

# The UK BIM Revolution

**Wilbert R. Thompson**

California Polytechnic State University  
San Luis Obispo, California

Building Information Modeling (BIM) is a relatively new technology many organizations are trying to efficiently implement in their workflows, as it can provide cost savings, reduce schedules, improve overall quality, as well as reduce conflicts and issues that arise throughout the construction process. In 2011 the UK government released a plan to mandate the use of BIM and collaborative procurement methods on all publicly funded projects with aims to reduce waste and costs, while also improving industry relations by becoming a more knowledgeable client. This paper highlights the challenges of transitioning from traditional construction workflows to collaborative methods, something essential for the use of BIM, in addition to evaluate the relative success of the UK government in implementing BIM in construction processes and achieving its goals. The use of BIM in California is also evaluated, and a recommendation to the California Dept. of General Services Procurement Division about the UK strategy is provided. Quantitative information was gathered from surveys of Cal Poly CM students and industry workers in the UK, and qualitative information was gained through interviews of project managers and BIM managers of contractors that work in California. Overall, the UK had success in its implementation, and California should follow its example.

**Key Words:** BIM, UK Government, Implementation, California.

## Introduction

“Building Information Modeling”, or BIM, has been widely touted as a technology that will revolutionize the construction industry. When properly implemented on a construction project, BIM has the potential to bring entire project teams together in greater collaboration that causes construction projects to be built faster, with less costs, and with higher quality throughout the process. On the other hand, BIM has the potential to disrupt typical company processes and workflows, overcomplicate coordination and project planning, create a skilled labor shortage, and cause inexperienced companies to lose work or impede work they were awarded due to their lack of experience with BIM.

When trying to implement this new technology, there are three things that must be addressed in order to create successful implementation: people, processes, and technology. The key to the successful implementation and utilization of BIM in projects today is getting the proper environment for the process correct, yet in the construction industry in California today, BIM hasn't had complete success being fully adopted and implemented in the construction process, causing BIM to be seen as an added cost to typical workflows, causing the use of BIM to be less efficient. BIM has had mild success in its implementation, mainly due to the use of alternative project delivery methods in private projects such as Design-Build, Integrated Project Delivery, Design-assist, and many other variances, but its success has been stagnated because traditional project processes, workflows, and ideologies do not optimize the use of BIM. These same traditional project processes, workflows, and ideologies that do not optimize the use of BIM are also so heavily rooted in the public construction industry in California, that BIM has been used mainly in the private industry, as a something one must sell to the owner. In order for BIM to revolutionize the construction industry, we need to change the construction industry to maximize BIM's usefulness. In other words, in order for the construction industry in California to fully implement and maximize the use of BIM on construction projects, the California government must mandate its use, and alter the frameworks used for public projects. I believe BIM hasn't been adopted as thoroughly across all contractors, nor has it been adopted as fully as possible (utilizing all tools BIM has to offer) because public projects in California are mainly being delivered through the traditional design-bid-build project delivery method, which hinders the usefulness of BIM, and increases implementation costs for general contractors. I think that if California adopted similar public construction standards

as the UK did in 2012, and worked with the industry to implement BIM as a typical workflow practice, BIM would be able to be utilized more and more efficiently, and projects would therefore be finished quicker and cheaper, with greater quality projects being created in the state of California for both public and private projects.

## **Background: The Construction Strategy**

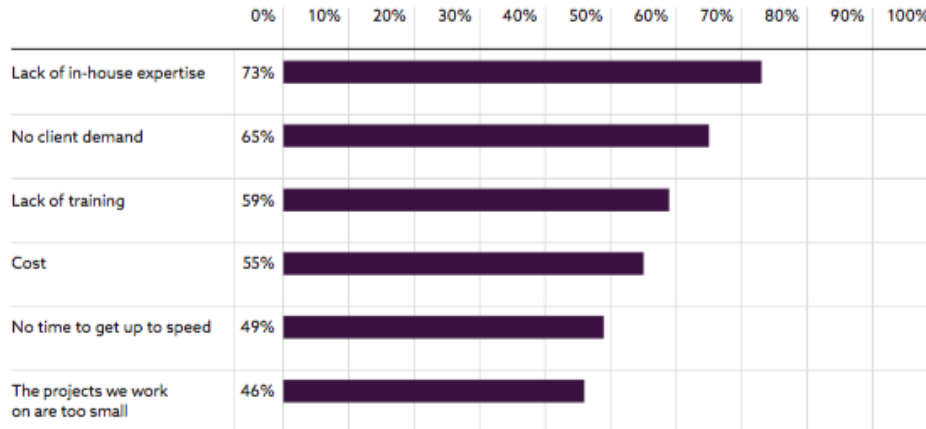
In 2011, the UK implemented a Construction Strategy report, outlining how all public projects with the central government must follow a new set of construction standards in an attempt to cut costs and time, while also delivering a better quality project. The two standards I intend on focusing on deal with the use of BIM, and project delivery methods, because the project delivery method used greatly affects how useful BIM can be. The UK has mandated the use of BIM as a 3D modeling component at the least, allowing contractors to utilize other components of BIM like cost estimating and conflict detection at their discretion. The UK also barred the use of traditional non-integrative procurement approaches unless using the traditional strategy can be shown to offer best value for money on a project. Essentially, alternative project delivery methods are now the norm unless design-bid-build is shown to be the best project delivery method, whether it is because the project is simple, or very routine; these types of projects are shown to not need BIM, as the added cost of utilizing BIM would make the project more expensive. In 2011, the UK implemented the construction strategy, and wanted the industry to use 3D CAD on all public projects. In order to hold the industry accountable, the UK had to set goals, and define them. Accordingly, the UK government identified different levels of BIM maturity, identifying to what degree of expertise they would like the industry to achieve, and further identifying goals for the future. As the UK defined it (NBS 2014), there are 4 levels of BIM maturity; Level 0 is where many organizations still operate at, and only involves 2D CAD drafting with no collaboration between trades. Level 1 involves a mixture of 3D modeling for concept work, and 2D drafting for document use. Level 2 is where all parties involved in the construction process use their own 3D CAD models, and can collaborate by sharing models and information through BIM software with common file formats such as IFC or COBie. This is the level of BIM maturity the UK set as the first goal for all work funded by the central government in 2016. The last level of BIM maturity as identified by the UK government, is Level 3, in which there is full collaboration on a single model with every discipline involved in the project.

Through all this, the UK hopes to: create a collaborative environment where a project team works together towards a group goal rather than their own company's goal, use BIM as a medium that all project teams can use for collaboration and discussion in an integrated project, and cause the government as a client to become more knowledgeable about what procurement method should be used and to be able to communicate clearly conditions that will help the project team better understand how the building is meant to perform and look all the while saving costs and time. The UK government set out this plan in an aim to reform the way the government procures construction, with the financial goal of reducing costs by 15-20% of all construction during the 2012-2016 Parliament. "The strategy is designed to reduce waste, tackle bureaucracy, and support economic growth through a more efficient construction industry." (Cabinet Office 2011). The UK government believes the key to the success of this strategy is through open collaboration with the industry, where new relationships can be formed.

## ***The Construction Strategy in Effect***

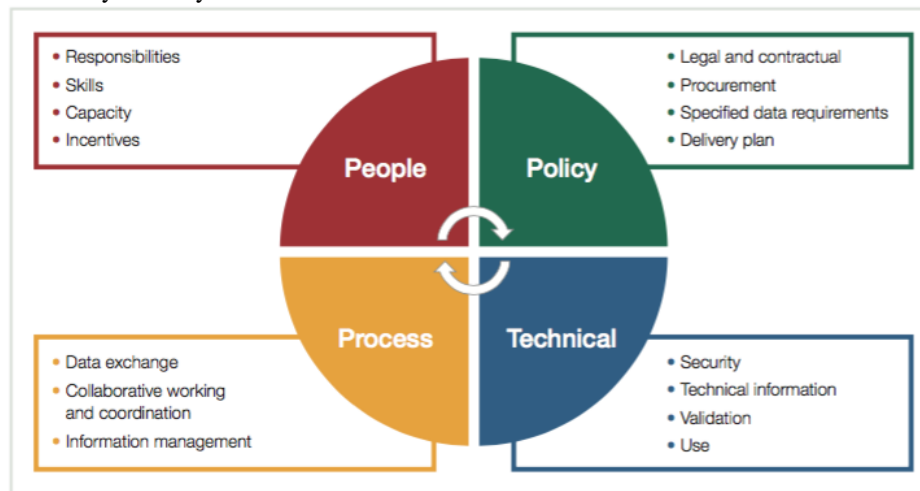
In order for the UK government to efficiently implement BIM across the industry it had to identify the barriers preventing companies from adopting BIM, and address each barrier respectively to ensure best use. the UK. Figure 1 below identifies the main reasons companies have been slow to adopt BIM in the UK. One of the key barriers to preventing the adoption of BIM by organizations is the demand by clients. But because over a quarter of construction output in the UK is funded by the central government and public sectors, the Government aims to utilize this influence to create the change they want by demanding the use of BIM. "A coordinated approach from government will enable it to leverage its position as the biggest single client to drive collaboration, which will help to deliver further efficiencies and better value for the taxpayer." ( Cabinet Office 2016)

### What are the main barriers to using BIM?



*Figure 1. Barriers to using BIM*  
*Source of information: NBS 2017*

The next figure, Figure 2, identifies the four different areas the government recognized that must be addressed for complete change. Affecting the people, policy, processes, and technical aspects are needed to implement BIM effectively industry-wide.



*Figure 2. Areas to Address for Change*  
*Source of information: NBS 2017*

The following chart, Figure 3, identifies the governments strategic framework for BIM programs in the public sector. The government had to affect how companies changed their workflow processes by changing entire procurement methods, educated their employees, and influence the ways companies utilized BIM technology.

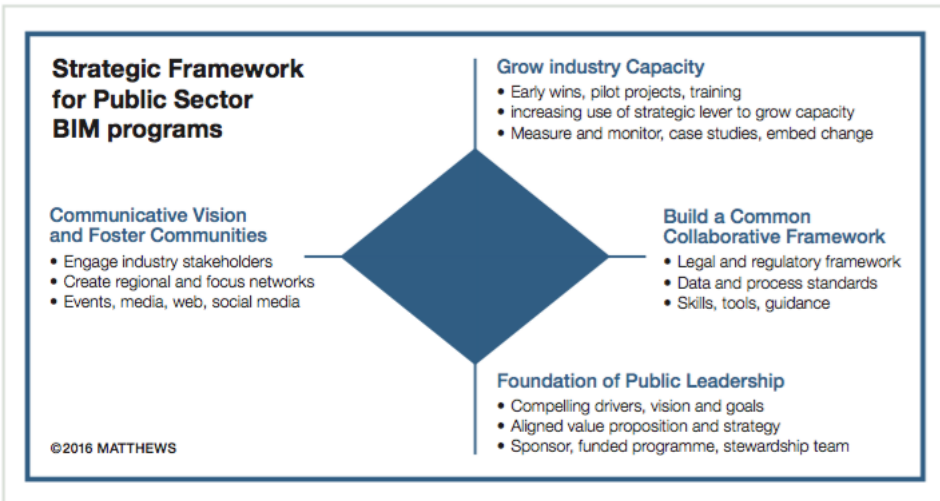


Figure 3. Strategic Framework Plan  
Source of information: NBS 2017

## Methodology

The objectives of this case study and basic research are as follows:

- To highlight the challenges and transitional difficulties to collaborative procurement methods, and identify best practice for overcoming said difficulties.
- To report whether the Construction Strategy(2011) and the efforts of the UK government were effective in implementing BIM in order to improve cost, quality, and efficiency of public projects.
- To examine whether the California construction industry would be a viable market for similar change.
- To provide a recommendation to the California State Government regarding adoption of construction standards similar to the UK.

The methodology chosen for this study was equal parts qualitative as it was quantitative. Two main sources were used for the quantitative information: annual survey regarding the use of BIM in the industry by the UK, and a survey was sent out to Cal Poly Construction Management students getting either a major or minor. The UK survey was conducted just at the end of the first milestone set forth in their Construction Strategy, and was analyzed to identify industry thoughts and trends. The Cal Poly student survey focused on the perception of California adopting similar construction standards as the UK, and explored how these standards would be implemented. The qualitative study was done through interviews of project managers, BIM coordinators, and BIM managers, with the focus on their perception of adopting similar standards as the UK in California, as well as the many different ways and processes used for implementing BIM into their company.

## Results and Discussions:

The UK government, through the Construction Strategy, is already starting to accomplish their goals. They already started change to the policy regarding procurement, delivery plans, data requirements, and legal issues, through their Construction Strategy mandate. They are giving examples of proven procurement methods, utilizing seminars to inform and educate, creating free resources on how to use BIM, pushing for the creation of BIM objects to be used in models, and running pilot projects that were used to analyze any successes and pitfalls of practices the government recommended. Educational resources for the use of the BIM managers and workers were provided, helping them learn new skills that were needed for the changes in the construction process, as well as helping them deal with issues relating to workflow practices, or dealing with the exchange of information and models on a scale not used before. Creating and detailing new procurement methods, as well as utilizing procurement methods that

have been shown to maximize BIM utilization, and then putting into effect these processes has been key to efficient implementation by the government.

The following figure, Figure 4, shows how much the Construction Strategy and the government's efforts to increase the use of BIM has improved throughout the years. Along with the following figure, for the first time, respondents to the annual UK BIM survey describe themselves as confident in BIM, with 55% describing themselves as confident; comparing these results to the 35% of survey respondents in 2012 that described themselves as confident shows how effective the UK has been in their implementation efforts. However, 90% of survey respondents said BIM adoption requires changes in workflow, practices and procedures, indicating that there is still much change and refinement needed.

#### BIM adoption over time

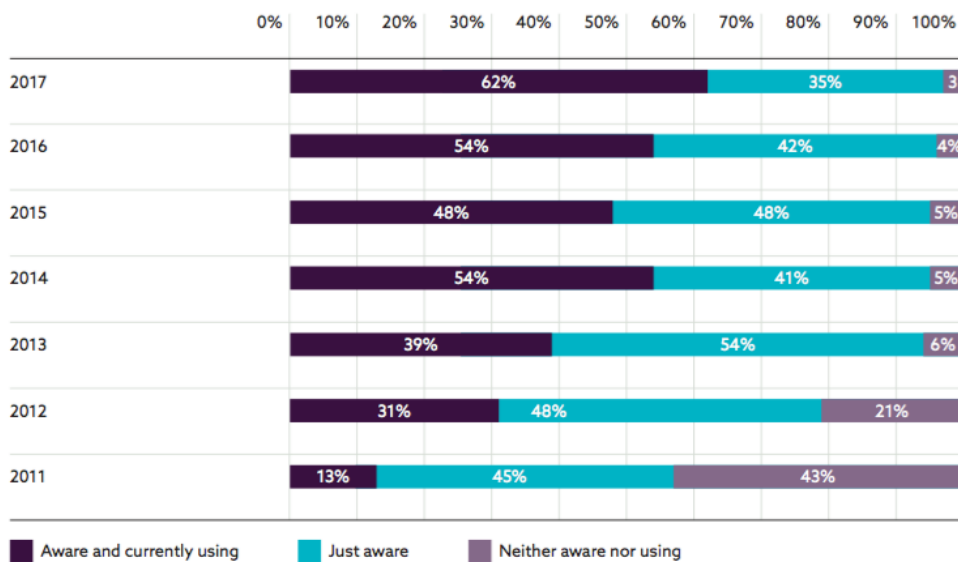


Figure 4. BIM Adoption Over Time

Source of information: NBS 2017

While the UK construction industry still has a lot to change, processes to refine, and learning to be done, the government is making progress. “The government has been publishing cost data since 2012 in order to understand the cost of government construction and to drive down costs to deliver 15-20% savings by May 2015. This data, which compares costs against a 2009/10 baseline, shows savings of £72 million in 2011/12, £447 million in 2012/13, £840 million in 2013/14 and concludes with £855 million in 2014/15.

The latest 2015 data set shows that cost reductions were still achieved despite a rising market.” (Cabinet Office 2015).

While use of BIM is on the rise, there are still problems with utilizing BIM until the end of a project's lifecycle. BIM is mostly used in the early stages of construction, for design and construction, but is used progressively less in the end of a project. Clients, followed by facilities managers are parties that benefit the most from the utilization of BIM, but less than 30% of facilities managers are provided with a 3D model and Cobie dataset at the end of construction (Robert Eadie, Mike Browne, Henry Odeyinka, Clare McKeown & Sean McNiff 2013).

#### Challenges and solutions to BIM implementation

Changing the way government construction projects are run by utilizing new technology is bound to have challenges, as it is a completely new process and technology the government is attempting to revolutionize construction workflows with. Below are some of the key challenges the UK government ran into, and how they have attempted to solve them:

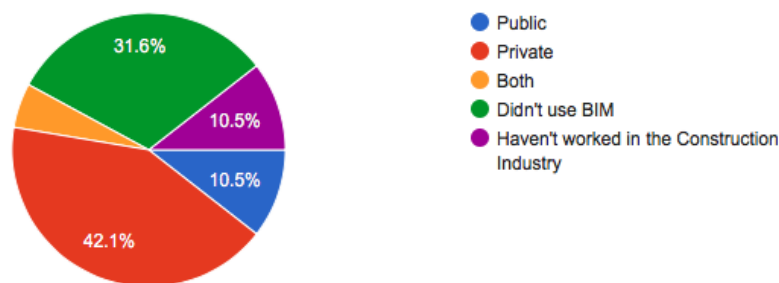
- The first problem the government had to address was creating new framework agreements that prevented the fragmentation of the design-bid-build procurement framework, which decreases collaboration and information sharing, and increases inefficient document management without decreasing competition. The UK government addressed this by adopting proven framework agreements from the private sector, as well as creating new procurement methods that increase collaboration, and redirect motivation and incentives traditionally causing companies to only worry about their own work and profit, rather than the success of the project. These arrangements also had to take into account legal issues associated with Intellectual Property. Finally, the UK government put into effect many of these framework arrangements through their pilot projects, to analyze its successes and failures.
- One of the biggest problems with the BIM mandate, are the lack of proven BIM modeling standards. The UK government has resolved this in a similar manner as the procurement framework issue, as they created their own standards, and adopted proven standards from the private sector. While this is not an issue for realizing level 2 BIM maturity, it complicates matters when trying to progress to BIM level 3.
- The next problem the UK government has dealt with, and will continue to deal with, is a lack of knowledge, education, and experience with BIM on projects. The government had addressed this by providing free resources online, as well as seminars and training best practices. This problem will get worse and worse however if not taken care of, and could create a skilled labor shortage, driving up prices in the future. The government addressed this problem in their Government Construction Strategy report for the 2016-2020 parliament by committing to deliver 3 million apprenticeship starts on projects that meet certain requirements of value, schedule, and use of BIM.

### *A California BIM Mandate*

California, like most places in the world, tends to utilize BIM on private projects more than public projects. Figure 5, below is a survey of construction management students and their experience in using BIM on public vs private projects. Every company interviewed also responded saying a majority of projects they undertake that use BIM were private projects.

#### **Were the projects you worked on that utilized BIM mainly public or private jobs?**

38 responses



*Figure 5. Public vs. Private Use of BIM*  
*Source of information: Student Survey*

The reason why? BIM is viewed as an extra to construction, something that companies must sell owners on to get it included in the contract, which is a hard sell to a public owner when it can increase costs and time during the design and preconstruction phases. But with the right procurement method, utilizing BIM on projects is perceived to save costs and time, while increasing overall value. Figure 6 below indicate Cal Poly CM students perception on the use of BIM, and Figure 7 represents UK Construction Industry workers opinions on the matter.

### Do you think mandating the use of BIM on projects would save money in the budget, save time on schedules, or add value to projects?

38 responses

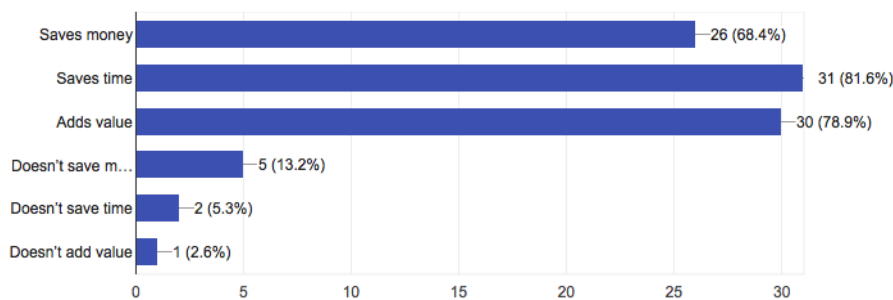


Figure 6. Benefits of BIM

Source of information: Student Survey

### Do you agree or disagree with the following statements?

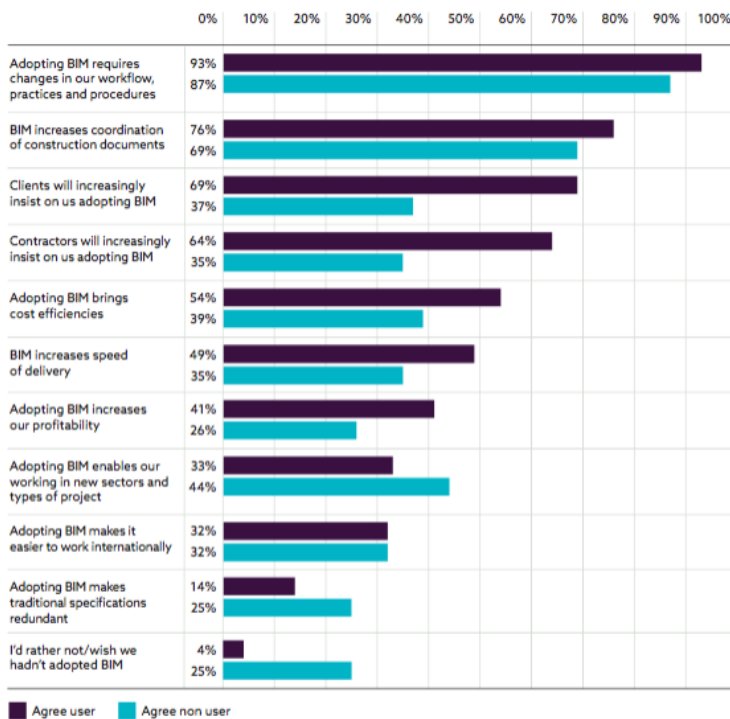


Figure 7 .BIM Statements

Source of information: NBS 2017

BIM can tend to increase costs and duration of schedules because projects are typically delivered through design-bid-build, a traditional procurement method that fragments the construction process, decreasing collaboration and information sharing: two things that must occur for the efficient creation of a BIM model that is useful to all parties. Companies also don't completely replace traditional workflow practices with BIM; many companies in the UK still don't utilize the automatic quantity takeoff tools available through BIM, and instead utilize programs that require the user to perform the takeoff, creating more inefficiencies (Wu S, Wood G, Ginige K, Jong SW 2014) .

Every Contractor interviewed however utilized at least some form of 3D CAD, mostly using BIM for clash detection and scheduling purposes. This shows that contractors in California have similar challenges as those in the UK with respect to implementing BIM, but they may even have more experience with utilizing it. The key challenge is lack of demand from clients. Even without client demand however, some contractors still created their own model for varying purposes.

## Conclusion

With the UK successfully implementing the use of BIM on public construction projects, and making costs savings through the process, California has a clear roadmap available for use if they choose so. Many procurement methods have been developed and tested in pilot projects recently to increase collaboration and the effectiveness of a BIM model; design-build, Cost Led Procurement (Cabinet Office 2015) integrated project delivery, design assist, and an altered design bid build framework (Atul Porwal & Kasun N. Hewage. May 2013) that has an additional bidding phase for a company to create a digital model for use in bidding documents, and throughout construction are all methods that are proven to work and effectively utilize BIM. With these procurement methods, traditional design-bid-build project delivery should be reserved for extremely simple and routine projects, with no need for facilities managers. With all this information at their disposal, the California State government should create a similar mandate, requiring the use of BIM and collaborative procurement methods, as this will help save money, decrease schedules, and improve value and relationships in construction projects. At the very least, California should

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