

Building Information Modelling (BIM), a term that the majority in the built industry would have known by now. It is one of the strategic solutions in raising the efficiency and productivity levels in the built industry. The Building and Construction Authority (BCA) had been actively promoting the use of BIM since the formulation of the first BIM roadmap in 2010. The key strategies in the first BIM roadmap were as follows below:

1. Public sector taking the lead
2. Promoting success stories
3. Removing impediments
4. Building BIM capability and capacity
5. Incentivising BIM adopters

The BIM climate in the built industry has evolved since then. Overall, BIM adoption has a tremendous improvement from 20% in 2009 to 65% in 2014.

Figure 1-1 shows the BIM adoption landscape for the Public Sector Panel of Consultants and Figure 1-2 shows the BIM adoption landscape for contractors.

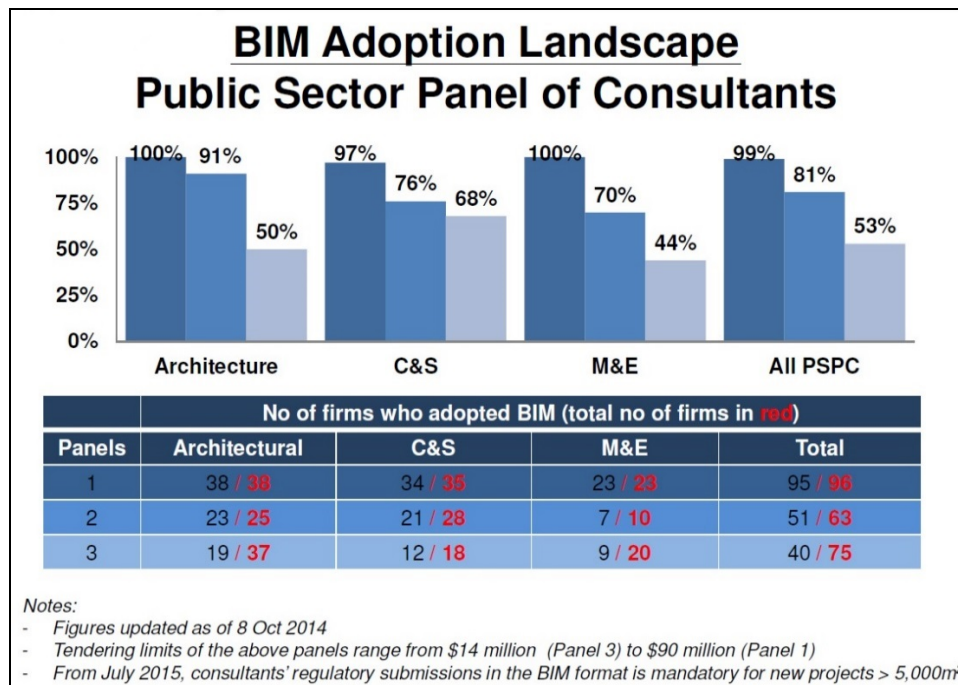


Figure 0-1 BIM Adoption Landscape (Public Sector Panel of Consultants)

(Source: BCA, 2014)

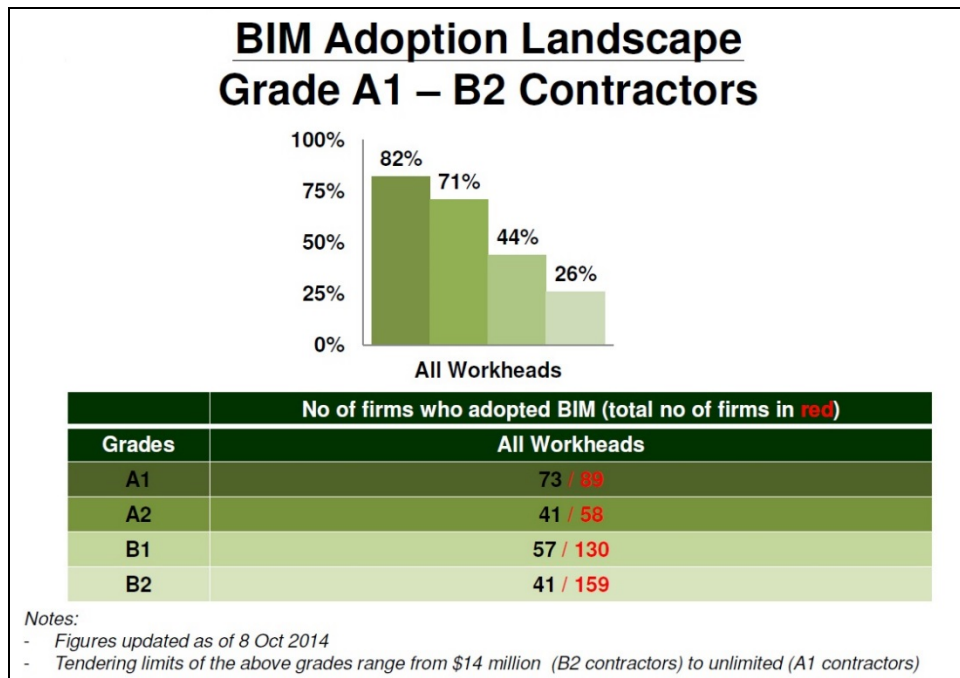


Figure 0-2 BIM Adoption Landscape (Grade A1-B2 Contractors)

(Source: BCA, 2014)

With increasing focus on processes like Design for Manufacturing and Assembly (DfMA), Virtual and Design Construction (VDC) and Prefabricated Prefinished Volumetric Construction (PPVC), BIM is the key tool to achieve maximum benefits from these processes. It allows main parties to collaborate in the early stage of design to develop digital engineering designs that are suitable for use in the Integrated Construction Prefabrication Hub (ICPH) – off site manufacturing and assembly production method. In addition, with advancement in visualisation technology, perspectives from the BIM model are easily shown and communicated before work is done. There are a lot of opportunities for productivity improvement.

While the bigger firms are able to ride on the BIM wave, the smaller firms in the lower parts of the value chain are still facing adoption challenges and this will prevent the industry from maximising the potential of BIM to reap maximum benefits.

The Emergence of New Challenges

The road map in 2010 highlighted 4 key challenges.

1. Lack of demand for BIM
2. People are entrenched in the current 2D drafting practices
3. Lack of ready pool of skilled BIM manpower
4. Additional resources needed to build up BIM expertise

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While the strategies introduced in 2010 are meant to resolve these challenges, new challenges emerged which impedes the full adoption of BIM in the built industry. These challenges are highlighted in Table 2-1.

Table 0-1 Challenges faced by the different disciplines

Disciplines	Challenges
Developers	Some developers may lack the knowledge to drive BIM process and find themselves detached from BIM process. BIM requires significant amount of resources upfront and even if there are ROI models to justify benefits, developers might not be able to see beyond initial spending.
Consultants (designers)	There may be over emphasis on e-submission and there is a significant lack of time to perform design coordination due to tight project timelines.
Quantity Surveyors	Quantity Surveyors faces the issue of a time lag. Cost estimates are required before the completion of the BIM model. In addition, not all items could be taken off from the BIM model.
Main Contractor	Sometimes, main contractors are not able to use the models created by the design consultants as the models were not created in the way contractors would have built the building. As a result, contractors may need to redo the model which takes a lot of time and hinders collaboration with the consultants.
Sub-Contractors	Many of the sub-contractors belong to the SME category and the biggest challenge faced is the lack of capital investment for BIM hardware, software and training. Apart from financial challenges, the relatively cheap foreign labour ¹ deter them from innovation.
Facilities Management	There is a lack of BIM usage for facilities management. In addition, facilities managers are generally not involved during design and planning stage of projects.

(Adapted From: BCA, 2014)

BIM works best with the concept of shared responsibilities which the current contract and procurement structure do not address.

¹ Despite increasing MYE and reducing foreign worker quotas, the labour cost of an unskilled construction worker in Singapore is still significantly lower as compared to those in the US, Europe or Australia.

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Early Contractor Involvement (ECI) is widely seen as a pathway to maximise the potential of BIM. All the parties get involved early and it paves way for collaboration at later stages of project. However, there are limitations with ECI model as it is both time and cost intensive and it may not be applicable for all projects.

Given that BIM is an essential tool for the Virtual Design Construction (VDC) and Design for Manufacturing and Assembly (DfMA) concept, it becomes increasingly important to find new strategies and solutions to maximise the usage of BIM throughout the value chain.

The Exploration of New Solutions

Technologies related to BIM have been constantly improving – more powerful hardware and a wide range of software and external applications to choose from. In addition, new innovative project delivery methods have also been developed in an attempt to improve efficiency and productivity throughout the project life cycle. What is lacking is perhaps mechanisms which can integrate both technology and process together.

Relook the Contract and Procurement Structure

It is an accepted definition that BIM is a tool while Integrated Project Delivery (IPD) / VDC / DfMA is a process. The maximum benefits are only derived when these 2 concepts are used together. However, such processes alter the traditional roles and responsibilities of owners, designers and contractors. This give rise to new types of contracts and procurement methods which can suit these processes.

The development in the area of contract and procurement for BIM is not new. A lot has been done overseas over the years. Some examples include the relational Tri-Party Agreement for Collaborative Project Delivery in the US, Project Partnering Contract and the Two Stage Open Book in UK and CIOB Time and Cost Management Contract 2015. The main objective of these contracts is very clear – to provide the environment and pathway to facilitate collaboration between owners, consultants and contractors from design to construction while clearing the common legal hurdles. Private and Public sector in US, UK and Australia have also gone a step further to include elements of relational contracting which further stressed on shared responsibilities, collective learning and introduction of shared risks and benefits that seeks to maximise the value created for owners. These contracts align all parties towards the common goal and strive for the best results (in terms of time, cost and quality) as a team rather than as an individual.

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In Singapore, the BIM Particular Conditions has been drafted to guide the industry on the use of BIM by addressing procedures of handling digital data, roles and responsibilities, intellectual property rights, extent of reliance on BIM models by each party and contractual privity. This perhaps can be seen as only first of the 3 steps approach² towards incorporating BIM and IPD/DfMA/VDC into the contractual framework. The main form of contract is still based on the adversarial system which creates an environment that prohibits collective benefits and encourages individual benefits leading to isolated silos of working environment which in turn leads to low productivity and inefficiency. The 2 key elements of IPD/VDC/DfMA – collaborative design process and sharing of financial risks/rewards are not included in the local form of contracts.

Given the rapid advancement in technology and BIM, it is an appropriate time to consider the evolution of Singapore's contract and procurement structure. It requires the combine efforts of both public and private sectors. Authorities could exercise more flexibility in the rules, regulations and bureaucracy. Public sector clients could learn to see benefits derived from relational contracting and break out of the conservative industry culture. Industry players must also have the willingness to trust each other and adopt 100% open-book cost certainty/transparency. This is integral towards prevention of corruption which is one of the top barriers in adopting relational contracting practices.

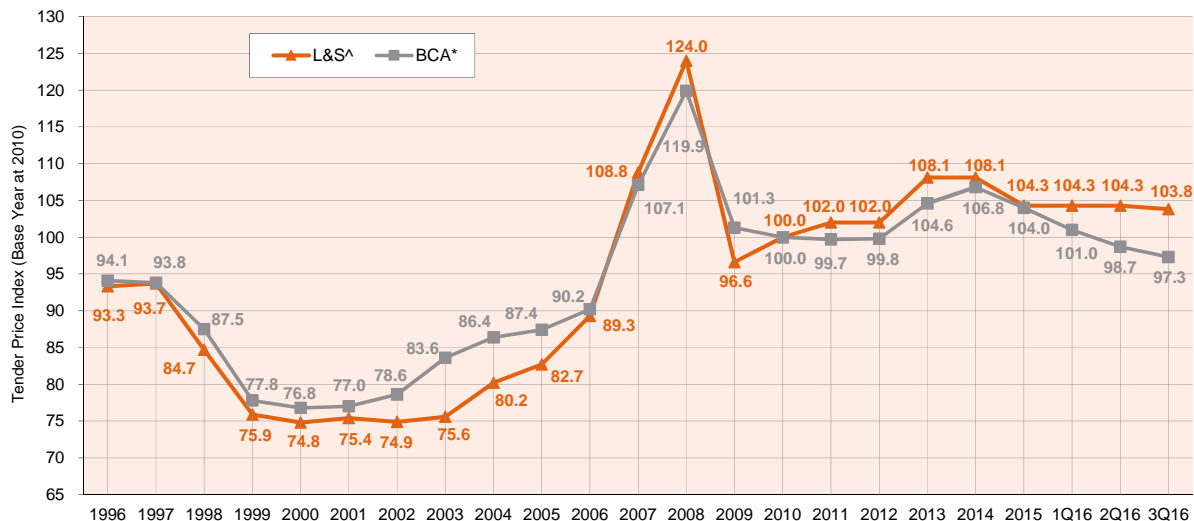
A Peak into the Future

Projects are becoming increasingly complex with tight budget and schedule, and the drive towards productivity is getting stronger. Technology alone cannot meet the changing needs or solve the productivity issues. It is important to integrate processes and technology together to solve problems and not look at the 2 areas separately. Tender documents of the future will have BIM related content which can help to set direction for the use of BIM in each project. Information requirements have to be part of the contract in order to secure data quality and relevance in a move towards incorporating BIM more into contracts. Perhaps with the recent 2nd BIM roadmap and the new set of strategies, it can help steer the industry to overcome the inertia to change.

² The 3 steps approach towards incorporating BIM and IPD in contractual framework is mentioned by Jay Wickersham, founding partner in the Cambridge, MA law firm Noble & Wickersham LLP and Associate Professor in Practice of Architecture at the Harvard Graduate School of Design
Wickersham, J. (2009) *Legal and Business Implications of Building Information Modeling (BIM) and Integrated Project Delivery (IPD)*, Rocket: BIM-IPD legal and business issues.

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L&S TPI is a measure of the comparative tender price movements based on the projects handled by Langdon & Seah Singapore Pte Ltd, An Arcadis Company. The TPI reflects the tender price level of contracts let out over the years. Other than material and labour costs, it takes into account the elements of competition, risk and profits.



Source: * Building and Construction Authority as at 14 November 2016.

Note: With effect from the 1st Quarter of 2015, BCA has implemented the new TPI series with Base Year 2010 = 100. The TPI chart shown above has been amended accordingly to reflect the Base Year as Year 2010.

[^] From 2009 onwards, L&S TPI based on 4th Quarter index.

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Eugene Seah, Ho Kong Mo and Cheryl Lum

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