

USERS BENEFITS IN USING BIM (*BUILDING INFORMATION MODELING*)

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ABSTRACT

Building Information Modeling is a set of interacting policies, processes and technologies generating a methodology to manage the essential building design and project data in digital format throughout the building life-cycle.¹ The use of BIM models improve the planning and design and construction processes and lead the users to new terms such as 4D (adding time to model) and 5D (adding quantities and cost of materials) which is not introduced in traditional 2D-Based design of building industry. This paper present a brief description of new 3D based intelligent modeling in building design and construction and operation and benefits of its (Designers, MEP and Contractors).

1. A brief introduction on Building Information Modeling (BIM)

Building Information Modeling is a concept and tools to transform capabilities within Architecture, Engineering, Construction and Operation industry. Use of technology in design and construction industry even in construction operation and managing the maintenance operations and at end renovation or demolition is the example of the use of 3D-Model based design information.

Building Information Modeling is the development and use of a computer software model to simulate the construction and operation of a facility. The resulting model, a building Information Model, is a data-rich, object-oriented, intelligent and parametric digital representation of the facility, from which views and data appropriate to various users' needs can be extracted and analyzed to generate information that can be used to make decisions and improve the process of delivering the facility²

BIM models can improve the planning, design and construction so it`s expected this rapidly growth of BIM, an increasing number of BIM-specific software tools, books, blogs, tweets, tags and report from trusted market watcher shows this growth.

¹ Refer to 'The Five Components of BIM Performance Measurement' by Succar, B in University of Newcastle, NSW Australia.

² Associated General Contractors of America '' The Contractor`s guide to BIM'', first edition

1.2 BIM Tools

To gain the benefits of using BIM designers, contractors and other inclusive team in building industry have to be prepared and concerned with some materials. In the first step they have to have a right plan and keep it simple. This plan should consist with following specifications:

Steering Committee: To support the efficient BIM process a senior management to engage in BIM performing process.

Dedicated Effort: Dedicate someone to the project with sharp interest in BIM process, they should be focused on the results and also they should be allowed to make decision to make effective updates to achieve the main goal.

Integrate the Effort: Ensure that the project works with the current situations of business and partners and also recognize where the BIM tools will require changes in the project.

Collaboration: sharing information and collaborating environment is one of the principle needs in BIM so having group of team which can collaborating and flexible in data sharing is important issue.

Hardware Requirement: BIM software needs to have appropriate computer hardware to have a good performance.

Connectivity: Access to the high speed internet connectivity in through the offices and site is necessary in BIM process because it is based on the collaboration environment.

It is important that use the right BIM tool(s), select the best software is based on these criteria³:

Simplicity: Make sure the software is easy to learn and use, read the instructions.

Functional: ensure that the tool meets your specific needs and usage by reading about the tool before you start using it.

Interoperability and Collaboration: the tools you use should work well with other software, as being able to interchange document formats or convert documents helps.

Providers' longevity: despite a quickly changing technology environment, make sure you are confident that the vendor will be around for the long run.

Support and Training: the tool should have quick, effective help and the provider should include appropriate training (electronic and in-person).

Environment: double-check that the tool will work in your environment with your hardware, communications, and collaborative partners. You may want to consider using one of the various technology hosting services to provide the environment for your tools (especially in the beginning, until you determine your specific needs).

³ Associated General Contractors of America "The Contractor's guide to BIM", first edition

2. BIM BENEFITS

There are some myths about Building Information Modeling such as⁴:

- BIM is only for large project with complex geometrics.
The benefits of using BIM on all projects, regardless of size and shape are being proven by contractors using BIM today.
- BIM is only for large contractors who can afford the investment.
The benefits of using BIM are being seen by contractors of all sizes. The level of investment and commitment is scalable.

The most common question about BIM is, who is receiving the most benefits in BIM and who has to pay for it? The answer is that all the users have benefits to use BIM and there are lots of detriments in not using BIM, for instance a contractor should cost initial cost to learn and use BIM but after using it by laborsaving in construction processes by reducing the errors and corrections and lower warranty costs, etc that cost will back.

On many projects the use of BIM can be as basic as the availability of a 3D model produced by one or more of the specialty contractors, suppliers, such as steel fabricator or mechanical contractors. Now there are software applications that can now combine models produced in different design packages into a file, to view one composite model.

There are some benefits to the constructors using BIM⁵:

- The ability to identify collisions: By using BIM contractors and also A/E can share their models and the complete model can be study and discuss in collaborative way so the probable errors can be detected before the construction process so, the correction just take place in modeling not in construction process (a complete 3D-model based can show if a duct running in structural member.)
- The ability to visualize what is to be built in a simulated environment: The 3D-model shows to A/E, Contractors and also non technical people who involve in the project (client, users, etc) to see and recognize visually the building in its environment, so they can share their idea and discuss about it.
Also it is useful in construction management such as sequence of operations and manages the sequence and tools by showing the environment of building construction not image of it.
- Fewer error and corrections in the field.
- Higher reliability of expected field conditions, allowing for opportunity to do more prefabrication of material offsite, which is usually a higher quality at a lower cost.
- The ability to do more “what if” scenarios such as looking at various sequencing options, site logistics, hoisting alternatives, cost, etc

⁴ Associated General Contractors of America ” The Contractor`s guide to BIM”, first edition

⁵ Associated General Contractors of America ” The Contractor`s guide to BIM”, first edition

- The ability for non technical people (client, users, etc) to visualize the end product. This can be useful in economic manner of project, such as selling the product before it completed.
- Fewer call back, lower warranty cost.
- The ability to interoperability of information exchanges in a project in different scales: There are lots of costing due to inefficiencies caused by lack of information sharing throughout the building life-cycle, the majority of this cost is happened during the construction to operation phases⁶. [FIGURE 1]

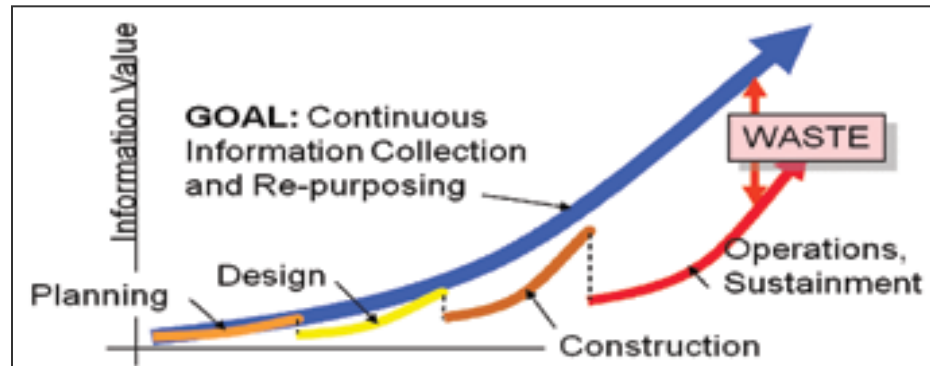


Figure 1

- Less maintenance cost (Design for maintenance): Energy efficiency is the first and biggest component to be focused while studying the operational cost. But A/E, Contractors should be aware of other big cost which is building maintenance cost. Now it is common to use BIM for design and construction phases but also it is required that to use it throughout the life-cycle to include facility management (FM). So by using BIM to design a maintenance strategy the cost will be reduced by assessment the life-cycle and managing facilities.
- There are also some indirect benefits in using BIM, it is harder to measure the indirect benefits of using BIM, for instance a easy measurable element is time. By using BIM to present 4D schedule, AEC can reduced their meeting time, to have a sum if a price of an hour for each person is 100\$ and the number of the AEC who involve in the meetings are X persons then at least $100\$ \times (X^2 - X) / 2$ economized. (If just each person has a meeting with other during the design and construction phases.)
This saving can be calculated also for design, administrative and management time that is saved by sharing information.

⁶ - Foster, Birgitta, BIM for Facility Management (Design for Maintenance Strategy), Journal of Building Information Modeling, Spring 2011

These are some benefits in using BIM also there are lots of negative effect and increasing in cost occurred by not using BIM. You can see the comparison between effects on project by using BIM and project without using BIM on the following table⁷

Audience	No BIM	BIM	Cost of Not Doing BIM
Owner	Your company's IT system goes down for two minutes because you couldn't find the facility management (FM) data you needed to test the generator in time. <i>Business cost: \$3,000,000</i>	You use BIM to create a digital FM tool. Your FM staff accesses data in seconds. Completes generator test. Your business stays up. <i>BIM / FM system cost: \$300,000</i>	\$2,700,000 million business loss
Architect/Engineer	A team designs a standard glazing and HVAC system without the benefit of BIM modeling or simulation energy analysis. First cost: 0 (included in standard AE services) <i>30 year life operating cost: +\$800,000</i>	A team performs optimized energy analysis using visual BIM interface with the owner and FM staff buy in. <i>First cost: Add \$20,000</i> <i>30 year life operating cost: \$100,000</i>	30-year lifecycle operating cost: Premium \$680,000
Construction manager	CM finds typical errors, omissions and conflicts in documents on \$100 million project. Change orders result. Funded via three percent construction contingency. <i>First cost: \$3,000,000</i>	CM, design team and subcontractors use BIM to resolve conflict pre-field. <i>BIM cost: \$500,000</i> <i>Contingency saved: \$1,500,000</i>	Potential net owner benefit lost: \$1,000,000
Construction manager	CM sets up and de-mobilizes three cranes and four sets of scaffolding by individual subs. Costs included in subcontractor cost of work to owner. <i>First cost: \$100,000 included in subcontract costs and general requirements</i>	CM uses BIM in scope meetings to visualize one shared crane and one set of shared scaffolding. Subcontractors reduce cost. <i>BIM cost: +\$50,000</i> <i>Shared scaffolding first cost saved: -\$50,000</i> <i>Schedule reduction yields 1 week general conditions cost reduction: -\$50,000 saved</i>	\$50,000 net savings missed
Trade Contractor	Trade contractor includes contingency in curtainwall bid based on 2D unclear construction documents. Submits higher bid proposal and loses job. <i>Added cost included in owner cost of work: \$450,000</i>	After seeing AE/CM's BIM in scope meeting with verified quantities, trade contractor increases certainty and confidence, reduces bid, uses cost-effective, unitized, prefab approach, wins project. <i>First cost curtainwall savings to owner's contingency: \$450,000</i>	Subcontractor loses \$200,000 profit opportunity from project award. \$450,000 additional cost of work to owner without BIM
Building product	Use road trip office visits, faxes and manual catalog updates. Sales revenues	With online digital BIM and integral product	\$1,000,000 impact to BPM

⁷ LeFevre, Michael, Leverage Points, Reframing and Key Decision Factors in BIM Transformation, Journal of Building Information Modeling, Spring 2011

manufacturer	Decline. <i>Business cost: \$1 million</i>	Data and live simulation/ analysis tools, AE's and owners download smart objects. Sales reps spend time building relationships and helping customers in value-added, context specific, customized ways. <i>Business savings: \$1 million</i>	
Building users, business, stockholders	Viewing 2D drawings and cardboard models, users are disconnected from the design and project. After move in, space does not function well for intended use. Morale and productivity suffer. Employee Attrition increases to 10 percent. <i>Business cost: 5 percent drop in companywide profits. Replacement cost of 2.5 times each employee lost. -\$2M annual impact.</i>	BIM visualizations and walk through are used to achieve user buy-in and understanding. A state-of-the-art, green design, quality construction and a high performance building enable a high performing business for the next 30 years. After move in, company employee retention increases 5 percent. Profits increase 5 percent. <i>Business profits: \$2 million above previous year.</i>	\$4,000,000 profit swing in one year

SUMMARY

BIM is a concept and tool to manage share the information and data to have a composite model to manage all phases of design, construction and also managing the maintenance operation to have efficient processes which based on 3D intelligent modeling

To compare project using 3D-model based design Information with a project using traditional 2D method, in the project with BIM performance errors and corrections and re-fabrication in the phase of construction reduce a lot, so cost saving is one of the result. The benefits in using BIM is are not only proprietary for contractors, all the involvement part of a project has their own benefits.

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