

Collaborative Construction: Making BIM Work for Builders

SAGE CONSTRUCTION AND REAL ESTATE SOLUTIONS



Introduction

By now, if you're in the construction business you've probably heard about Building Information Modeling (BIM). What you may not have done, however, is thought much about how this emerging and evolving technology can—and will—affect your business. In this paper, we'll discuss how BIM technology will impact the construction industry, and, just as important, how it can be used as part of a process to make your company more productive and profitable.

The Evolution of BIM

BIM has been an AEC industry buzz word now for a number of years. But its staying power is clear. It is more than “buzz;” it is a real technology being used by more and more design and construction companies. According to a survey conducted by a joint committee of the American Institute of Architects and the Associated General Contractors of America, BIM/3D technology is being used by 34% of architectural firms for intelligent modeling.¹ And on the “C” side of AEC, the adoption rate has been increasing, rising from 3% in 2003 to more than 11% today (source: Construction Management Association of America).

So BIM is for real, but what exactly do we mean when we use those three letters? Ask several people and you'll likely get several answers. And the design world certainly looks at BIM differently than the construction world.

One common way to describe BIM is the “dimensional” model whereby designs are not only rendered in the three spatial dimensions (3D) but further information may be added to the design, giving it even more “dimensions.” In these schemes, the fourth dimension (4D) is related to project scheduling and sequencing, and the fifth (5D) to cost estimating. This multi-dimensionality is achieved by creating building designs not through drawing but through modeling, where standard digital models for different parts and assemblies can be used and can include a wealth of added information. But is working in “3D” enough to say you are implementing BIM, or is BIM “5D”? And what about additional dimensions of information that we can envision being incorporated to our design models in the future?

To escape this multi-dimensional definition trap, we can return to a basic definition of BIM, the term itself popularized by Jerry Laiserin (see <http://www.laiserin.com/features/issue15/feature01.php>), as a common name for a digital representation of the building process to facilitate exchange and interoperability of information in digital format. Also informative is a definition provided by the buildingSMART Alliance of the National Institute of Building Sciences (where formal definition work on the BIM standard is being done):

“A Building Information Model (BIM) is a digital representation of physical and functional characteristics of a facility. As such, it serves as a shared knowledge resource for information about a facility forming a reliable basis for decisions during its lifecycle from inception onward. A basic premise of BIM is collaboration by different stakeholders.”

So at the highest level, BIM is intended to be a structure for collaboration in the AEC value chain.

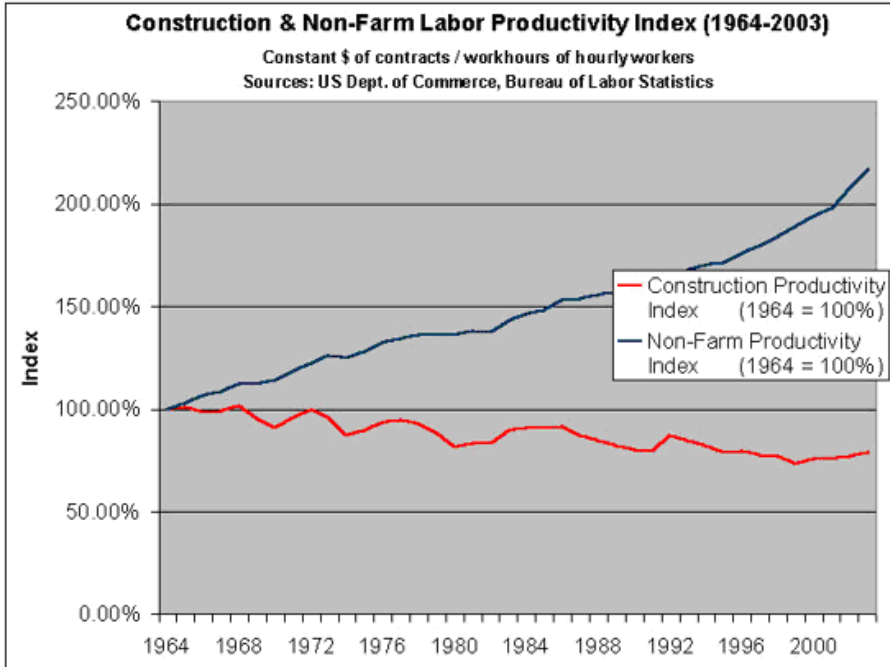
In these definitions there are no specifications regarding dimensions of information or the type of software needed to create or use the information. The key words are “**digital**,” “**interoperability**,” and “**collaboration**.” As it turns out, these concepts are what define the value BIM brings to builders.

Making the Case for BIM

Before we discuss the potential value of BIM to those on the construction side of the AEC industry, let's look at why BIM makes sense at all.

Most of us are gently pulled into adopting new technologies. There are always early adopters who are excited to try new things, and then some of us who only go kicking and screaming into the next wave. But for the most part, we move to new technologies when the risk level has dropped and when we see a clear return on our investment.

So how does a contractor figure out when the “digital interoperability” delivered by BIM delivers a return on investment? This can be hard to quantify, but there is some compelling evidence to suggest that the industry as a whole has some catch-up to do in adopting new information technologies. For example, studies show that the building industry lags the manufacturing industry by six-fold in new technology investment.² As a stand-alone fact, this may not mean anything, but now look at the trend in construction productivity compared to the aggregate of all other industries:



Many things might account for the apparent poor construction productivity when compared to other industries. For example, structures both residential and commercial are certainly becoming more complex. And many studies point to a construction workforce where skilled labor is retiring faster than it's being replaced. But these factors actually suggest that better information technology might be even more important for our industry. It may be a coincidence that building productivity did not suffer in comparison to other industries until we entered the so-called “information age” in the 1960s, but the chart above at least suggests a strong correlation.

Want to get started implementing BIM?
Here are some options to explore:

Sage Timberline Office

www.sagetimberlineoffice.com

A complete suite of financial and operational software from Sage Software, including construction estimating that accommodates BIM technology.

Visual Estimating

www.innovaya.com

The first true BIM-based estimating solution to integrate Autodesk AutoCAD Architecture, AutoCAD MEP, and all Revit applications with Estimating for Sage Timberline Office.

DProfiler

www.beck-technology.com

Macro-BIM software from Beck Technology that automates the modeling process and integrates with Sage Timberline Office estimating applications to enable predictable outcomes and reduce risk.

Unlike the manufacturing sector, there is no “off-shoring” solution for increasing building productivity. Building by nature is a local effort. But the increased efficiencies in the manufacturing sector were not due just to off-shore labor—increased productivity was driven by a relentless push toward supply chain integration. Instead of working in silos, all the participants in the manufacturing value chain were driven to work together more efficiently. And accompanying this more collaborative approach was a willingness to embrace new technology. According to Phillip Bernstein and Jon Pittman of Autodesk, Inc, “Facing global competitive pressures on every front, automobile, airplane, electronics, and consumer goods manufacturers turned long-ago to model-based digital design processes based on data that supported engineering analysis, bill-of-materials generation, cost modeling, production planning, supply-chain integration, and eventually computer-driven fabrication on the factory floor.”³

This approach sounds a lot like what BIM, by its definition, promises for the construction industry. It is an emerging technology that will create new collaborative processes in the design and building communities. So let’s return to the return-on-investment question we posed earlier.

Taking the longer view, the decision to participate in BIM as a builder isn’t as much a number-crunching calculation as it is a growth strategy. BIM will raise the productivity level of the industry as a whole. And all “ships” that embrace the technology will rise with the tide as well. The trick will be to know when and how to implement BIM into your company’s business processes. But there are also compelling reasons to start investigating BIM for benefits that can be realized in the short term.

To help make the decision about when and how to start incorporating BIM into your business, it will help to understand the impact it can have on you as a new technology and also the process changes it can have on the way you do business—in both the short and long term.

BIM: The Technology

There is no question that builders are downstream of designers in the value chain of the industry. That means that as a builder you’re on the receiving end of plans that arrive in different formats. For example, today you have to be prepared and equipped to take plans that come to you as blueprints or as digital files and quickly turn around accurate cost estimates. This is true even in the growing number of companies who provide integrated design/build services. With an increasing number of architects using BIM technology, you can expect more plans to arrive in this format. So from a purely technological standpoint, adopting BIM will become a “can’t-not-do-it” decision for many builders.

“Can’t not do it” is a fairly weak and reactive case for BIM adoption, But that is not the end of the story. There are significant advantages that you as a contractor will have if you adopt BIM technology.

Virtual Construction

Even the best designs may not account for the realities of construction and of maintenance through the lifecycle of a building. The essential value that BIM as a technology brings to the industry is in the way it enables “Virtual Construction.” By incorporating data that better models construction and post-construction realities, the worlds of the contractor, developer, and property manager are brought closer to the world of the designer. Together, all parties can enjoy the benefits of “building twice” that are provided by BIM-enabled Virtual Construction. The benefits are many. Here are a few of the most important:

1) Constructability: Identifying potential issues with the constructability of a project before you break ground increases productivity and saves everyone time and money. Working with BIM data that includes sequencing and scheduling information allows designers and builders to ensure that plans are not just architecturally sound but that they can be built as designed.

2) Maintainability: Dealing with changes during construction costs time and money. But once built, designs that have not taken into consideration post-construction maintenance will continue to cost even more time and money through the lifetime of the building. Something as simple as easy access to lighting fixtures to change bulbs can be overlooked in the best of designs. The ability to construct a building in a virtual sense with BIM-based models allows those who will own and maintain a property to protect their interests and investments by participating actively in the pre-construction phase of a project.

3) Liability: Everyone involved with a construction project wants it to succeed, but the traditional design-bid-build process places the owner, designer, and builder into somewhat different interest groups. The design that reflects the wishes of the owner may not reflect the needs of the contractor with respect to building means and methods, compliance issues, and phasing considerations—all things which impact the contractor's liability exposure. Virtual Construction technology allows for contractor participation in pre-construction beyond just the bidding process and helps them to manage the risk and liability that are inherent in every construction project.

Builders and property developers equipped to interpret the BIM data that enables Virtual Construction will be able to “measure twice then cut once” in the pre-construction phase. This will reduce time and money spent on changes during construction and on ongoing building maintenance.

Cost Estimate Accuracy

A number of factors are contributing to tighter margins for builders in all segments of the construction industry. Competition is increasing, cost of materials is rising, and the current economic conditions are less than favorable. In this environment, it becomes even more important to ensure the accuracy of your cost estimates. The closer your margin of estimating error approaches your profit margin on a job, the closer you come to potentially losing money.

The traditional estimating process consists of design review, quantity takeoff, and input of quantity values into an estimating program to perform construction material breakdown and pricing. This process typically involves several different applications or workstations and a lot of manual data manipulation, so it can be prone to inefficiency and error. Receiving designs in BIM format then processing them with BIM-estimating applications revolutionizes cost estimating in several ways.

Kevin Yu, President of Innovaya, LLC, characterizes this type of new approach to cost estimating. Innovaya provides 4D and 5D BIM construction solutions that enable total integration of design, estimating and scheduling (see www.innovaya.com for more information). “A BIM-based estimating solution should provide a unified platform for the estimators to easily review a BIM model in both 2D and 3D, while at the same time, producing the quantity takeoff automatically based on the calculation criteria set by the estimator,” according to Yu. He goes on to say, “BIM estimating is not only about quantity takeoff. It is important that the same application is able to further take off the quantities into estimating assemblies and items, with a breakdown of construction materials, equipment, and subcontractor costs.”

BIM-enabled estimating solutions permit the contractor to do all this by intelligently connecting design quantity information and item cost databases. As Yu explains, “True BIM estimating software has the potential to retain the connections between design, quantity, cost items, and scheduling activities so that any design or resource change can be reflected in the estimate and schedule. When such a BIM system is used in pre-construction, it helps all project stakeholders increase productivity, perform constructability analysis, improve budgetary decision making, and accelerate construction planning.”

Builders who decide to move toward BIM will not only be able to respond effectively to designs modeled with this technology, they will be able to initiate productive, informed communications with the designers regarding the constructability and maintainability of projects. And they will be able to anticipate construction problems in the pre-construction phase before they become costly mistakes or change orders.

BIM: The Process

Being able to bid accurately on BIM-standard designs and to address design issues before they become construction problems are compelling reasons to work with this new technology. These advantages address improvements to the communication between designers and builders. There are, however, other less obvious but equally important advantages.

Equipped with the rich information that is inherent in BIM, builders can become involved in the construction process sooner. Instead of waiting for and reacting to designs that come your way, you can initiate dialogues with owners and clients to help secure business that meets the expectations of all involved, including your own profitability objectives. And if you are involved in post-construction lifecycle management of the buildings you construct, BIM information can be invaluable. So let's consider how you as a builder can equip yourself to do this.

Beck Technology is a part of the Beck Group, a well known, full-service architectural and contracting company. They have introduced the idea of "Macro BIM" a concept that defines BIM in broader terms than that of a pure technology. According to Beck Technology Chief Operating Officer Stewart Carroll, "Many projects that contractors are asked to price end up dying in the design development phase of the project due to the inability to get a design to fit a specific budget. Macro BIM enables users to minimize their costs and maximize their value by determining a project's scope and budget at the same time and provides owners with a mechanism to proceed into the design development phase only once these are aligned."

Carroll also explains that using BIM as part of the pre-construction process will help contractors adapt their businesses to the requirements of green building. "As sustainable design and green building technologies become the norm, it becomes ever more important to make the right decisions, based on the right data at the right time. The wrong choices can inhibit the ability to design a LEED-certified building at a reasonable cost. Macro BIM integrates first cost, operating cost, and life cycle costs into a single technology with the ability to run rapid what-if scenarios."

The DProfiler solution from Beck Technology is an example of Macro BIM solution which enables the complete budgeting of a building at a schematic level in just a few hours (see <http://www.beck-technology.com> for more information). Such tools allow users to rapidly study "if-then" alternatives such as changing the orientation of the building to calculate changes in mechanical and electrical costs as well as energy consumption for the life of the building. This leads to true "Performance Centered Design" which includes considerations such as green building, sustainability, aesthetics, and conflict detection.

Products like Beck Technology's DProfiler are designed to answer the question about "if" one should proceed with the project. DProfiler graphically models a complete project for estimating purposes, both by incorporating some known elements in a building and inferring others. The advantage of this technology is that it allows an estimator to rapidly model a project (without needing to include every detail of the building), from which he can derive quantities and budgets in real time.

Other examples of rapid "what-ifs" through Macro BIM solutions include changing the perimeter of the building, varying skin components and coverage areas, and changing floor-to-floor heights to

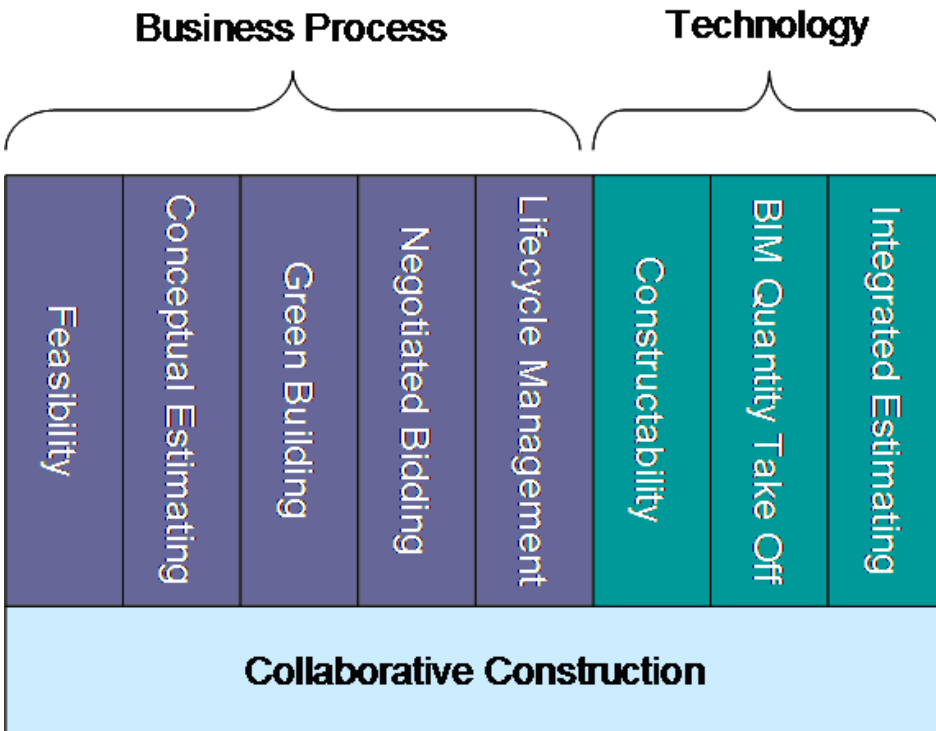
rapidly study changes in construction and operating costs. This allows for a much more informed understanding of the project before design begins and ensures that the design proceeds within agreed upon parameters and the project budget.

BIM technologies enable a fundamental change in the relationship between the owner, architect, and contractor. Instead of the contractor simply reacting to the architectural design, these tools enable a much closer collaborative relationship between all three, with cost more integral to the design process. For the contractor, cost estimates can be justified through design visualization and assumption validation. And the ability to show owners and developers, in real time, the cost and constructability impact of design changes puts the builder in a position where conceptual estimates can be quickly produced and lead to a negotiated bid.

Collaborative Construction

Some advances in technology make existing tasks or processes easier and/or faster. Then there are those that go beyond improving the way we work—they change how we work. It may not be obvious yet as the standards are still being created and adoption rates are still relatively low, but BIM falls squarely into the latter category. It's worth noting that many of the next generation of leaders in the AEC industry will come from a pool of people whose educational training has focused on the concepts and processes of BIM and Virtual Construction.

BIM as a technology improves the direct relationship between builder and designer. But when embraced by the builder, BIM becomes the catalyst for better collaboration throughout the entire value chain, from pre-construction through to post-construction.



BIM empowers the contractor—and all other stakeholders in a project—to play a role in all phases of construction. More than just a new data standard for designers, BIM has the potential of bringing to the construction industry the same economies and productivity that the manufacturing sector has experienced. This potential lies in the ability of BIM to bring about enhanced collaboration and new processes built around the idea of Virtual Construction.

Sage Software is a leading provider of business solutions for the Construction and Real Estate Solutions. For more information on BIM and Virtual Construction solutions, contact Sage Software at productinfo.timberline@sage.com.

¹To architects, building information modeling is still primarily a visualization tool, Joann Gonchar, AIA, <http://archrecord.construction.com/features/digital/archives/0607dignews-2.asp>

²Barriers to the Adoption of Building Information Modeling in the Building Industry, Phillip G. Bernstein and Jon H. Pittman, Autodesk, Inc.

³Ibid.

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