To BIM or not to BIM, This is NOT the Question

How to Implement BIM Solutions in Large Design Firm Environments

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Building information modeling is the technology that is converting the workplace in design firms. The initial resistance to applying the concept has faded due to many reasons. Professional architects now see the feasibility and benefits of using the new technology. CAD managers in design firms are working toward the implementation of BIM packages in order to eventually, replace the conventional CAD platforms that are still widely used. However, there are still internal obstacles that slow down the process of the implementation. The change in the project management and the required proper training for the conversion are the two major internal obstacles. The current well organized work flow tailored around the conventional CAD platforms has to be changed in a way suitable for the new technology. The training firms provide for their employees should also be re-structured in a more vertical organization in order to guarantee that everyone understands the new concept and the new work flow.
Architectural education usually reflects the needs of the work market. It is very important to understand the needs and identify the directions where the architectural education should go. What do we expect from newly graduated architects? How should we shift the focus toward BIM based CAD in design schools? And, what does it mean to teach modeling versus teaching drafting?

Keywords*: Computer Aided Drafting; Building Information Modeling; Architectural Education*

Introduction

CAD technology has gone through many stages of development since the very first CAD system. Initially, the problem was to digitally represent and present geometry. By the 1980s, the focus of the development started shifting toward a more fundamental question which was how to present and represent the components of the building themselves rather than just the lines and arcs used to display them. This effort resulted in the emergence of what is now called Building Information Modeling, BIM. It is the new CAD technology that promises to change the AEC industry production and delivery methods and bring it closer to the aircraft and automotive industry models of handling the information about buildings (Beucke and Rang lack, 1993).

With BIM technology, the building is represented as a digital database that holds information about the geometry of the components as well as the data

relevant to these components. The concept depends on objectifying the components and attaching all related data to these objects as properties. Having the building information as one data model suggests the potential to utilize this data in several other ways such as the automatic generating of bill of materials and online cost estimates.

The problem

Slowly but surely, BIM based CAD systems are finding their ways into design firms around the world. However, it has been obvious that the smaller the firm size the faster to implement the new technology than larger firms. But, despite a well established conventional CAD practice, feeling the competition and fearing being late to adopt a winning formula have become major forces among others, behind the decision to implement the new technology everywhere. The question of whether or not to implement this new technology has changed to how to implement it.

In a big design firm environment, it seems difficult for CAD managers to easily choose and adopt such a technology from a management point of view.

This is due to many reasons; first, there are many BIM platforms provided by different CAD vendors with considerable differences in their capabilities, major differences in the way they handle the data and some differences in the way their work flow should be organized.

Second, the way CAD vendors take advantage of their previously proven technologies complicates the choice decision even further, as they push the decision makers in the firm toward investing in what they already have of older CAD systems, consequently skewing the decision to a particular vendor regardless of what is most appropriate.

And third, because of the immaturity of most of the current available BIM packages, CAD managers need to foresee the future development of the product and guarantee in some way, the future inclusion of the required functionalities and tools that current versions usually lack (Ibrahim and Krawczyk, 2003).

The internal story

However, and regardless of all the obstacles, the implementation of a BIM platform has been one of the highest priorities most big firms are thinking about and working hard to realize.

In fact, CAD managers in architectural firms do see the full benefit behind implementing such a technology and also value the performance benefits even where this adoption means big investments in conversion and training (Johnson, 2000). The initial resistance to implementing BIM has disappeared, but a different set of internal obstacles tend to appear.

Those obstacles can be categorized into two major categories; project management related obstacles and training organization problems.

Project Management

Project managers are the people responsible for getting the job done, one way or another. They are always concerned about the efficiency of their teams and the proper use of their budget. Having never used such CAD platforms before raises many objections:

BIM is yet another three-dimensional modeler

The first internal obstacle is dealing with misconceptions and clarifying that BIM is not just a fancy three-dimensional modeler of geometry as it is perceived. There is sometimes a confusion between BIM based CAD and the three-dimensional modeling on standard CAD software. Architects might believe that they are working with BIM as long as they are solid modeling their buildings in three dimensions.

Bad experience memories

Another obstacle is dealing with some of the bad memories professional architects had while working with other applications that proved very difficult to

setup and maintain. Poorly developed applications which marketed the BIM concept very early has contributed to the rejection of implementing better solutions. Persuaded by the promise of automating chore tasks, many offices tried some sort of BIM based CAD very early on. Except for few packages, using the poorly developed software has always affected the opinion about all other packages.

Understanding the full potentials

It is very important for the CAD manager to explain the full potential of the technology and how BIM based CAD connects to other applications and analysis tools because many architects believe that BIM only benefits would be the automatic drawing generation (Graphisoft White paper, 2003).

It is very important to highlight the real potential behind a BIM based CAD platform as a way to look at the building. This is achievable by introducing the database concept, and clarifying that drawings, tables and perspectives are just different ways to look to the same database (Revit white paper). Also, to highlight the potential of extracting certain data about the building that can be directly used in another application for analysis. Otherwise, BIM packages would be perceived as a direct replacement of the general purpose drafting CAD. If correctly tied to other useful analysis tools, the acceptance rate becomes sufficient to overcome the concerns.

Multi disciplined design environments

The problem becomes more complex when dealing with multi disciplined design environments; where structural and mechanical engineers work with architects in closer relationship than the regular architecture only environments. In such an environment, it is preferable to bring up the issue of data sharing in terms of formats and platforms. The best solution is upgrading the whole team to the same platform when possible; otherwise it is very crucial to bring up the process of file formats conversion and compatibility.

Efficiency and work flow questions

What are the benefits? Isn't the current production method efficient? How would this affect the production of the project? These are some of the project managers concerns which are always related to efficiency. They always compare the current process with the new process.

In fact, there is a difference between managing a project that started on BIM versus a project that started on conventional CAD. The BIM project would need allocating more personnel in the early phases of the project, which contrasts with the conventional way of allocating personnel when large numbers are usually needed in the construction documents phase later in the project. The changing curve of resource allocations and changing the process of production of drawing has to be fully introduced and understood.

The answers to these questions are all related to providing adequate training to architects as well as project managers as discussed later.

Where/how to start

When it is time to select a pilot project, CAD managers always hear: "I can see it is a very promising technology, but not my project, not in this phase, not on this time schedule, not on this budget, etc." Because of the question of efficiency, project managers will always be concerned about selecting the right project to start with.

In fact, it is irrelevant which project to choose. Neither the size nor the budget would affect the success of the pilot project; it is the determination of the team that will get it through. The pilot project team should consist of the most enthusiastic architects about the technology.

Risk management

Last but not least, is having a contingency plan. One of the big concerns in a design firm is fulfilling the responsibilities the firm has toward the client. Because of the nature of the contract, the architect has to deliver his responsibilities regardless of the tools

used. It is always better to have a contingency plan in case the conversion to the new platform did not go as planned. If a project manager would be brave enough to test a new platform or technology, he/she has to take into consideration the way out contingency plan as well. Software vendors and their technical support teams usually play a vital role in providing this insurance.

However, excessive dependence on an escape rout might itself destroy the benefit of the challenge to succeed.

Training

The issues regarding training are several. The very first problem is comparing the training firms used to provide for their employees on conventional CAD platforms with the kind of training required for BIM based CAD.

Conventional CAD platforms were more or less a replacement for the drafting table and pen, which made the training focus on the aspects of using the application rather than rethinking the work flow.

It is different in the case of BIM based CAD, as training should consider the change in the process along with the new application interface and functionalities. The user of a BIM application should start thinking about the building more than thinking about drafting.

In the design firms today, we still see designers who do not touch computers and keep their conventional media as their primary tool to exchange ideas with their teams. And even with computer savvy designers, it is always the task of younger architects to draft and model on CAD. The review and markup process also depends on printing digital drawings on paper and marking them up with colored markers then passing them back to younger team members who correct the remarks on the digital copy. It is not unusual for a team leader to mark up a plan, an elevation and a section of a building then give away these corrections to three younger team members. This will be different working with a BIM based CAD system, as such corrections should be passed to only one architect who will make the required change to the model once and it will get reflected in the plans, section and elevations automatically. Therefore, the training should not only be provided for the team members who would model and draft digitally, but also to designers and project managers who oversee the process and review the drawings.

Here are some other concerns regarding training:

Ubiquity of conventional CAD users such as AutoCAD

As much of an advantage this was at one day, it is becoming a disadvantage today as it is required to change the mind set of conventional CAD users to a different one. An architect with no previous CAD training would be easier to comprehend the concept of BIM.

Vertical training: training within the different levels of personnel in the office

As previously discussed, almost everyone in the firm should get introduced to BIM technology in order to guarantee its successful implementation. What was acceptable before that some people do not need to know CAD has become unacceptable, since they will need to work closely with users who operate the application in an unprecedented way.

In this regard, it is important to tailor the training to address different categories needs. Project managers for examples should be trained differently than the architects who will deal with the model on a daily base, but everyone should get trained.

New hired architects training

A market full of conventional CAD users would only provide them as new hires. Setting up a policy of providing a specific amount of basic training to every new comer, once accepted, should homogenize the team and guarantee basic level of knowledge to the work force. In addition, the experience sharing between architects should be highly encouraged,

as it is hard to have one architect who would be fluent in all aspects of the new applications. This is true nowadays and will be particularly true with the new BIM platforms. It is obvious that the conventional CAD training provided by most architectural schools will not provide the required skills to the graduating students joining the work market.

Layered training: action plan

Without the proper organization of the training plan, it is very hard to reach the required results. A good training plan should be divided into: first, a broad introduction in the form of presentations, followed by hands on trial sessions that is open to everyone during lunch hours and after hours.

Second, scheduled training classes should start shortly after this type of introduction starting with and targeting those who are most interested and enthusiastic about the technology and willing to go the extra step to understand and utilize it.

Third, more specific advanced topic classes can be provided as electives where every individual would choose as desired.

Fourth, because of the nature of the packages and the amount of instructions required to remember, it is a good idea to schedule follow up classes with the purpose of providing an interactive question and answer sessions that help solve real world problems the users face while working with the application.

Architectural Education

Ironically, the same problems facing professionals in design firms are those facing academic educators in schools of architecture, but with some different aspects. The misconceptions about the reality of BIM, the previous bad experiences with slow systems and badly designed packages and the lack of understanding of the full potential of the applications are the common issues.

In the light of the new paradigm shift, few schools have started looking at the problem of preparing their students for a career in a BIM enabled work environment. Many schools around the world are still sticking to the old curriculum for teaching CAD, mainly teaching AutoCAD as a general purpose drafting package. The problem is due partly to the novelty of the technology as there are few people capable of teaching it, and partly to the dilemma of teaching one application versus teaching the technology behind it.

As mentioned before, the training required for BIM based CAD should focus on the change in the work flow rather than the application interface and functionalities. Therefore, building a course for teaching these systems should follow a different path than what it used to be with conventional CAD. The training should be tied closely to the design curriculum in the design schools. Students should get acquainted with the application after they get to understand what design is, but before they get trained on a conventional drafting CAD application.

Which package to choose for education? This will become a serious question facing educators. We can not teach computer classes without computers, and we can not teach a certain technology without demonstrating it with examples.

Some vendors have reached to design schools faster than others. They know that the more students get trained on their platform the higher the likelihood that they will use it after graduation. Is this going to be the criteria to choosing which package to use?

In fact, it is possible to explain the concepts behind BIM technology which generally applies to all different applications and it is also essential to explain the differences between these applications and conventional CAD, but when it comes to demonstrating and training, there will have to be a package of a choice.

It might be enough that students learn the basic concept behind it and get trained on one package, then pick up the rest as needed on their own.

Another approach is having a class that is made up of different sections showing many applications

and leaving the choice to the student. This will also mean investing in more software and teachers for the school computer lab.

Regardless of the approach, it is clear that addressing this problem is inevitable, and it is becoming more important of an issue than it used to be.

Finally, this paper is written by an educator who had the chance to interact with a big design firm in North America and to witness first hand experience the challenge to adopt a BIM based CAD system while working as a digital design team lead.

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