VIRTUAL CONSTRUCTION:
ADVANTAGES AND EXECUTION

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SUMMARY

In-house building information modeling (BIM) offers many advantages and can be implemented in several stages to ensure enhanced control of the overall process.

VIRTUAL CONSTRUCTION

There are many reasons that motivate a company to switch from two dimensional (2D) to three dimensional (3D) tools. For instance, the exceptional graphic support that comes with the ability to view projects during discussions and coordination meetings greatly facilitates the comprehension of the more complex aspects of a given project.

Advantages of building information modeling (BIM)
In addition to providing a 3D perspective of a project, BIM offers project partners many other benefits, such as:

- time-lapsed construction simulations that can be used to produce the building schedule (four dimensional (4D));
- availability of real vs. estimated costs (five dimensional (5D));
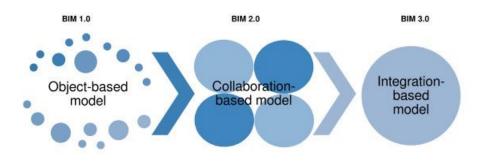- facility management (six dimensional (6D)).

The various sourcing and calculation methods used to obtain the information needed to execute a project inevitably impacts a team's approach to deliverables. Consequently, both organizational and policy changes are necessary. However, changes to work processes must be addressed in chronological order in order to achieve established objectives.
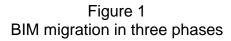
Three phases of migration
A migration towards BIM begins with a joint collaboration between the information technology (IT) and technical design teams in order to establish an implementation plan that takes all possible factors into account. An action plan must be created to define objectives and subsequently divide and assign responsibilities to various resources. A roadmap is then established with which to perform all essential tasks without getting lost along the way.

The three main phases of a BIM migration are illustrated in Figure 1 and explained in the following paragraphs.

Figure 1
BIM migration in three phases

BIM 1.0 – Object-based model
In the first phase, the most expensive and critical in the integration of these new practices, user training and a new project methodology must be developed and implemented. It is also at this time that BIM terminology should be provided to all team members. Teaching institutions, specialized external consultants and user groups can be considered as valuable resources for the creation of a training program.

BIM expert is required at this stage to operate the model. Generally, 2D and 3D viewing documents are sourced from the building information model. However, the model itself is a data powerhouse, which is not shared with other disciplines. This object-oriented parametric model is the evolution of solid and pure 3D geometry. During this phase, the BIM is always discipline-independent and deliverables are mainly represented in a lightweight exchange format (3D PDF, DWF, 3D XML, etc.). All contractual and responsibility-related considerations continue to be applicable.

BIM 2.0 – Collaboration-based model
Several experts are necessary during this phase in order to manage both the models and the various teams involved. Multiple project partners must proceed to exchange data that is exempt of geometry in the original (native) format. Companies can mutually generate project data through collaboration, a consortium or a joint venture. They can also choose to create a model using a non-proprietary exchange format such as IFC, CIS/2 or SDNF. This interaction allows participants to conduct a variety of analyses, including clash detection and construction simulations, as well as perform building schedule planning and other tasks.

This particular phase facilitates several aspects including the exchange of participative data via a virtual 3D mock-up of each discipline, inter-operability, design based on user needs (calculation and simulation tools) and team collaboration. It also allows users to interact using dialog similar to that of social media through a number of dataflow tools extracting data from the models like BIM Server (Graphisoft), Bluestreak (Autodesk) and GTeam (Gehry Technologies). Contrary to BIM 1.0, in which user-managers (readers) are limited to viewing or only a passive use of the content that has been created for them, users can create content and share data in a virtual environment.

BIM 3.0 – Integration-based model
This phase is the ultimate goal of BIM theories and concepts. Integrated Project Delivery (IPD), which replaces the traditional design-build and design-bid-build approaches, is the new method used to execute projects. The approach fosters collaboration with other project partners in order to ensure an optimal overall outcome. Unlike IPD current mainstream project delivery models favor silo-type responsibility-sharing in which participants only exchange essential information that has been specified beforehand in a contract.

An integration-based model unites the knowledge and strengths of all project partners in a group effort to improve each stage of the project including design, fabrication and construction. This type of collaboration exposes any benefits to a specific participant that are made at the expense of the project.

The customer is generally more present during the design phase caused by the multiple iterations of the design team, increased accuracy of construction costs brought by the collaboration of the general contractor and the more detailed and streamlined control and follow-up of the project. The building owner therefore benefits from the concerted efforts of a team of professionals who work together to achieve the best possible results.

This global optimization and merger of integrated solutions opens up new horizons. Intelligent systems can automatically update models and vice versa. Data is collected during different stages of the building's life cycle and from regulatory authorities, which ultimately will slowly reduce human interventions.

Participants collaborate in real time using centralized servers. The production and sharing of data, accesses and user rights are defined and performed by the BIM system, effectively replacing the user. Iterative analyses by successive input, previously impossible due to lack of time, are conducted via cloud computing. Experts work in teams to create one or more models and to consolidate systems, processes and policies.

CONCLUSION

A full migration towards BIM can be achieved by segmenting actions into several phases to ensure an enhanced control of the overall process while accounting for all applicable factors. The current market stakeholders as well as certain government agencies are already making a place for BIM by taking a keen interest in these new technologies.

REFERENCE

BimerWorld, blog and articles on Revit and BIM.

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