

TRENDS OF BIM DEVELOPMENT

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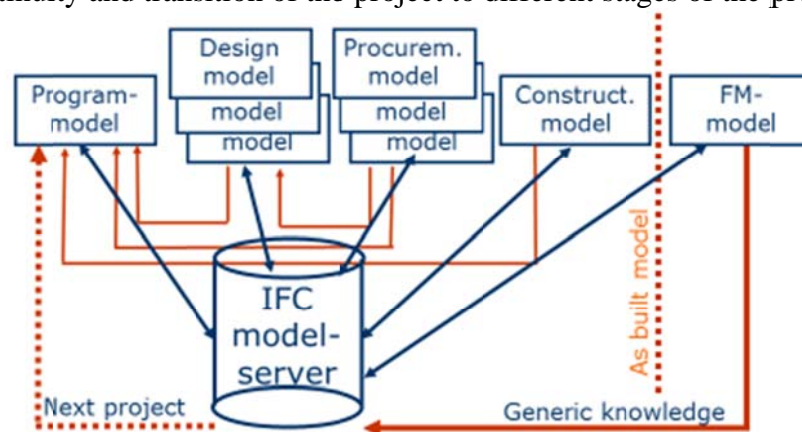
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Abstract: The article will be considered as BIM is a new way of organizing and processing building projects with coordinated software inducing various significant benefits to the AEC industry. Although a relatively new process, in an industry generally slow to adopt change, BIM has made an ongoing impact in the construction process.

However, many companies have been slow to fully implement the process of BIM and the financial recession has further hindered the transition.

The future of BIM is becoming a reality; the construction industry should see huge benefits, through many advantages, with the structure and functions of AEC professionals being transformed. The potentials of the technology involved in BIM processing have yet to be fully realized, and will continue to amaze and inspire over the coming years.

Nowadays, considering the market of consumers of computer-aided design, can be stated that it is more or less saturated. Enterprise, aimed at intensive and high-tech approach in the design, for the most part are the owners of an impressive set of licenses of various software. Among them: three-dimensional design tools, simulation, engineering calculations and other programs. However, this does not mean automatic transfer of the enterprise to a higher level of performance in terms of speed, quality and complexity of development projects. More and more organizations in the field of construction development trying to organize the practical environment to engage the group design, system engineering and data management. It is not enough to buy and confidently and skillfully use the professional software, vitally important to build a process chain and create unified design environment, to ensure the continuity and transition of the project to different stages of the project life cycle.



Pic.1 Effect of BIM by using in all phases of the project life cycle.

New technologies play the main role into the construction market development and BIM is one of the most important.

BIM (Building Information Modeling is a building information modeling) is one of the most promising and revolutionary technologies, allowing to solve problems of ROI (return of investment). This technology allows optimizing processes related to the design, construction and operation of buildings, it is also created to provide seamless transfer of data from one holder to another and to make a picture at any stage of the life cycle of the object is completely visible. This can provide financial and time savings.

BIM is not software, but a process. The software facilitates the principle of this fresh approach. BIM is a relatively new independent medium or way of addressing the business of monitoring a construction project in a way that is modern, and perhaps futuristic, but above all, can produce very accurate results and cost savings – over the entire building lifecycle, particularly design but also in the construction phase and facilities management area.

“Building Information Modeling (BIM) is the process of generating and managing building data during its lifecycle” (Lee, et al. p. 758) It is most commonly used in cooperation with a 3D modeling software such as Autodesk's Revit but other solutions are possible and I will elaborate on these at a later stage. The BIM process includes the production of a digital model which incorporates not only the geometrical model but also building data such as quantities, geographical information and energy calculations. BIM or Building information modeling, aids professionals from various building disciplines, to collaborate and work together efficiently and simultaneously, potentially on a single dynamic digital model. It is also a database in which to share data and store valuable project information.

Revit is one of the software ,which totally revolutionize the way work can be shared and edited, compared to the traditional methods, for example in AutoCAD where only one person could open the file at a time. Collaborating in groups; successfully creating working models together, with different students completing their own “part” of the building.

Although BIM is not a software based platform in itself, it relies on specific software to generate the process. Without the software the process of BIM cannot be achieved, but without the process the software is just a 3D modeling program.

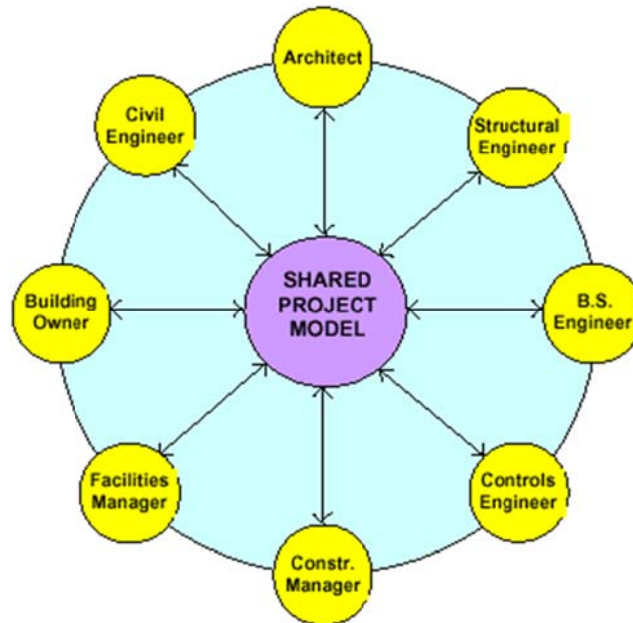
BIM allows the parties in a building project to cooperate and share information faster and more efficiently. An easily managed representation of a shared project, which issued throughout a buildings lifecycle, can save a vast amount of time and money, by cutting costs which would have been unavoidable in a traditional building project. I will talk about the potential cost and time that BIM can save businesses later on in the report.

Traditionally, since hand drawings, projects have been represented or illustrated through various CAD drawings, then manually edited with text or notes, in order to explain the information of the particular illustrations. Detailed, time consuming specifications would also have to be written up in order to fully explain what is being illustrated. In many ways this was similar to hand drawings, which were being used before the implementation of CAD, the main difference was that it could be stored digitally.

Along came BIM. The principles of building information modeling completely changed and revolutionized the way that building projects are being managed. It is now much

more important to inject as much detailed information into the models database as possible at the beginning of an eu project. This information will then be used throughout the design, and can be used at any time to present the information back to the user via illustrations or schedules. The drawings become self-explanatory and a large data base in themselves, containing parametric and user inputted data. You can therefore begin to understand how costly mistakes are avoided, by all parties of the process interacting, at an early stage of the design.

BIM models organize the project/building team through collaborated digital databases, which can be worked on locally, or through a network. This means that different parties of the project can work on the same model simultaneously, while the Building information modeler will manage the changes, to collaborate efficiently. This is achieved through a “central file” which can be accessed and updated by all of the parties, and also heavily restricted with reserve and release portions of work, depending on the user's preferences. A log of all updates and changes is made, so it is clear to see who has done what. I will talk more about this further on in the report. This opens up a lot of new opportunities for these parties to work together, to create a more cost-efficient design and build.



Pic.2. BIM Collaboration Diagram

What are the benefits of BIM and its tools?

Building information modeling enables users to input coordinated information in the design phase, in order to estimate cost at a preliminary stage of design, predicting the performance of a building. It can also produce construction documents used for planning, specifications and scheduling. This sort of automatic quantification saves time in the post design phase. BIM's process relies on a technology that accesses a single database, in order to store project information and enable easier and quicker communication within the parties involved in the construction project. This is one of the main benefits of BIM. Here are some more:

- Allows multiple operators, to simultaneously, work on a single model
- Gives accurate documentation and schedules from the construction process
- Reserves and releases portions, on different services allowed, for concise coordinated work
- All information stored in one model to avoid loss of documentation or confusion

- Pre-fabrication can be used to increase the quality of production
- Minimize building lifecycle to increase interaction between architects, engineers and contractors
- Contributes to improved construction management

The model can be used for collaboration with all parties of the project, from client to mechanical engineer. This 3D digital model can be integrated with design, analysis and construction documentation, and used as a basis to bring a design from a computer screen to a physical real life representation, quicker than traditional methods.

Who benefits from BIM and how?

“Since its inception by the design and building industry, there have been a host of other benefits, besides documentation, derived from a BIM model. All of these additional benefits are primarily due to BIM's ability to virtually realize the building through all of the stages of the design process, in the form of a database.” (Krygiel & Nies pp.38)

It is clear, that when processed correctly, BIM has many potential benefits to the overall design and life cycle of the building. I will now discuss how the process of BIM helps each individual party in a typical building project.

Architects

BIM allows Architects/Designers a lot of freedom and choice in the early stages of the design with the use of sophisticated, web-based tools, such as Trelligence Affinity, which connects the project's program to other BIM tools such as Tekla, Revit and ArchiCAD. The Architect also has a scope of incorporating eco-friendly design aspects, before the commencement of the project (Building Construction, www.BuildingsConstruction.co.cc). Software such as Autodesk's Ecotect, can be linked with Revit, to produce a better environmental design. Design prototypes, can be quickly drawn up, in order to test space arrangements, materials suitability, energy aspects and many other features. Multiple design alternatives can be studied simultaneously, within a single model. Revit also has a number of other advantages over AutoCAD, some of which are illustrated below at Pic. 3.

Model checkers will also be able to view and quality control the model while it is still in a preliminary stage, through the aid of clash detection (RevitServices, <http://www.revitservices.com/revit-clash-detection.htm>). Aside from the design perspective, the architect will also benefit from the production of well-coordinated documentation and the accuracy of quantification and costing. The reliability of the schedules can be used to create accurate lighting, energy and other mechanical calculations all within the single model. (BIM Outsourcing, www.BimOutsourcing.com).

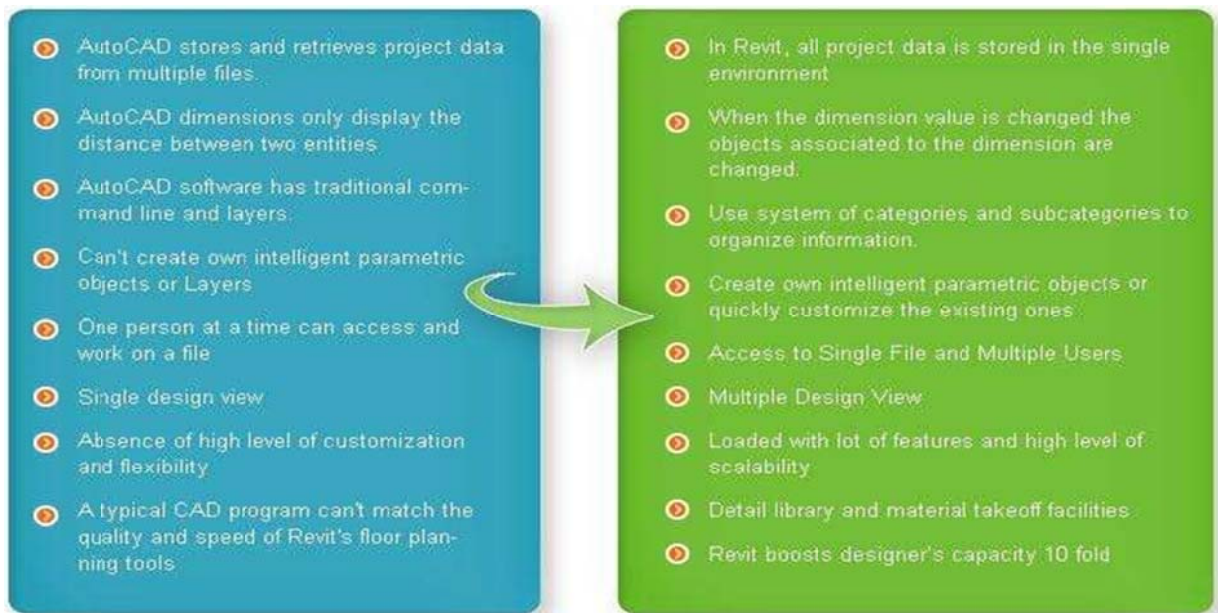
Clients

The client can also gain a lot from the implementation of BIM. From a preliminary stage of the design, clients can see a visualization of their project, which will result in fewer changes having to take place during construction. Savings from additional expenses, construction costs and operational costs, can be dramatically cut, and overall savings of around 5-10% can be expected when the project is managed successfully. Owners can get more involved with the project, ensuring all their needs are met, with a 3D visualization and walkthrough of the build. Due to early and fairly accurate cost estimations, clients will be able to check their requirements are covered by their budget.

Structural Engineers

One of the main benefits for structural engineers using BIM is they can digitally

examine and test their materials, e.g. beams, columns etc., before the construction process actually begins.



Pic.3.AutoCADvs.Revit.Source:www.BluEnt.com

This way, issues can be resolved before they cause any large problems. Detailed drawings can also be produced faster and more attention can be paid to cost issues by studying alternative design solutions on the model. Better cooperation between the architect and the structural engineer is aided by structural symbols on the model making the architect more aware of the structural limits of the building. Once a client has seen how these new methods can bring projects on time and to budget.

Contractors

There are also many ways in which the contractors benefit from BIM. Accurate construction schedules can be generated from the model, and aid in arranging materials etc. It will also give the contractors an insight into the construction site including the site logistics, which will prepare them sooner and more efficiently. Improved coordination of projects further reduces waste and costs evoked from issues such as bad planning or misunderstandings.

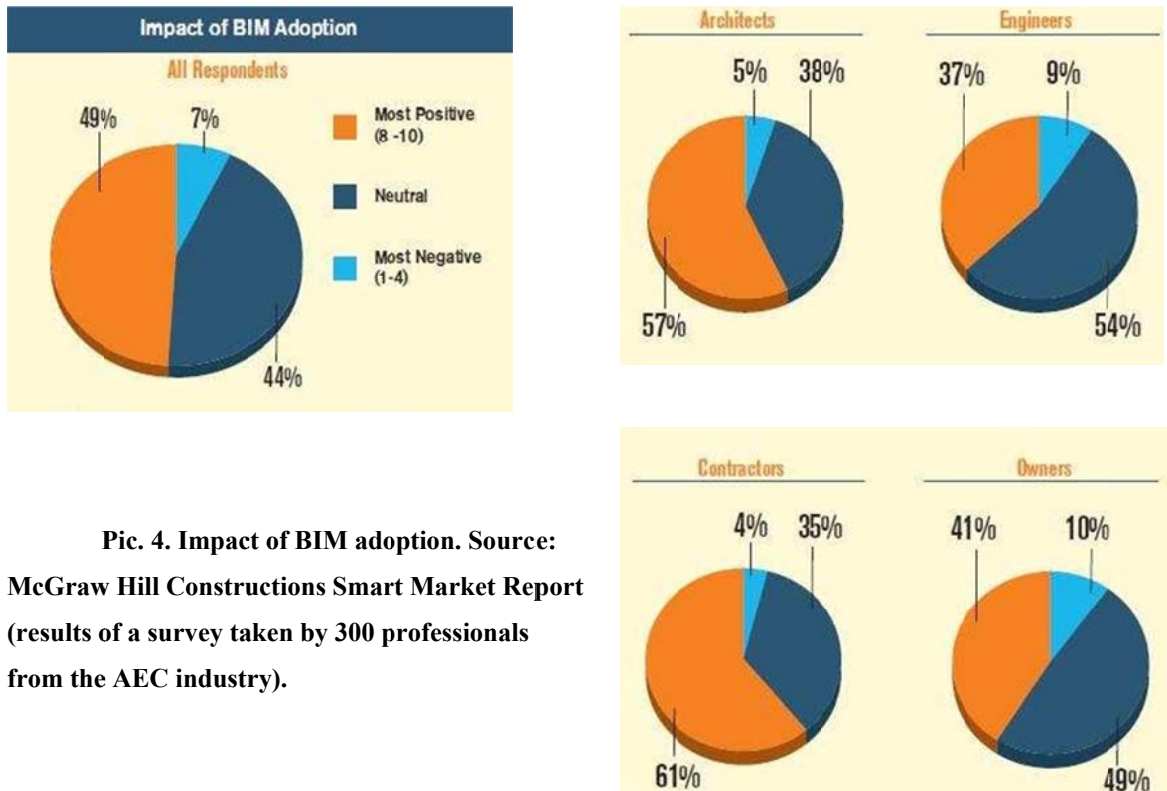
Not only contractors but sub-contractors also benefit, they now can see that a virtual model allows for better control, regarding both collisions and time planning in the procurement process (Young, Jones, et al. 2008). This has gone so far as the Association of General Contractors (AGC) in the USA, recommending to its members to build a model before bidding, if a model is not part of the tender documentation. This is having a much bigger impact than first thought (Young, Jones, et al.2008).

Cost Engineers

A BIM Model allows for better cost estimation of human resources, raw materials and structural components. Cost Engineers can utilize more accurate feedback, from the model to determine adequate quantities, suitable materials, and costing accuracy, all with the original cost plan/estimate in mind. BIM facilitates informed decisions with regard to time and material costs and the impact of each on the project's bottom line.

MEP Designers

One of the disciplines greatly benefitting from BIM are MEP Designers and Engineers. Due to the fact that mechanical engineers, plumbers and electricians will all be working on the same model means that coordination of the systems prevent clashes with each other. (<http://www.revitservices.com/revit-clash-detection.htm>) This will also produce a better working relationship between the professionals. Again, the efficiency to generate documents comes in to play, with HVAC information extracted directly from the digital model. Schedules such as fixture schedules and electrical system schedules, can be automatically synchronized with the model, to minimize errors and improve coordination and efficiency. A notification will be given if changes which are made to their system, either by the designer or a professional from another discipline, with information about what was changed, at what time, and by whom. Finally, revisions to the plans can be checked and solved faster compared to CAD, with a 3D fixture layout. Perhaps each designer will own a copy of Revit MEP or a similar service modeling program, if not there are programs out there in the market place, such as Navisworks Freedom, which would allow them to open and view the model, even without the compatible software to edit the model. (<http://www.revitservices.com>).



Pic. 4. Impact of BIM adoption. Source: McGraw Hill Construction's Smart Market Report (results of a survey taken by 300 professionals from the AEC industry).

Future of BIM

The future of BIM is exciting for all those involved in the AEC industry. Within the last 15 years, we have seen a huge impact on the AEC industry through the implementation of BIM, yet it is still in its early years. Even within the last 10 years, as BIM has become more popular, there have been large changes in its usage, where as to start with, it was mainly used to create 3D models in a similar way to CAD. BIM is still not being used to anywhere near full capacity or functionality, but is slowly getting there. With the increase of awareness and knowledge on the subject, users have begun to use the process to inspire better design and communication throughout construction projects.

As tools and applications of BIM keep developing, their function ability also improves, giving the user more control and opportunities in designing their projects. Here is the list of some tools and functions that could be involved in the future of BIM:

- Automated code checking will be a huge help to designers from all of the AEC disciplines. The possibility of importing your model into a code checker in order to ensure your construction is within regulations has already been discussed and even implemented in certain areas. This will be a hugely useful tool for designers and will eventually become a necessary part of design. (Eastman 2008 p.312).

- Internet catalogues, with prices, will be directly connected to BIM for updated price on real life items, making the estimating process even more accurate. Material companies are likely to produce 3D family catalogues of their furnishings, materials etc, to be compatible with software for example Revit, promoting their products at the same time.

- Integration of a GIS (Geographical Information System) into BIM is expected, and would aid the design and construction process significantly. An exact replica of the area you are working on could be copied and displayed as a virtual model on your computer screen. This would help the design of the site, as well as site layout, access points, transport links etc.

- Portable BIM? The potential of being able to bring a virtual model onto a construction site is being realized. Nowadays more and more on site managers walking around with iPad type devices with their Revit model available to view and extract data. This significantly decrease the amount of errors made, as well as making essential 'live'MEP and HVAC data available onsite.

- As internet connection speeds increase, so does the likelihood of AEC professionals being able to work remotely from anywhere and have online "meetings" where they will be able to discuss their virtual model in a board room style online setting. Less need for offices any more then!

- Some CAD (computer-aided design) software companies are already offering possibilities to use their software in the cloud to help people find sufficient system resources easily and to also help people work together. Cloud resources are flexible and scalable. Compute-intensive tasks can be done rapidly (think hours or even minutes, instead of days). CAD files can be stored safely, cost-efficiently and with immediate availability for being extended or reworked with a cloud-based CAD application. Collaboration is a natural add-on. With a suitable user authentication system in place, small or large teams can work together in the cloud on one or multiple graphics projects.

The future of BIM is becoming a reality; the construction industry should see huge benefits, through many advantages, with the structure and functions of AEC professionals being transformed. The potentials of the technology involved in BIM processing have yet to be fully realized, and will continue to amaze and inspire over the coming years.

Conclusion

BIM is a new way of organizing and processing building projects with coordinated software inducing various significant benefits to the AEC industry. Although a relatively new process, in an industry generally slow to adopt change, BIM has made an ongoing impact in the construction process. However, many companies have been slow to fully implement the process of BIM and the financial recession has further hindered the transition.

There is no doubt that BIM is already a large part of the industry, here and now, and also the way forward for the future. What may cost in the beginning, can save a lot of money in the long run, and it seems anyone who will not follow the trend may be left behind.

With some companies, there is reluctance, particularly by senior staff to embrace this new technology and new principles of design and operation. Some of the benefits of BIM only come in the longer term, and through hard work, the cost of implementation widely being the reason for not implementing BIM, will hopefully disperse as the financial recession eases and professionals become more comfortable and knowledgeable with the process. BIM has proven itself as an essential process for the industry and individual companies, eliminating and revolutionizing the traditional ways of working.

The experience of Western countries, shows high potential of BIM technology. The adoption of the document, which officially is called the European Union Directive on budgetary procurement (EUPPD), means that from 2016 all 28 countries participating in the EU can encourage or even mandate the use of BIM technology for funded projects. UK, Netherlands, Denmark, Finland and Norway already require the use of BIM technology in the construction of facilities financed by the state government.

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ТЕНДЕНЦИИ В РАЗВИТИЕТО НА BIM

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Ключови думи: BIM, технологии, развитие, строителни процеси

Резюме: В статията ще се разгледа BIM, като нов начин за организиране и обработка на строителни проекти с координиран софтуер за предизвикване на различни значителни ползи за промишлеността. Въпреки, че е сравнително нов процес, в една индустрия като цяло бавно е нужно да се приеме промяна, в тази връзка BIM текущо въздейства в процеса на строителството.

Въпреки това, много фирми са бавни за пълно прилагане на процеса на BIM и финансовата рецесия допълнително затрудни прехода.

Бъдещето на BIM се превръща в реалност; строителната индустрия трябва да види огромните ползи и предимства. Потенциалите на технологиите, свързани с обработка на BIM все още трябва да бъдат напълно реализирани, и ще продължават да се развиват и вдъхновяват през следващите години.