



## BIM education - Case New Zealand

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### Abstract

This article is a first step in a longitudinal research in New Zealand context to identify what impact national education approaches have on uptake of BIM education in individual tertiary institutes. Although BIM and BIM education as research topics are on rise, there is limited research on national approaches and their impact on width and depth of BIM education and through that graduate capabilities and BIM adoption by the industry. Case study approach has been selected to investigate first the challenges encountered by the tertiary institutes, how these can be addressed at national level and in later stages what the impact has been to the width and depth of BIM education and graduate outcomes. Only a limited number of countries such as United Kingdom have introduced national approaches to BIM education. In New Zealand National BIM Education Working Group (NBEWG) was established in December 2014. The group has representatives from eight tertiary institutes who have strong interest in including BIM as part of their programmes. NBEWG promotes integration of BIM into all architectural, engineering and construction programmes in New Zealand by providing national curriculum guidelines and guidance in adopting BIM curriculum. A survey was conducted among the institutes to identify the key challenges encountered in BIM integration. Among these were knowledge and skill gaps among faculty, crowded curricula, and limited time for development work.

*Keywords:* BIM education, BIM integration, curriculum, graduate capabilities, national approach

## 1 Introduction

In the recent years there has been a significant increase in research when it comes to BIM and BIM education (Abdirad and Dossick, 2016; Yalcinkaya and Singh, 2015). Lack of education and training are well known obstacles for BIM adoption and implementation (Yalcinkaya and Singh, 2015) and although programme and course level approaches to BIM education have been explored widely in the academic literature, there is very limited research on national approaches and their impact on BIM education in individual higher education institutes and on graduate outcomes. Only a handful of countries have adopted national approaches to BIM education Australia, Canada, New Zealand (NZ) and United Kingdom (UK) among these. The approaches to BIM education is discussed briefly to compare the approaches in each country with the approach taken by NZ. In NZ National BIM Education Working Group (NBEWG) was established in 2014 to create wider BIM awareness and encourage BIM adoption and implementation within the higher education institutes across NZ.

## 2 Methodology

This research explores application of national policies for BIM education, principally in tertiary/professional institutions, among leading countries in the field. The research principally concerns approaches to BIM education, especially in higher education. National policies for BIM education in these countries are critically reviewed and compared in order to draw conclusions towards development of standardized national policies fit for specific contextual requirements. Approaches towards promotion of BIM education, most especially at higher education level, in New Zealand are explored in depth. These policies are scrutinized in order to conclude the expected significant potentials of applying them at national level.

## 3 BIM education

BIM education has been widely explored in the literature. Various authors such as Forsythe et al. (2013), MacDonald and Mills (2013), and Wong et al. (2011) have discussed BIM curricula models from programme levels to course levels. Sacks and Pikas (2013), Succar et al. (2013), Becerik-Gerber et al. (2011), Wang and Leite (2014) and Miller et al. (2013) have introduced competency targets and learning outcome frameworks for BIM in order to bridge the gap between education and the workplace by understanding the required concepts and skills. Woo (2007), Kamardeen (2013), Peterson et al. (2011) and Becerik-Gerber et al. (2011) have examined pedagogical challenges of BIM such as relevant disciplines and subjects, resource availability, teaching methods, available software/tools, and other supports to embrace BIM in the curriculum. Finally, practical challenges that hinder BIM education has been discussed by Gier (2015), Lee et al. (2012), Puolitaival and Forsythe (2016) and Underwood et al. (2015) to name a few: annual software package update, limited educational resources and expertise among staff, industrial requirements for graduates, lack of collaboration between academia and industry, limited up-skilling needs and so on. These previous studies support the current some consensus in the BIM education which skills associated BIM are highly required in future graduates in the built environment disciplines (McLernon et al. 2015) and BIM education at both undergraduate and graduate levels should be provided to meet these requirements in order to respond to the inevitable update of BIM in the Architecture, Engineering and Construction (AEC) industry.

Although a large amount of research has been done regarding various areas of BIM education, there is very limited research on systematic and holistic approach to BIM education according to national strategies and consensus between educational institution and industry. Most of the literature is case

studies either within one higher education institute, one programme or one course. The number of countries which have adopted national approaches is also limited.

## 4 National approaches on BIM education

### 4.1 Australia

In Australia there has been several regional or national BIM education initiatives.

Multi-disciplinary BIM education was identified as one of the six areas requiring priority attention in buildingSMART Australasia's (bSA) 'National BIM initiative' report in 2012. It called for a Nation BIM initiative to drive change. The implementation plan required a work program to "deliver a broad industry awareness and retraining program through a nations BIM education taskforce" based on a core curriculum and encourages pilot projects with a due date of 2013 (buildingSMART Australasia, 2012).

In 2012, Australian Institute of Architects published 'BIM Education, BIM in Practice' report. Three sections outlined the users, the learning providers and a draft collaborative education framework.

University of South Australia, University of Newcastle and University of Technology, Sydney recently contributed towards a collaborative design approaches to teaching BIM (Mills et al., 2013). There has also been a lot of work done in individual universities such as the 'Programme-wide implementation strategy' in University of Technology, Sydney (Foresythe and al., 2013) and 'Global passport through co-integration of construction immersive environments' with its 'Threshold capability framework' at RMIT University (London, 2015).

Australian Construction Industry Forum and Australasian Procurement and Construction Council released in March 2017 the BIM knowledge and Skills Framework. This is a significant piece designed to provide the principles, practices and outcomes as the foundation for building a curriculum, such as creating a shared language and a base for assessing learning progress. The document defines seven knowledge areas and maps processes and concepts across them with and six proficiency levels (Australian Construction Industry Forum and Australasian Procurement and Construction Council, 2017). In connection with the framework bSA is currently developing BIMcreds. An online testing tool aimed at certifying practitioner's skills in BIM and its application. BIMcreds are expected to be available in June 2017 (buildingSMART Australasia, 2017).

### 4.2 Canada

BuildingSMART Canada (bSC) released a 'roadmap' in 2014 to lead the transformation in achieving lifecycle BIM modelling in Canada. The roadmap proposed a collaborative approach based on six principles including one for education. The 'Educate' stream outlined in the roadmap starts with building a community of practice then suggests a two-pronged approach, developing a reference curriculum for BIM education and accreditation for institutes and simultaneously developing BIM training packages for stakeholders then providing certification for individuals. (buildingSmart Canada, 2014) In alignment with the roadmaps request for communities of practice, bSC established an education committee and an MOU was signed with Canada BIM Council (CanBIM) research & education committee (Poirier A. E., 2016). CanBIM began offering certification in 2014. It was designed to be an 'industry-wide benchmarking platform' and now provides four levels of Certification for Individuals as well as Educational Course and Program Certification (Canada BIM Council, 2016).

Although it seemed Canada was making good progress along the road map, in 2016 they were not any closer to having a national curriculum. A workshop was held to identify challenges around BIM education and to look for solutions. Six key actions were identified including establishment of core learning outcomes, online platforms to link stakeholders with academics, research, collaboration,

seeking grant funds, and shifting the focus of BIM education more toward theoretical foundations (Poirier, et al. 2016).

### 4.3 United Kingdom

The United Kingdom is one of a few countries to take a national approach on BIM education with BIM learning outcomes framework which BIM Academic Forum UK has developed to acquire BIM knowledge and skills based on a long-term vision (BAF, 2013). This framework defines learning outcomes at undergraduate (level 4, 5, and 6) and postgraduate programmes (level 7) according to knowledge and understanding, practical skills and transferable skills. It also proposes BIM teaching impact matrix as an aid to determining the optimum requirements in the curricula with BIM level: Absent, Aware, Infused and Embedded. This BIM initiative has been not only shared amongst 55 members from 30 teaching centres across the UK, but also became the fundamentals for professional institutions – Royal Institute of British Architects (RIBA), Royal Institution of Chartered Surveyors (RICS), Institution of Civil Engineers (ICE), UK Contractors Group, Construction Product Association – to provide the skills and knowledge required for BIM adoption and implementation in the industry. For example, based on this framework laser-scanning to BIM process was adopted to enhance the teaching of BIM in undergraduate architectural education at University of Wolverhampton, UK (Heesom and Boden, 2016) and RICS (2015) published the global guidance which should be used as a source of reference for quantity surveyor (or cost managers) when BIM has been implemented in a construction project.

### 4.4 Others

Although the Nordic countries, especially Finland, have been in the forefront of BIM adoption, there has been very little happening until 2015/2016 at the national level when it comes to BIM education. BuildingSMART has been the common factor in most of the Nordic countries in coordinating BIM related education both when it comes to tertiary education and professional development. As an example, buildingSMART Norway has a programme to support teachers, which includes teaching curriculum for basic, client and consultant/contractor level. Their web portal also includes a large repository of student work related to openBIM and they organise student seminars on various topics in openBIM (buildingSMART Norway, 2016). BuildingSMART Finland has an education working group, which is looking at improving collaboration between those ones who need and who offer training. Their aim is also to develop curriculum and related material. (buildingSMART Finland, 2016)

Online search found signs of national BIM education initiatives in multiple countries, Hong Kong, Netherlands, Czech and US among other. However closer literature investigation didn't reveal anything further on these initiatives.

## 5 Case NZ

National BIM Education Working Group (NBEWG) was established in December 2014 from the initiative of the BIM Acceleration Committee (BAC). BAC is an alliance of industry and government charged with coordinating efforts to increase and accelerate the use of BIM in New Zealand. NBEWG is reporting back to BAC. The charter of the NBEWG is:

1. Promoting the integration of BIM into all architectural, engineering and construction (AEC) programmes in New Zealand
2. Promoting and following national BIM guidelines, such as NZ BIM Handbook

3. Monitoring and guiding the integration of BIM in the membership institutes
4. Providing national guidelines for BIM learning outcomes
5. Providing guidance in adopting BIM learning outcomes
6. Collaborating for joint activities and research projects to benefit BIM adoption and implementation in New Zealand particularly through education and training.
7. Working closely with industry in educational and research activities.

NBEWG has representatives from eight NZ tertiary institutes, which have interest in integrating BIM as part of their AEC programme delivery. The group meets physically and virtually throughout the year to record what is happening across the institutes in regard to BIM and to discuss and plan its response. Most institutes do not allocate specific time resources to this group, the members fit it into their current workload.

Since its establishment NBEWG has followed the work of BIM Academic Forum UK (BAF) closely. As an example, the national guidelines for BIM learning outcomes are based on learning outcomes defined by BAF.

Creating momentum in this space has been challenging. NBEWG conducted a survey around some of the issues the institutes were facing with the intent of using that data in providing direction for the group. Although that data set was small it was helpful.

NBEWG identified the following as challenges with high impact

1. Lack of BIM process knowledge among staff - BIM is not widely adopted in NZ: Adoption levels vary among projects, sectors, and businesses. Skills are not well developed among existing teaching staff nor recent hires. This is an industry wide issue. Not just the teaching space.
2. Lack of BIM software skills among staff - Buoyant construction environment means recruiting is difficult: BIM experienced staff are in high demand. Opportunities to upskill current staff are slim in NZ. BAC intends to keep BIM training as software agnostic as possible. Institutes vary in the software they use.
3. Crowded curricula, no room for BIM specific courses - Degree programs have some flexibility, but Diploma programmes have very if any flexibility. Diplomas have recently been reviewed and updated with specific mention to include BIM.
4. Lack of time in workload for BIM related work - Most of the institutes don't provide allocated time for BIM related work (unless considered research)
5. Lack of support from Colleagues - Teaching staff are generally assigned to a paper or course. Due to workload pressures teaching staff are generally unwilling to be involved on projects that do not impact or contribute to their paper.
6. No process training available for staff - As mentioned above NZ does not have many training opportunities available.
7. Lack of support from management for BIM introduction - Just as the industry is still undecided on the benefits of BIM adoption it appears, so is the management within institutes.

NBEWG has a plan in place to advise and support the individual institutes. Among the tools are collegial support across the institutes; collaboration in resource development, resource sharing and research; and monitoring of training opportunities. BAC has also offered their support in increasing the

understanding of importance of BIM integration. The plan is discussed more in detail in future publications.

## 6 Conclusions

The impact of proficient education on effective uptake of BIM for construction industry is eminent. Though, as highlighted earlier, BIM education has been promoted at domestic/regional levels, the context of applying nationwide BIM education policies has been limited. In fact, a nationwide perspective towards promotion of BIM education for AEC provides an overview, catering as a parent platform, for supplementary entities/institutions to adapt and extend the policies. Execution of an effective national BIM education policy for AEC stakeholders is expected to boost the uptake and pragmatism of using BIM at practical levels through standardizing clear policies. This is especially beneficial as the current BIM maturity level, even in many of the leading countries in the field including New Zealand, is still far from iBIM (BIM 3.0).

As a result, it is in fact of outmost importance to integrate development of national BIM policies with a clear view to current approaches taken by the design/construction industry. Though major standard policies can be adopted for various contexts, it is essential to localize and fine-tune such policies in accordance with national preferences in order to expect maximized efficiency.

In this line, the role of tertiary/professional institutions in adapting effective standardized national policies to educate BIM-ready graduates is crucial. In fact, forming the education landscape with a national perspective on graduating BIM-ready professionals, is anticipated as a significant step towards nation-wide effective uptake of BIM for the design/construction industry at established levels.

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