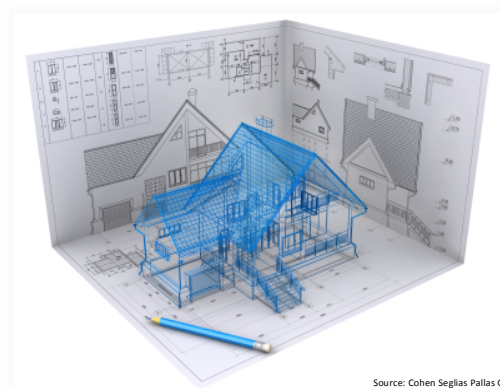




## Research Report

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# Building Information Modelling (BIM) in Tasmania: Foresight report



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CENTRE FOR INTERDISCIPLINARY BUILT ENVIRONMENT RESEARCH

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## 1. Executive Summary

As the last in a series of three discussion papers commissioned by the Tasmanian Building and Construction Industry Training Board (TBCITB) the following pages contain a digest of current BIM thinking contextualised in Tasmania. Given that it is known that BIM capacity is barely present in the State it has been decided to treat this as a strategic *Foresight* report where both the statewide industry and individual firms are examined using a SWOT analysis. Wherever possible it builds upon pre-existing published research and other publicly available documents/media, but ultimately it signposts possible Tasmanian futures in a BIM-enabled world.

This paper begins by analysing the capabilities of the architectural, engineering and construction (AEC) sector as a whole, highlighting some critical implications for sector-wide productivity and its impact on the State's economy. It goes on to examine a notional firm within the Tasmanian AEC sector, identifying a range of consequences for it, arising from its action or inaction in relation to BIM. The paper concludes with a set of recommendations that can be summarised thus:

- Tasmanian engagement with a BIM-enabled AEC environment is starting from a low base, but the roll-out of the National Broadband Network (NBN) provides it with a comparatively brief opportunity to leverage faster data transfer speeds than the majority of mainland competitors.
- The Tasmanian AEC sector is entirely comprised of small- to medium-sized enterprises (SMEs). Firms of this size are more capable of agility and responsiveness.
- In an information-intensive industry BIM provides the opportunity for new products and services to be created, marketed and delivered to Tasmanian, mainland, and international clients and supply chain partners.
- Creating competitiveness through BIM is as much a human and business issue as it is a technological one. Unleashing the full innovative potential of a BIM-enabled Tasmanian AEC sector can only be achieved through a combination of the strategic recognition of BIM's innovation potential by leaders of businesses, followed by appropriate high-level technology adoption and training.
- The TBCITB is ideally positioned to support BIM (and other high-technology) adoption and consequent innovation across the sector.

## 2. Introduction

As has been seen in the earlier reports, the issue of BIM is fast becoming a pressing concern for the AEC sector around the world. What a decade ago had appeared to be a vague and nebulous aspiration has in recent times become something of a reality, and although thorny technological issues remain to be overcome, it is simply a question of "when" rather than "if".

The decision to engage with any innovative technology must inevitably be taken by those leaders, or within the leadership group of businesses, and their decisions are informed by a myriad of competing concerns. BIM can be thought of as a classic example of a "disruptive technology". This term was coined by Harvard Professor Clayton Christensen in a 1995 article entitled 'Disruptive Technologies: Catching the Wave',<sup>1</sup> and subsequently expanded into his seminal 1997 book 'The Innovator's Dilemma'.<sup>2</sup> He described disruptive innovation as being "the process of developing new products or services to replace existing technologies, thereby gaining a competitive advantage." The common characteristic of all disruptive innovation is that it tends to lead to a new product or service that is more efficiently delivered than its predecessors.

The disruptive innovation literature is replete with examples of sector-leading firms that lose their market dominance as a result of a reluctance to engage with disruptive technologies: Christensen cited Bucyrus-Erie's reluctance to engage with emerging hydraulic technology for their large-scale excavators, preferring to stick to their tried and tested cable technologies. This opened the door for rivals such as Caterpillar and John Deere to corner that market (Christensen, 1995).

In the building and construction industry the issue is compounded by the quandary as to whether firms are providers of products or services, or perhaps even both. Sector-leading enterprises have come to regard their core business as being information-intensive, lending weight to the notion that they are, at their heart, service providers. It is from this perspective that BIM as a disruptive technology makes the most sense. It is therefore perhaps paradoxical that these same firms regard the failure of its widespread adoption to be an impediment to innovation, since they tend to be the leaders of project supply chains through which information has to flow.

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<sup>1</sup> J. L. Bower and C. M. Christensen, 1995. 'Disruptive Technologies: Catching the Wave.' *Harvard Business Review*, Jan.-Feb., 43-53.

<sup>2</sup> C.M. Christensen 1997. *The Innovator's Dilemma*. Cambridge, MA: Harvard Business School Press.

When set in a Tasmanian context the availability of disruptive technologies is particularly challenging since the AEC sector is entirely comprised of SMEs, for whom such technologies represent disproportionately large investments, both in terms of capital costs and training. What is not often immediately apparent is the extent to which disruptive technologies require the reconfiguration of business models and business processes. When combined together these resource implications are undoubtedly daunting, and are frequently regarded as insurmountable, however the history of disruptive innovation shows that such a position will normally prove detrimental to a business's long-term prospects, and quite often fatal.

The challenge for firms operating in the AEC sector in Tasmania is to conduct sufficiently sophisticated strategic evaluations of BIM, both in relation to exploitation of existing opportunities through increased efficiency and exploring its potential to create new opportunities by developing new products, services and markets: fundamentally, these are business management decisions, rather than technological issues.

### 3. State-wide SWOT Analysis

This section summarises the strengths and weaknesses of the Tasmanian AEC sector as a whole in relation to BIM, and other disruptive technologies and innovations, providing an assessment of the consequent opportunities and threats that their existence creates. As will be seen, many of the strengths also appear in the weaknesses side of the equation; opportunities arising out of BIM adoption within Tasmania are likely to be balanced by threats created by BIM-savvy competitors located elsewhere.

#### **Strengths:**

- Firm size – it is well recognised that smaller enterprises display higher levels of responsiveness to, and agility in the face of changes in the competitive landscape.
- TBCITB – whilst not unique, the existence of an overarching body responsible for sector wide education, training, and skills development represents a significant advantage in that it can both collate market intelligence relating to the training needs of enterprises, and thereafter act as a conduit to appropriate education and training products.
- Government clients – it is also well recognised that informed and enlightened public sector client groups are the ideal triggers to BIM innovation, since they can demand state-of-the-art technologies and services on showcase projects, in the expectation of long-term value for money throughout the operational phase of assets thus procured.

#### **Weaknesses:**

- Over-reliance on government funding: while enhanced economic outcomes can be stimulated by government sponsored enterprise support programs, the rising economic and political cost of such programs has led to a reduction in their number.
- Over-reliance on public sector projects: whilst these are essential, and probably provide the best opportunity to gain BIM experience, they are atypical of projects on which BIM will be used in the longer term, particularly in interstate markets.
- Opportunities for exposure - Not enough exposure to large construction projects in Tasmania within which to develop the financial and managerial skills to deal with major projects.
- Financial resources - Limitations on the financial resources to take on high-risk major projects.

- Remoteness – overcoming the Tasmanian and mainland psyche that the Tasman is a major barrier to trade with mainland Australia and overseas.
- Access to a workforce with the existing skills to implement innovative approaches.

### **Opportunities:**

- Potential new business models facilitated by the National broadband network (NBN) – as a consequence of its geographical isolation, and the potential economic stimulus that it represents, Tasmania has been chosen as one of the venues for the roll-out of this high-speed broadband network.
- BIM adoption- Adoption of BIM technology at different levels and in different modes of, to change operational efficiency and business models through
  - Lonely BIM – adoption of BIM in isolation to achieve efficiency gains as an individual firm
  - Social BIM – adoption of BIM with the intention of engaging with other project team members to achieve efficiency and effectiveness gains
  - Retro BIM – adoption of BIM to model buildings after construction, specifically for refurbishment or facility management purposes
  - BIM-integrated manufacturing – use of BIM outputs to specify manufactured/engineered products using CAD/CAM equipment
- Environmental Responsiveness- Responding to the high level of environmental awareness with alternative technological and business solutions (this is a double-edged blade, with opportunity for branding balanced by the threat of environmental activism blocking undesired use of the island's timber resource)
- Education - Exploiting the knowledge and skills of BIM trained students graduating from the University of Tasmania and Tasmanian Polytechnic

### **Threats:**

- Lack of synergy building alliances - Lack of engagement of the Tasmanian industry with interstate AEC firms to increase the synergies in order to be competitive.
- Reluctance for technology adoption - Reluctance to engage nationally and internationally even when Tasmania becomes BIM-capable to remain competitive
- Wider state level social/economic/policy issues impacting on the advancement of the AEC sector e.g. low levels of population growth, evolving market structures



## 4. Generic Tasmanian SME SWOT Analysis

This section summarises the strengths and weaknesses of a notional Tasmanian SME in relation to BIM, and other disruptive technologies and innovations, providing an assessment of the consequent opportunities and threats that their existence creates. As before, many of the strengths also appear in the weaknesses side of the equation; opportunities arising out of BIM adoption within Tasmanian markets will tend to be offset by threats from BIM-literate interstate competition.

### Strengths:

- Agility potential - As AEC firms in Tasmania are exclusively SMEs they are inherently more agile and responsive than large enterprises, both culturally, and when reconfiguring their resources to meet new challenges.
- Response to training needs - Tasmanian AEC firms are supported by a cohesive Training Board that encompasses all sectors of the industry and is sensitive to the training needs of the sector.

### Weaknesses:

- Resources limitations - SMEs generally have fewer resources than larger enterprises, particularly in terms of capital investment in disruptive technology such as BIM.
- Cash flow constraints - Cash-poor SMEs generally require a fast return-on-investment to justify expenditure - this perspective tends to inhibit explorative innovation in favour of exploitative, efficiency driven initiatives that generate fast ROI.
- Vulnerability in skill shortage - SMEs are vulnerable to skills shortages in the labour market – this will be particularly so in relation to BIM-literate staff.
- Tasmanian AEC SMEs have historically been sensitive to the level of publicly funded projects.
- Lack of exposure to mega projects - SMEs do not have enough exposure to large construction projects in Tasmania, where high-end BIM processes are most likely to be employed.
- Geographical and mobility constraints - Tasmania's remoteness ensures that the Tasman is both a physical and psychological barrier to exchange of services and trade with mainland Australia and overseas.

### **Opportunities:**

- Potential for efficiency gains through alternative workflows - Well designed and executed BIM business practices must necessarily result in efficiency gains (doing current activities differently, faster and more cheaply).
- BIM presents individual enterprises with a range of information-intensive opportunities that could not otherwise exist. These could include products and services, developed in isolation or in collaboration with others in the supply chain, delivered directly to clients or to their supply chain customers (e.g. energy audits).
- Reputation based alliances - Early adopter enterprises could develop a positive reputation and with larger clients and/or supply chain customers, who would naturally gravitate towards like-minded, BIM-enabled suppliers.
- Marketing edge: Early adopters forming strategic alliances with positive image, can provide a marketing edge.
- Innovation drive -The presence of BIM capabilities within an individual enterprise has the potential to trigger it to do different things – genuine innovation – particularly where collaboration with non-traditional partners (e.g. CAD/CAM equipped manufacturers) could result in new products or services (e.g. industrialised building products).

### **Threats:**

- External competition - Tasmanian AEC SMEs are increasingly likely to be forced to develop BIM-enabled productivity and competitiveness that is equal to their interstate rivals in order to remain competitive within their own local markets.
- Being reactive -Tasmanian AEC SMEs cannot afford to ignore interstate or even international markets as legitimate avenues through which to generate return-on-BIM investments.
- Macro-Micro economic pressures - Individual enterprises may well feel the effects of an economic downturn at precisely the time when substantial BIM investment is required, or has occurred.
- Balance between short Vs. long term view of return on investments - Demographic pressures on both markets and the skilled labour pool may reduce an enterprise's ability to generate adequate turnover to justify BIM investment, and/or its ability to recruit a suitably skilled workforce to exploit its BIM capabilities.

## **5. Addressing the challenges**

Thus far this report has identified a range of structural strengths and weaknesses, opportunities and threats across the Tasmanian AEC sector, and attempted to foretell their consequences for individual SMEs within the sector. In doing so it has become apparent that accelerated rates of BIM adoption are contingent upon the existence of adequate resources, both human and financial, and appropriate opportunities within which to exploit them.

It is clear that appropriately skilled operatives will be required to use BIM effectively, and that whilst Tasmanian educators are beginning to embrace BIM their current level of effort will not in itself be sufficient to meet eventual demand, primarily because the Tasmanian AEC sector comprises a workforce that requires re-education more than it needs in new graduates from education.

Further, it is apparent that whilst the existence of an adequate number of BIM-capable operatives (of various types) is desirable, they will not find employment if the leaders of Tasmanian AEC enterprises do not first recognise business opportunities arising from BIM, and then seek to reconfigure their firms' capabilities to exploit these opportunities.

Section 2 introduced the notion of disruptive technologies, leading to disruptive innovation: BIM is such a technology, and those firms at the vanguard of BIM adoption have the opportunity to become disruptive innovators, changing the way in which buildings are conceived, designed, delivered and operated. In doing so they will be able to achieve what many admire in the work of the leading innovators of our time – the ability to shape the markets in which they operate. Of course very few innovators actually achieve this aim – the Tasmanian AEC sector will be no different from any other in this regard – though many go on to be highly profitable. But the critical issue is that business leaders themselves have to become sensitised to the possibilities raised by exploring new options, whilst concurrently ensuring that their core business continues to exploit existing opportunities in tried and tested ways.

There will be technology-push and demand-pull for change. There will be a natural reluctance to resist change from those who feel their current business models are adequate. There will be an equally natural reluctance from many in the workforce to engage with technology that is superficially bewildering, and that clearly represents a threat to employment for those experienced in conventional ways of working. And lastly, there will always be the nagging doubt that new technology and new ways of working will actually result in any higher profitability – the risk of failure is clearly a possibility. Planning an education and training regime designed to prepare an entire industry sector for a BIM future must therefore be well informed and constructed in multiple layers.

The strategy for successful BIM adoption in Tasmania must be educational in focus enabling people within enterprises, from the very top downwards, to make informed decisions based upon a broad understanding of the issues. A number of these will be

highly technical in nature, and these are generally well served by traditional education providers, though the rise of online education and channels would seem to make them ideal for BIM training: the software vendors are clearly very skilled in this regard. What is missing from the picture are two key components: firstly, and understanding of precisely how conventional business processes such as estimating, or work programming will be affected in a BIM-enabled world, and; secondly, how business leaders currently evaluate strategic business opportunities, so as to better equip them with comprehensive decision-making tools and support.

Previous research in Australia and elsewhere, in the AEC sector and in other industries, has suggested that SMEs are prone to taking a short term view in relation to business opportunities. Explanations for this have included the acknowledgement of the higher risk that failed innovations represent in the SME context, low levels of awareness of strategic planning skills among SME proprietors, and the lack of time available to them to engage in strategic planning activities. Engagement with BIM is not a short-term investment, nor will the benefits be recouped over the short-term. The challenge is therefore to support and re-educate SME leaders and leadership teams to be more explorative in their assessment of business opportunities.

The TBCITB is ideally positioned to facilitate change, and is arguably the only Tasmanian entity that has the capacity to undertake this role. Whilst it may not develop and deliver all of the content required to achieve change it should aim to facilitate engagement with appropriate content, acting as a broker/clearinghouse in this regard. Crucially it should identify gaps in existing education and training provision, based upon an informed investigation, and needs-analysis of the Tasmanian AEC sector, and be prepared to offer training that will fill such gaps.