Realizing the full potential of BIM technology

By understanding the full suite of potential BIM benefits and hiring the right people to oversee project-wide implementation, engineering and construction players can better leverage this nearly ubiquitous tool in major projects.

Doug Brent

Vice president of technology innovation, Trimble

Dennis Sheldon

Associate professor and Director of the Digital Building Laboratory, Georgia Institute of Technology

Chris Shephard

Vice president of construction solutions, Trimble

Few would argue that building information modeling (BIM) has become a crucial tool in the modern construction industry. In fact, in some ways it represents the primary technology that has broken through the shell of the industry's aversion to new technologies, particularly during the conception phase of a new project as contractors, owners, and other players build and adjust their initial model.

However, while many would nod their heads in agreement that BIM is a valuable information system, in practice many players see it still as primarily a means to that conception phase—that is, to build a model. In fact, BIM can be used for so much more across the life of a project: to create shared documentation, facilitate connections between contractors, and build a library of information—a truly connected network that can streamline processes, prevent errors, and speed up work. Moreover, the data produced by BIM can be used to institute repeatable processes based on the cost, performance, and installation techniques of previous projects. Even tasks that are bespoke to a given project, such as earthmoving and steelwork, can benefit from a data-centric approach that can more accurately spell out desired outcomes based on previous experience.

The potential to improve productivity using a tool with which many players are already familiar is an opportunity too big to pass up; one McKinsey report found that "if construction productivity were to catch up with that of the total economy—and it can—the sector's value added would increase by an estimated $1.6 trillion, adding about 2 percent to the global economy. Such a gain is equivalent to about half of the world's annual infrastructure need."[1] By informing their projects with data early in the process, contractors can discover issues faster and solve those issues before they manifest into hard costs, accurately predict outcomes, and set aggressive schedules—resulting in better yield and reduced rework. The best way to get started on creating the requisite predictable, repeatable processes is to ensure that your company's culture and talent pool can support skilled workers' efforts to incorporate data into their workflows, from the back office to the field.

Moving toward a new interpretation and use case for BIM

BIM has been around for years, but only in the past decade has it evolved into almost universal use. According to McGraw-Hill Construction, in North America "the percentage of companies using BIM jumped from 28% in 2007, to 49% in 2009, and to 71% in 2012."[2] Today, many in the industry are quick to point out their use of BIM to visualize projects. However, visualization is actually a limited usage of BIM—one that fails to take advantage of its potential role as an information hub that can drive real efficiency gains throughout the life cycle of a project, including engineering, estimating, project planning, construction, and documentation. Our analysis indicates that contractors actually estimate the highest value of BIM can be realized in the latest stages of a project—but that's where adoption is currently lowest (see exhibit).

Indeed, in most cases architectural models are of limited value for the actual construction process because they lack the detail needed to build from. This is because in a typical major project, each trade partner will produce and maintain individual sets of drawings or models that do not include direct links to shared source data. Amid potentially thousands of change orders throughout the life of the project, for which construction can last years or even decades, each change can result in hundreds of adjustments by project stakeholders—which compound at later stages of a project.

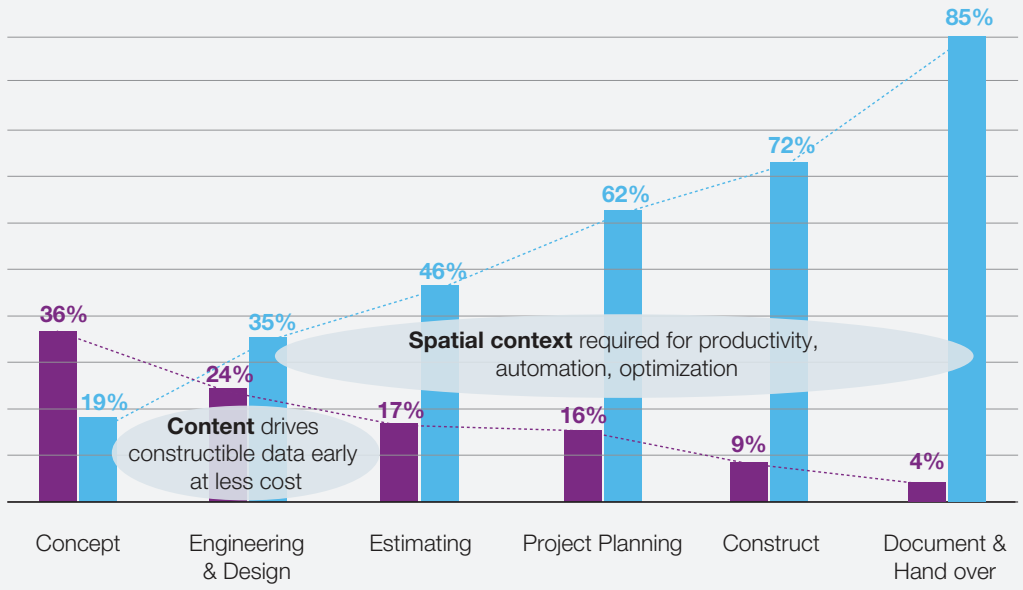
A better way is to include design detail in models that directly tie to a master to avoid potential costly errors or omissions. As such, a new interpretation of BIM views it as an information ecosystem that first

Exhibit

Productivity driven from constructibility

Constructible data will increase productivity, reduce waste and increase safety

% of contractor adoption of BIM by Phase
% of where contractors believe BIM provides ROI



Source: (1) 2014 McGraw-Hill Smart Market Report; The Business Value of BOM for Construction in Major Global Markets, (2) Internal Trimble market estimate

advises on constructability—that is, determining whether a design and its components are buildable—and then helps build that design in the most efficient way.[3]

The benefits of expanding the interpretation of BIM

Detailed constructible models facilitate more than just the design; they can drive the actual workflow of a project. Project scheduling, fabrication, and installation of components can all be driven by a shared and coordinated set of digital construction documentation. Cost estimating can be transformed from the manual process of counting the number of doors, the linear feet of steel, and the volumes of concrete to a streamlined and repeatable takeoff from the digital record. The complex relationship between mechanical, electrical, and plumbing systems is fully coordinated before installation starts, then precisely placed on-site to avoid clashes due to the smallest errors in execution by one of the trades. If contractors at later stages of the project can access an ever-evolving BIM information system that details not only the design but how that design has evolved—for example, changes to the constructed airflow that better take into account the pressure changes caused by wind—you can adapt later in the project, for example by making utility decisions based on what the airflow tells you about how quickly you can heat or cool the space.

Putting the data to work can also help mitigate the risks of one of the most unpredictable elements of a large infrastructure project: the people on the ground performing the work. If the BIM system can tell you where each bolt goes, you can feed that information to a robot on-site that can automatically drill the holes in exactly the right spots. With no interpretation required, there is much less room for error—and more ability to automate. In our experience, using precision instruments in the field to lay out foundations and floor plans can cut layout times by 50 percent or more over using manpower alone.

Major projects tend to involve a very large number of stakeholders—contractors, subcontractors, government agencies, etc. In addition to better aligning the workflows and decision-making of each, centralizing communications also makes it easier to trace decisions and changes—a huge benefit in today's construction landscape, where the threat of litigation can stymie fast, confident action.

Finally, in recent years we've seen a rise in availability of pre-existing content that project stakeholders can draw from—everything from the faucets and furniture an architect uses to render an interior space to the chillers, ducts, and fans the mechanical team uses behind the scenes. Major projects tend to be undertaken with an approach of reinventing the wheel; we've never built this airport before, so we need to start from scratch. In reality, a more robust use of BIM can help build a digital content library across projects. Access to good content saves design time, but also improves understanding of the expected performance of the systems and how various components will work together to meet the requirements of the occupants.

Moving toward full adoption of BIM

To realize the full benefits of BIM, major project owners, contractors, and other industry players need to prepare their organizations for both cultural and operational shifts that put data in the center of all they do. Such shifts will likely require hiring new talent at the highest levels of the organization as well as on the front lines. While there are many others, major-project players that are just starting the process of getting the most out of BIM should focus on three important considerations:

1. Create a top-down culture for data-centric workflows

Businesses that want to change their ways are putting people in influential positions to help create a data-centric culture. For example, instituting a role such as chief data officer makes data a business imperative and can help facilitate a culture shift by demonstrating investment at the highest levels. A chief data officer also has the knowledge and the authority to affect real changes that cut across functions in the business and allow various groups and systems to gather and share data.

2. Trust and embrace results of data-driven practice

It's a good sign that over the past decade, many contractors have added roles such as virtual design and construction (VDC) managers, adding BIM expertise to support their key projects on a broad range of construction tasks. In practice, though, simply having a VDC manager is not enough. VDC managers often struggle with job-satisfaction because project teams are resistant to the potential of data-driven practices to fundamentally transform their workflows, rather than simply augment the status quo. Executives can navigate this challenge by working with their project teams to help them embrace the idea that a major change is warranted. By testing data-driven practices and demonstrating meaningful improvements in predictability and breakout productivity gains, executives can win over skeptics and position their VDC managers to succeed.

3. Push the data into the field

The value of constructible data and models is not limited to virtual construction – it is capable of directly automating physical construction as well. The same data and models are fully capable of directly controlling robotic instruments for on-site placement of structural construction components and interior layout, as well as driving computer numerical control (CNC) machines for off-site fabrication of construction components. Leaders should leverage "blue-collar BIM," in which data models are taken out to the field and applied to fabrication, assembly, and location-based scheduling of labor and equipment to ensure assets are available exactly when and where they are needed.

Conclusion

Expanding our understanding of BIM as a true information system is an important step in better embracing technology in major projects. Improving productivity in major projects requires evaluation and scrutiny across the entire supply chain—not just the discrete links of the chain. The owners and builders embracing the idea of repeatable processes are seeing the greatest improvements today and positioning themselves for the greatest returns tomorrow. ■

[1] Filipe Barbosa, Jan Mischke, and Matthew Parsons, "Improving construction productivity," July 2017, McKinsey.com.

[2] "The business value of BIM in North America: Multi-year trend analysis and user ratings (2007–2012)," McGraw Hill Construction, 2012, bimforum.org.

[3] For more on building a connected data environment, see Greg Bentley, "Going digital to advance infrastructure delivery: The open information project," Voices on Infrastructure, March 2018, McKinsey.com.

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