

Chapter 1

Defining Building Information Modeling (BIM)

In This Chapter

- ▶ Exploring what BIM actually is
 - ▶ Comprehending how BIM can help you
 - ▶ Explaining the BIM plans and strategies you need to be successful
 - ▶ Getting excited about BIM and encouraging others
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The construction industry has been doing things the same way for thousands of years. Concrete is poured and set, bricks are stacked on top of bricks, and systems for heating and water are designed around corners and over multiple floors. For way too long, the construction industry has done a lot of these processes in isolation. At its worst, the construction industry brings some people involved in the construction of an asset like a building or a bridge onto the project just in time for their part, and the project team has to work around decisions or redo work, often on-site and under pressure of project deadlines.

Even in some of the most collaborative schemes, communication between different teams still has a long way to go, and the other users of building data and outputs, like clients and facility managers, are sometimes the last to know. The quality and quantity of data they receive on a project can vary wildly. What you need is a way to involve the entire project team earlier and coordinate all the project information in clear and accessible forms.

If only a combination of processes and technology existed that provided the framework to improve communication and data exchange across the construction industry, no matter how large or complicated projects may be. Well, interestingly enough, you're in luck. This chapter serves as your jumping-off point to that very process: Building Information Modeling, commonly shortened to BIM.

Explaining BIM in Plain Terms

Here we provide a good definition for the term BIM so that the three members of your author team and you are on the same page. Frustratingly, BIM actually has lots of definitions, many generated by various organizations, because the subject has changed over the years. To prevent any confusion, we present you with our own definition that we think really clearly explains what BIM is and what it isn't.

Most people agree that the acronym BIM stands for Building Information Modeling, but a few folks argue for Building Information Management (and, to be honest, some other alternatives too). (The next section takes a closer look at what the three letters in BIM mean.) More often than not, though, BIM is now an accepted acronym, so you don't need to break it down further anyway, just like RAM for random access memory. We think that BIM is a process, so we could easily use both Modeling and Management in our definition. Here it is:

BIM is a process for combining information and technology to create a digital representation of a project that integrates data from many sources and evolves in parallel with the real project across its entire timeline, including design, construction, and in-use operational information.

Examining the A-B-Cs of BIM

BIM stands alone as a word in its own right, and you can feel confident using it, instead of having to say "Building Information Modeling" in full every time. But when it comes to understanding what BIM really is and explaining it to other people, those three letters can be a very useful place to begin. The following list gives a bit more detail about the A-B-Cs of BIM, or, more accurately, the B-I-Ms!

B is for banana

One of the best ways we've found to describe BIM to someone without any knowledge of it is to grab a piece of fruit. Explain that you could develop a perfect 3D replica of the fruit in digital modeling programs or even by 3D-printing a copy, but that's only one kind of representation of the fruit. It doesn't include any of the fruit's

data; for example, its sugar content, calories, use-by date, country of origin, whether it has Fairtrade certification, and so on. The 3D object on its own isn't enough to represent the fruit. It isn't Banana Information Modeling. That's the difference between 3D CAD and true information modeling.



- ✓ **B:** Because the B in BIM stands for *building*, think of this as the verb *to build*, and not just the noun, as if BIM was for just physical, discrete buildings. In fact, you can apply BIM to infrastructure, civil engineering, and landscape, along with large-scale public and private projects.

You're modeling a process, the act of building something. Refer to Chapter 2 for more information on what the B in BIM means and for help on BIM for infrastructure.

- ✓ **I:** The I in BIM is about understanding that unless you have *information* embedded throughout the project content, the work you're producing is telling only half of the story.

You don't even really need to worry about the modeling in order to start applying BIM; you can put the processes and data exchanges into practice long before drawing work begins on a project. The real value in BIM is the ability to interrogate the model and find the data you need, when you need it. Turn to Chapter 3 for some great examples of information modeling from other industries, like aeronautics and automotive racing.

- ✓ **M:** The M stands for *modeling*. This aspect of BIM probably has the most history, and hundreds of programs for representing the built environment using 3D CAD techniques and virtual design and construction (VDC) are available. (In fact, the majority of free resources on BIM, especially in the United States, can put too much focus on the 3D modeling aspects of BIM.) Chapter 4 is about how the visual model should evolve in detail, but only as much as you require for the relevant output. The model should allow the output of whatever plan/section or perspective or walkthrough or 3D-printed model that you require.



One of the simplest ways you can explain BIM is that the project should be *built twice*: once fully modelled digitally and then again for real on the construction site.

After you comprehend the definition of BIM, the next step is to grasp what BIM is actually trying to achieve. BIM processes aim to make you (and the construction industry as a whole) more efficient, and to allow project teams to make savings in terms of cost, time, and carbon, and removing waste across the timeline. Chapter 5 provides a really simple overview of what BIM is trying to do and some of the key fundamentals you need to know.

Understanding the Requirements for BIM

Here's a list of what you really need for BIM implementation to thrive:

- ✓ **Digitization:** You have to be confident that the future of the industry is digital. Think about how technology has evolved in most industries and how in your experience of the construction industry you may have

noticed that it's still traditional and paper-based. BIM implementation requires a change of direction, toward new tools and software and a digital future.

- ✔ **The right foundations:** In order to build advanced BIM processes, you need the firm bedrock of efficient systems for communication, information exchange, and data transfer. Think about what practical changes you may require and even the type of projects you focus on. We show you how you can describe your BIM readiness in terms of levels of maturity. Chapter 7 discusses the importance of having a foundation before you implement BIM.
- ✔ **Process:** What's wrong with what you're already doing? We hope you can see where you can make improvements in your current processes, and that moving toward BIM implementation should have a positive effect on your business. Some essential elements to collaboration exist, and in Chapter 8 we show you an example of best-practice work flow and an explanation of some of the key acronyms you'll encounter.
- ✔ **Technology:** You need to ensure that you have the right technology to support your BIM aims and objectives. Technology includes software and hardware. Having the right technology enables you to work in a digital environment. In Chapter 21, we show you different types of BIM platforms and software, with some important examples and discussion points for when you have to make decisions.
- ✔ **Training:** All the processes, frameworks, and documents in the world won't help if people don't understand them and can't use the tools and methods you're implementing. So a key requirement is to support all the technology and protocols with dedicated and personal training. We point you towards some great resources you can look to for help in Chapter 22.
- ✔ **Incentives and business drivers:** *Incentives* are what motivates and encourages you and your organization to undertake BIM, whereas your *business drivers* refer to processes that are vital for the continued success and growth of your business. Some business drivers may be outside business drivers; for example, economic conditions that a company can't always influence. The UK is mandating BIM from 2016, and the United States, although still behind, demonstrates huge potential for standardization. In Chapter 9, you can read about the UK Government Construction Strategy and where the BIM mandates came from, and compare it with BIM uptake in the United States and across the rest of the globe.
- ✔ **Standardization:** For BIM to thrive, you need interoperability. Interoperability is a term that's important in BIM-speak. *Interoperability* is ensuring that you can use the outputs someone else in the project team has produced, because you're all using standard formats. Other BIM standards exist, along with a range of recommended protocols, guidelines, and specifications for the properties of objects you use in your models in the form of information exchanges. In Chapter 9, we help you navigate through these documents and show you how everything could evolve.

A very brief history of BIM

Even though there's been a recent push to implement BIM and a realization of its benefits, BIM isn't a new concept. The earliest use of the term *building modeling* was in the 1980s, in a paper that predicted that model objects would connect to relational databases full of different kinds of information. And long before that, college research teams were developing computer modeling techniques with buildings in mind. Even just on the graphical side, university research has had a significant impact on modeling advances.

Software companies have been developing tools for built environment professionals to design, plan, render, and analyze buildings and structures for decades. Although most have focused on 3D geometric modeling systems,

the largest platforms have been exploring how to make the most of data science and the properties of building products too. The first use of the term *BIM* to describe all this goes back as far as the 1990s. The awareness, investment, and supporting documentation have all increased dramatically in the past few years, though.

For more information on the history and theories of BIM, we suggest that you check out some great books by the fathers and godfathers of BIM such as *The BIM Handbook* by Chuck Eastman, Paul Teicholz, Rafael Sacks, and Kathleen Liston (John Wiley & Sons, Inc.) and *Building Information Modeling: BIM in Current and Future Practice* by Karen Kensek and Douglas Noble (John Wiley & Sons, Inc.).

Considering BIM Plans and Strategies

Having a clear plan and strategy is essential to the success or failure of your BIM journey. You'll need an overall strategy for encouraging BIM in your office or on-site. Use the BIM protocols and frameworks to refine and improve your processes and quality assurance, and develop individual BIM execution plans for particular projects.

So that BIM processes have the best possible chance of becoming everyday practice, you want to make a start with your current team and your next project. In Chapter 13, we show you what having a BIM strategy really means and what benefits you can expect from new methods of working. To help you do this, we also present a couple examples of different BIM strategies:

- ✓ **BIM in the UK:** You can use the UK's suite of BIM documents in combination with your preferred tools and supporting platforms to achieve BIM Level 2 and what it's going to take to progress to Level 3.
- ✓ **BIM in the United States:** In the United States the same clarity of a national approach doesn't exist, but we direct you to a number of useful protocols and guidelines from certain states and BIM organizations, so that you can begin to build an efficient set of BIM processes and workflows.



Like everything in life, BIM also has some associated risks that you need to be able to identify. Some of those risks include

- ✓ **Digital security:** Sensitive information about the operation of assets
- ✓ **Intellectual property misuse:** Answering who owns the property
- ✓ **Risk and liability:** Recognizing who is responsible if something goes wrong

Chapter 14 discusses these challenges, what you can do to avoid them, and how to handle them quickly if you should encounter them.

Measuring the Real-World Benefits of BIM

Say that you've won over some key decision makers in your organization and they need you to produce a business case for BIM. As part of your business case, you need to justify the *capital outlay*, which relates to the money your organization spends to implement BIM. You also must consider upheaval that will come from new technology, new team structures, and even new staff. Not only that, but you probably have to demonstrate return on investment (ROI) as quickly as possible.

Your boss is going to want to know how much BIM is going to cost. BIM needs to generate savings and efficiencies that make it worthwhile. In Chapter 15, we pass on some solid examples of BIM benefits that aren't just aims for the future but exist in the real world today, including the following:

- ✓ **Better information:** Because you're going to be working with digital data and methodologies in the office or on the job site, the accuracy and currency of your information will improve, including precise quantity take-off and the ability to set the site out such as the asset's position, levels, and alignment from the model.

Not only that, digital information also allows you to test and validate the data far more quickly than with traditional processes. As the model evolves, instant awareness of the impact of changes at any point in the project leads to better assessment and rapid decision-making.

- ✓ **Data exchange across the project timeline:** BIM can help you to avoid data loss over the course of a project. At many points of information exchange, you can use project data more collaboratively with little waste or duplicated effort.

What's even more important is that multiple roles and disciplines can use the same data on the project, including cooperative working with the supply chain and project participants further down the timeline, like facilities management and operations teams.

- ✓ **Communication:** BIM is your best chance to give your clients the built asset that they actually want and to output the deliverables that meet their own objectives, from slick visualizations to high-quality carbon data. Through a combination of 3D and nongraphic data, you can understand more about the built environment than ever before. Even better, you can also test out ideas in the safety of the model.
- ✓ **New efficiency:** The potential accuracy of BIM and the chance to refine engineering long before ground is broken on-site means that projects can begin to exploit new concepts like off-site manufacturing (OSM) where manufactures can deliver pre-built construction elements to site.
- ✓ **Carbon saving:** You can calculate statements about energy use and embodied carbon with new levels of detail. By running simulations and testing lifecycle concepts in the model environment as early as design and pre-construction stages, you can be more confident about the future performance of your asset. You can also have greater certainty over the project program and the likely issues that could arise.
- ✓ **Health and safety:** By improving information at the front end of BIM (including getting contractors and subcontractors on-board early), you can understand areas of risk in the project, especially where dangerous activities will take place, and achieve high levels of safety during later phases of the project. Throughout this book you can find examples of construction and site delivery of BIM, not just office-based BIM for designers. Chapter 16 specifically looks at some of BIM's impact on construction, especially the potential for BIM to improve health and safety on-site.

As well as including all the information about BIM's effect on projects today, we take a good opportunity to understand the future of the industry and where new technology like augmented reality (AR) could take BIM and digital construction in Chapters 18 to 20.

The construction industry is finally being disrupted by innovation and new business methods. It won't be long before the buildings and projects you're working on are more connected than ever. You may have heard the term *smart cities*, and BIM is one of the main generators of the embedded digital information required to achieve the connected globe. Through the addition of more smart building sensors, and what's called the Internet of Things, your understanding of how people really use the built environment (and your own projects) will improve beyond anything you could have previously imagined.

Encouraging BIM in Your Workplace

The amount of software and industry documentation you throw at an office doesn't matter, because so much of BIM implementation is about changing real-world processes and engaging individuals, with their various concerns, agendas, and opinions. How do you go about integrating BIM into real teams with real people?

People are the pulse of BIM, and you need to understand that the same BIM and the outputs it can generate are going to be used by different (and new) roles in the industry, at different times and in very different ways.



You can encourage people to embrace BIM by

- ✓ **Leading by example:** Be a BIM champion and lead by example with your commitment and enthusiasm.
- ✓ **Showing support:** Give support and encouragement by identifying and providing any training needs.
- ✓ **Communicating:** Deploy simple but clear messages about why and how you're implementing BIM.
- ✓ **Providing feedback:** Listen to other staff members and provide any reassurances that they may need around fear of change and the unknown.

There are various processes to BIM and many potential users involved. In more detail, Chapter 12 looks at encouraging BIM processes, and Chapter 17 focuses on BIM users and roles from inception to demolition (and beyond).

Our experience with BIM

We co-authored this book because we all have varied experience, from large contractors to small architectural practices. We've seen everything from the genesis of BIM for landscape to the development of ground-breaking software and documentation, including the various protocols and standards that the industry needs to communicate better, to evolve new methods, and to increase innovation.

BIM will continue to impact all areas of construction design, build, finance,

management, and operation, and the relationships between all the parties involved in a project, both cooperatively and contractually. We think everyone can work together in more collaborative ways, toward a creative tomorrow that makes the most of diverse groups of people. Digital cooperation and access to information isn't just the heart of BIM; it's the heart of a connected, global society.

So are you ready? We want to make sure that you don't miss the BIM boat!