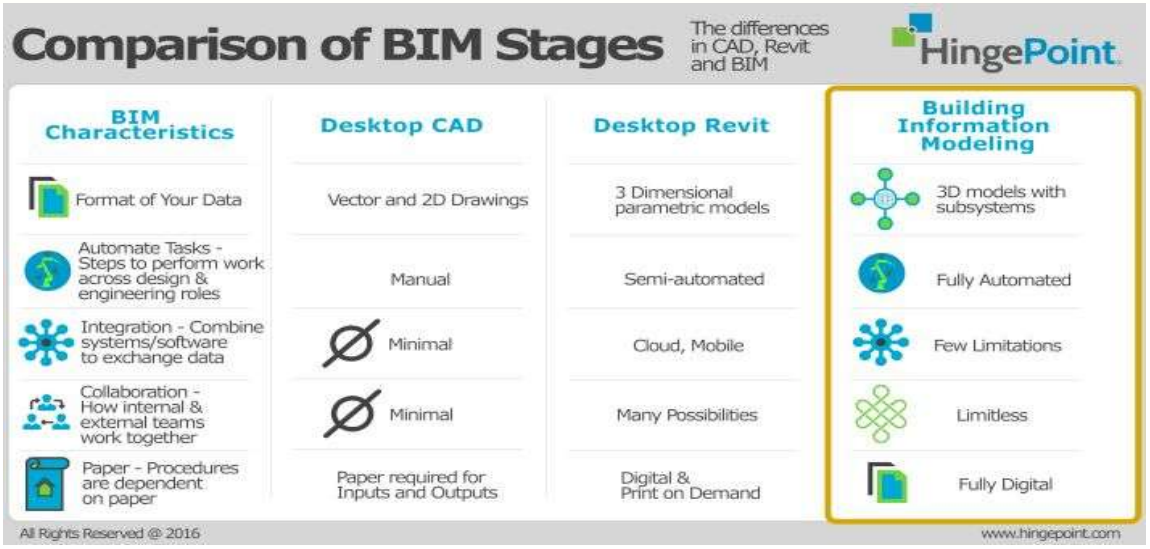

Fig3: Sketch showing comparison of CAD, Revit and BIM.

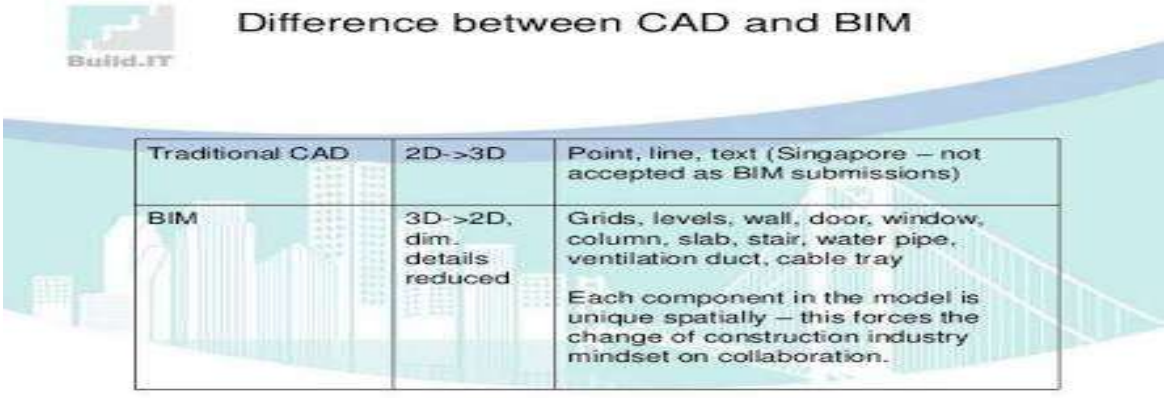

Fig4: Sketch showing difference between CAD and BIM

The main part of the BIM is devoted to discussion about what kind of difficulties during construction and implementation of BIM technology, risk in construction, potential benefits, and limitations.Methodology introduced changes in the building design, construction and maintenance are traditionally managed. This paper presents literature review of the interaction of BIM. The review consist conference proceeding, journals and books which are science direct, taylorand francis. There are lot of BIM software in Autodesk. In order to explore the BIM tools, as support to planning of construction and 3D model created first. By using Revit software only infrastructure model and architectural model were generated. And to create 4D model time factor should linked to BIM model element. To generate 4D model the Navisworks software is used. 4D model gives the visualization and planning simulation.

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	

Table 2: The efficiency difference between CAD and BIM applications for a particular project in different phases

The main difference between BIM and CAD are CAD system is usually 2D document, CAD represents two line wall. And in BIM wall is created in the form of interactive tool. Also Revit is applicationbuilt for BIM with architectural features in short Revit is not BIM. Revit is built for BIM. Tekla structure is a BIM software able to model structure that incorporate all type of building material like steel and concrete. Tekla structure is known as Xsteel. It is professional tool for project.

IV.RESULT AND DISCUSSION

Quantity takes off and cost estimation with the help of BIM software, precise quantities for materials can be obtained as reports. For instance, documentation of reinforcement including information about the quantities and properties of the material can be obtained.Cost estimates can be extracted from BIM software through quantity take off. This way, the object- related information stored within the model can more easily be converted into bills of quantities that provide accurate cost estimates, while minimizing the risk for human errors and miscalculations. Time simulation (4D) BIM offer the possibility to link scheduling and planning to the 3D model. This allows for work tasks to be linked to physical objects and visualized sequentially, which effectively communicates scheduling in a completely new way.

V.CONCLUSION

Most of the studies reveal that BIM can address interdisciplinary inefficiencies in the construction industry. Also, it can serve as future of the project management which can be really beneficial for the construction Industry. During the construction phase, usage of BIM would reduce the co-ordination problems between various agencies involved in multidisciplinary work and thereby would enhance the collaboration project due to which many of the project risks can be avoided and also the overall project cost can be reduced BIM can play a significant role to change the scenario of construction Industry which suffers due to several problems.

This ideal scenario offers many benefits, including:

I.Reduced management and infrastructure equipment costs.

II.Critical building system information is readily available at all levels of the enterprise.

III.Employees can access and act upon this information without the constraints of a dedicated workstation at a fixed location.

IV.New services are possible that save time and preserve resources.

As there is need for more greener projects in construction industry within few years, BIM can execute more greener and more sustainable projects to the construction sector, hence directing construction Industry to more Environmental friendly Industry. When making an investment in BMS technology, an organization should look beyond today's configuration. Decision makers need to cast a wider net and recognize the advantages of merging the building automation system into the IT infrastructure. Whatever technology platform is selected to harness energy and operational data, it must be fully compatible with the IT network that is already in place.

As a future scope of study, the BIM model can be further strengthened by exploring the potential of use of BIM with Integrated Project Delivery (IPD) for operation of the transportation system.

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