

BIM EDUCATION - GLOBAL – 2017 UPDATE REPORT**ISSUE VERSION:** V4.0**ISSUE DATE:** May 2017**COMPILER:** Kevin Rooney (NATSPEC)**EXECUTIVE SUMMARY**

In January 2014 NATSPEC issued the first version of a report summarising the status of BIM education in a number of countries across the globe. The report was updated and reissued in 2015 and again in 2016. This report is version 4.0 of what is now an annual update to the original report.

The countries included in previous versions of the report were given the opportunity to update their information to reflect the current status of BIM education in their respective countries. The updated reports also included input from additional countries than just those who contributed to the original report.

As observed in previous years, the level of BIM education being provided by higher education institutions is progressing and is being developed further each year, with more courses being provided by Universities and technical colleges. Most countries are now reporting that some form BIM education is being provided by their higher education institutions.

Analysis completed in countries such as Australia, Canada and the UK has indicated that there are many challenges being faced by educators in regards to incorporating BIM into the curricula and a number of these are indicated in this report.

Challenges such as fitting additional material into an already crowded curriculum and converting lecture-based courses into smaller multidisciplinary teamwork-based courses.

However, many higher education institutions are providing BIM education on both an undergraduate and postgraduate level, with

countries such as Australia, Singapore, Sweden, the UK and the USA reporting a significant volume of courses and subjects available. Many vocational education institutions are also providing BIM education to the industry's workforce.

Whilst the majority of BIM education being provided tends to focus on the use of particular BIM software packages. It can certainly be observed that training for both graduates and professionals in openBIM concepts, BIM management and working in collaborative BIM environments, appears to be increasing but still has a long way to go in most countries.

Countries including Australia, Hong Kong, Norway, Singapore, Sweden, the UK and the US have reported training and education being available in these topics.

BIM awareness and BIM uptake appear to still be on the rise. However, this is not strictly a consistent global trend, with BIM being widely adopted, and even required by government, in some countries, whilst still only being considered in others.

A trend towards training and accreditation/certification programmes to validate the BIM experience/education of professionals in industry is also being observed with countries such as Australia, Canada, New Zealand, the UK and the US all having or developing accreditation/certification programmes of one type or another. Registers of BIM competency are also starting to appear, with countries such as South Africa commencing such initiatives.

INTRODUCTION

Question

In October 2013 Richard Choy (NATSPEC) sent an email to a global group of parties with an interest in BIM, asking for a brief paragraph outlining the current status of BIM education in each of their respective countries.

This question was interpreted in two ways, with the respondents either describing the current level of BIM awareness/use in their country or the current level of training/higher education available. Some respondents also provided a much more detailed response than a brief paragraph.

Original report

A report summarising the responses received was compiled by NATSPEC and issued in January 2014. The report only included countries from which a response was received and was based purely on the responses provided.

It did not attempt to fully document the status of BIM education/awareness in each country.

Updated report

In 2015 and again in 2016 NATSPEC produced an updated version of the original report. The updated reports also included input from additional countries than just those who contributed to the original report.

Early in 2017 NATSPEC again contacted the respondents who had contributed to the previous versions of the report, offering them the opportunity to update the information to reflect the current status of BIM education in their respective countries.

This report again summarises the responses received. As per previous versions, this report is based purely on the responses provided; it does not attempt to fully document the status of BIM education/awareness in each country.

6 countries who have previously contributed either did not provide an update this time or confirmed that last year's update was still current. Where no response was received from a previous contributor, it was assumed that the status of BIM education in their country has remained unchanged.

This assumption was explained to the contributors when asked if they would like to update their information.

BIM EDUCATION - BY COUNTRY

AUSTRALIA

Education/Training

There are 30 Universities that are accredited to provide undergraduate programs in at least one of the Architecture, Engineering and Construction (AEC) disciplines. Of these, 11 provide programmes in all three discipline streams.

These 11 institutions have shown the greatest uptake of BIM in their undergraduate curricula. However, this has mostly been at a very basic level of information, simply covering the concepts of BIM or the basics of using a particular BIM software package, not yet looking at collaborative BIM across all three disciplines.

Construction management programs appear to be showing the fastest creation/uptake of BIM education courses.

Many TAFE (technical) colleges are providing courses where BIM is incorporated into the syllabus. However, this is usually related to the use of specific BIM software packages.

The topic of BIM management or the procedures for working in a collaborative environment are not generally covered in these courses.

In Western Australia, the Central Institute of Technology is developing a 3 year BIM course, and also runs a short 3-day course titled 'Introduction to BIM'. The University of Western Australia offers a BIM Masters course.

NATSPEC has been providing an *Introduction to BIM* presentation to undergraduate students at Universities across Australia for the past 6 years.

NATSPEC also provides industry seminars on the use of the NATSPEC BIM Project Inception Guide, NATSPEC National BIM Guide, NATSPEC BIM Management Plan and their associated documents.

Initiatives/Organisations

Three Universities (University of South Australia - UniSA, University of Newcastle - UoN and University of Technology, Sydney - UTS) were involved in a project supported by the Australian Government Office for Learning and Teaching (OLT) called CodeBIM

(Collaborative Building Design Education using BIM).

The OLT funded project has concluded and the results have been published in a PhD thesis *CODE BIM: Collaborative Design Education utilising Building Information Modelling* – Jennifer Macdonald (2017).

The project aimed to examine whether collaborative design education could be improved using BIM technologies; how best to adapt these technologies to existing AEC courses; and to develop new curricula for collaborative building design courses in a variety of delivery modes (traditional face to face, distance and block/intensive mode, for example).

A framework to help academics implement BIM (the IMAC framework), was developed and published. It aimed to help identify existing courses that can be modified to incorporate BIM and collaborative working practices, rather than having to create entirely new courses.

Some of the identified problems faced by educators in implementing BIM include:

- How to fit new topics into an already crowded curriculum.
- Reluctance to change teaching habits established over many years.
- With those who may have developed their own niche or expertise, there may be resistance to take on a new subject, about which they are not expert, or to retrain in an area they are not familiar with.
- Technologies supporting BIM evolve at a rapid pace; they may feel overwhelmed trying to keep abreast of them.
- Class sizes of 80 students (and often over 130 students) are common place. The resources required to convert large lecture-based courses into smaller multidisciplinary teamwork-based courses may seem an insurmountable challenge.

Outcomes from the CodeBIM project have resulted in the development of new undergraduate courses. For example, an “IPD studio” class has been developed at UTS which involves multi-disciplinary students working over a semester on a project using BIM tools and processes, learning how to work in a collaborative team and the information needs of their partner disciplines. At UniSA, similar collaborative BIM courses have been developed.

The Australian Institute of Architects (AIA) and Consult Australia established a BIM education

working group of industry and academia members in 2011.

This group produced a series of documents, published in August 2012, which represented the position of the group and were to act as a foundation for further work.

The Western Australia AIA BIM Group is collaborating with Curtin University, University of Western Australia, Central TAFE and the Construction Industry Training Board (CITB) to advance BIM education.

Curtin University has also collaborated with Huazhong University of Science and Technology (HUST), Wuhan, China, to establish the Australian Joint Research Centre for BIM.

The centre focuses on developing leading research that integrates BIM with other advanced concepts and technologies and acts as an allied international platform for creating and sharing knowledge among researchers, engineers and innovators to improve the performance and productivity of building projects in the energy, mineral and construction industries across Australia and China.

buildingSMART’s National BIM Initiative report to Federal Government (2012) identified 6 key areas needing attention to drive the construction industry forward. One of the key areas identified was multi-disciplinary BIM education.

A working group was set up, and details can be found at buildingsmart.org.au.

The Australasian Procurement and Construction Council (APCC) and the Australian Construction Industry Forum (ACIF) jointly published their *Framework for the Adoption of Project Team Integration (PTI) and BIM* at the end of 2014. Education and training in PTI and BIM is a key theme of this framework.

As a result, APCC and ACIF established a BIM education working group to develop a framework and objectives for training providers. This was released early in 2017 and titled *BIM Education and Skills Framework*. A corresponding BIMcreds knowledge testing tool is being developed by buildingSMART to compliment the APCC/ACIF framework.

The Australasian BIM Advisory Board (ABAB) was established in 2016 and now in 2017 has

started to form technical working groups to look at issues identified by the board.

Awareness/Uptake

BIM is being widely used on projects in Australia and by Australian consultants working on overseas projects. The use of BIM for FM/Operations/Maintenance is starting to take a hold, with more projects using BIM for these purposes. Some projects such as the Sydney Opera House using BIM retrospectively to create a working model for FM.

The NATSPEC National BIM Guide and BIM Management Plan are being increasingly adopted across industry and government both as a framework for building projects as well as within education programs.

The NATSPEC BIM website, accessed by clicking on the BIM logo on the NATSPEC homepage (www.natspec.com.au), is a useful resource for general information on BIM, BIM R&D projects and the numerous BIM guidelines that are available.

CANADA

Education/Training

The [Roadmap to Lifecycle Building Information Modeling in the Canadian AECOO Industry](#) continues to drive the change required to realise industry transformation.

buildingSMARTCanada (bSC) and [Canada BIM Council](#) (CanBIM) are jointly moving ahead with the implementation of the Canadian BIM Education Strategy. The Strategy was soft-launched at two events in May and October 2016 respectively. A joint academia/industry workshop took place in May, prior to the Canadian Society for Civil Engineering annual conference, in London, Ontario. This was followed by bSC/CanBIM participation in a two-day BIM Research in Education workshop at the École de Technologie Supérieure in Montreal, Quebec in October. The latter workshop brought together key actors in BIM training, research and education as well as key players in industry from across Canada. The goals of the workshop were to identify challenges and needs regarding BIM research and education in Canada, look abroad for potential solutions and devise an action plan to establish a way forward.

As a result of these events, five work groups comprising bSC and CanBIM members, academia and industry partners have been

created to develop a Canada-centric BIM learning outcomes framework (LOF), associated University, college, professional development curricula, and recommend BIM accreditation/certificate for the Canadian ACEOO industry. Target completion of the LOF is September 2017.

bSC continues to participate on the buildingSMART International Technical committees and is an active member of the bSI People Compliance Committee. This committee is developing an international BIM qualification that will serve as a benchmark for Open BIM knowledge and awareness.

The CanBIM committee continues to focus its efforts on exploring and understanding how BIM is best implemented within the AECOO industry while also understanding the connection between Education and Industry. Since its inception in 2014, the success of CanBIM's Certification Program for Professionals has led to the creation of the CanBIM Educational Certification Program which, through the establishing of course and program outcomes, assists educational institutes in aligning their respective curriculum to CanBIM education assessment targets. To date, the CanBIM Educational Certification Program has certified and/or currently reviewing upwards of 20 BIM-specific programs or courses offered both nationally and internationally.

Initiatives/Organisations

bSC Initiatives

Practice Manual

Government funding was secured in 2015, under the National Research Council of Canada Industrial Research Assistance Program (IRAP), to help the Institute for BIM in Canada (IBC) to deliver a Canadian Practice Manual for BIM. Volunteer in-kind support and other in-kind contributions contributed the reminder. This manual has since been completed and is expected to be promulgated in March 2017.

The practice manual is multi-disciplinary, multivolume, intended to be a comprehensive guide that reflects both international best practices as well as the use of BIM in Canada.

The practice manual builds on the Roadmap to deliver value to industry. It is being used to develop a BIM 101 course/workshop to be offered by bSC. IBC/bSC have identified a communications strategy to overcome some of the challenges in raising awareness and

continue to work through the Education Committee to facilitate content delivery to those providing education at a regional and local level.

Educational Outreach

bSC has produced a short video to promote the benefits of Open BIM. The video will be launched in 2017 for outreach across the country in conjunction with ongoing presentations on the Roadmap. In addition, bSC runs monthly webinars open to anyone who registers through the bSC Community.

Educational Offerings Matrix

bSC has created and maintains a matrix of educational opportunities in BIM at the College and University levels. This matrix included course offerings and key contacts for BIM training and is routinely updated. Instructors are encouraged to contact and collaborate with their counterparts to share and exchange case studies, lesson materials, and best practices. The bSC scan can be viewed at the following website:

buildingsmartcanada.ca/educationnetwork/.

CanBIM Initiatives

Certification

The CanBIM Certification Program was launched in 2014 with the objective of bridging BIM education and the AECOO industry's implementation and use of BIM through the pursuit of excellence in certification. The aims of CanBIM Certification Program are:

- A four-level certification program for BIM Professionals recognizing knowledge, skill and experience.
- Assessment and certification of courses and/or programs offered by:
 - . Educational Institutions both private and public.
 - . AEC industry training providers for industry professionals.
- Assessment and Certification of tiered CanBIM Certification Program for BIM-enabled companies and organizations.
- Assessment of single-course and program learning outcomes and objectives in Canadian post-secondary education.

Provision of guidelines for Continued Professional Development through:

- CanBIM Regional Sessions – Educational Presentations and Panel Discussions.
- Technology Exhibition – showcasing the latest technologies in the building industry.

- BIM-related academic programs.
- BIM-related industry training providers.
- In-house company/organization sessions.

CanBIM Satellite Sessions

2016 saw the launch of the CanBIM Satellite Sessions; a joint event between CanBIM and CanBIM Educational Member Institutions; with Industry and Academia presenting on relevant topics within the host Region. These events are intended to bridge the gap and unite the interests between Academia and Industry. The host Academic Institution has the opportunity to highlight its BIM related programs, a student from the host school is invited to present a BIM-relevant topic and the remainder of the agenda is filled out with Industry leaders from the host region. It's an opportunity to educate and connect all stakeholders over the course of an evening while also showcasing the latest developments of the educational institutions across Canada. CanBIM has three Satellite Sessions planned for 2017.

Awareness/Uptake

Awareness and uptake continue to be on the rise. Many local interest groups across the country have grown in number as bSC and CanBIM work to promote understanding of BIM. New programs continue to be developed, the most recent being Algonquin College's BIM Lifecycle Management Course.

bSC and CanBIM continue to offer monthly newsletters to their respective memberships with interviews and articles from industry leaders discussing the latest in BIM.

The bSC and CanBIM Education Committees continue to work together to progress BIM education in the ACEOO community and actively participate at each other's events.

CHINA

Education/Training

The China BIM Union has given many education presentations to thousands of BIM professionals, presented by Mr Huang Qiang, the vice president of the China Academy of Building Research (CABR), the chairman of the board of directors of China BIM Union.

Mr Huang also attended and presented at the Government BIM Symposium 2013 in Singapore, the APEC Workshop on "Utilizing

Building Information Modelling to Increase Building Performance” held in 2014 in China, and HKUST & CIC joint technical forum “The Current Status of Global BIM Standards” held in 2015 in Hong Kong. The China BIM Union has hosted 3 MOHRSS workshops on BIM systems and application since 2015. Over 200 senior professionals attended the workshops, and more than 10 top experts are invited to give lectures at the workshops.

A joint experiment research centre on building internet + BIM has been founded by China BIM Union and Shenzhen University, and the lab will be completed in 2017.

Initiatives/Organisations

The China BIM Union and the development of BIM standards keep progressing.

The Chinese National Standard ‘Unified Standard for BIM Application’ has been approved and issued by MoHURD in 2016 and will come into effect from 1st July 2017.

A series of CECS standards will be approved and issued for P-BIM (Practice-based BIM) software application and data exchange for specific tasks in 2017.

The China BIM Union has been approved as the China Industry Technology Innovation Strategic Alliance by the Ministry of Science and Technology of the People's Republic of China in 2013.

Awareness/Uptake

Current BIM objectives for China include:

- Targets/Goals: Data sharing and interoperability in project life cycle.
- Motivation: Improve efficiency in industry.
- Challenges: The distribution of interests of BIM data.
- New initiatives: Promote BIM through P-BIM mode and HIM (Huang Interoperability Matrix).
- Strategies: Combine BIM application with specific tasks of AEC in the project life cycle.

CZECH REPUBLIC

Education/Training

The Czech BIM Council continually provide education through BIM seminars, workshops and presentations.

In 2015 they set up a working group titled ‘BIM and Education’ to look at trying to introduce BIM into the education system.

Leading Czech technical Universities gradually implement BIM into their curriculum, mainly as standalone subjects or as innovations of regular subjects.

BIM is also being implemented in secondary education (especially at technical high schools) mainly in CAD based subjects. There is no dedicated BIM study branch or programme.

Initiatives/Organisations

The Czech BIM Council held a conference titled ‘BIM DAY’ in October 2013 and the Czech BIM Guide was released shortly after. The BIM Guide will be followed by a BIM execution planning guide, protocols, etc.

There has been a lack of impulse from government for the promotion of BIM use, this was partly due to elections taking place. The political situation was unstable and therefore a number of important approvals were delayed.

A representative of the Czech Office for Standards, Metrology and Testing attended the buildingSMART week in Munich.

The acceptance process of ISO standards is ongoing.

Awareness/Uptake

There are a few BIM projects currently running (big projects) but 2D is still used for the majority of projects.

Designers are still a bit sceptical of BIM, primarily due to the cost of software and education/training.

However, awareness of BIM in the Czech Republic is increasing due in part to the activities of the Czech BIM Council.

FINLAND

Education/Training

Universities and polytechnics provide BIM education for their students. All current construction and architecture students study BIM to some extent.

For postgraduates, there are a number of options:

- Software companies. All vendors (Autodesk, ArchiCAD, Tekla, Magicad etc.) are providing BIM training for their own software solutions.
- Various courses provided by a variety of players.

- Large companies such as Skanska (construction) and Senaatti (state client office) arrange focussed in-house training as required.
- According to the 2013 BIM survey, asking colleagues is the most popular way of obtaining information about BIM.

Initiatives/Organisations

There are a number of initiatives taking place in Finland, including the following:

- COBIM, the national common BIM requirements, was published in March 2012 and it is now in widespread use. A Spanish translation of the requirements has also been completed.
- Guidelines similar to COBIM, but for Infrastructure, have also been developed.
- The Finnish XML based data format for neutral BIM data exchange for infrastructure is now a buildingSMART project - MVD for LandXML v1.2.
- buildingSMART Finland has over 110 members and user groups for public clients, building permit authorities, HEPAC design, town planning, and infrastructure are all up and running.

Awareness/Uptake

The 2013 BIM survey provided a good picture of the status of BIM in Finland. The survey results showed that 87% of respondents were aware of BIM and 65% were currently using BIM.

The results of the 2013 survey can be found at the following link:

www.rakennustieto.fi/material/attachments/tutkimus-ja_kehittamistoimita/6JKcTDSMO/BIM_Survey_Finland_findings.pdf

BIM is now in everyday use in Finland, it is not known on exactly how many projects, however large firms such as Skanska use BIM for 100% of their own production.

Public sector clients are using BIM on some (estimated 30%) of their projects.

The size of the Finnish market is 30 billion euro.

In Finland BIM always means using open standards: IFC for buildings and LandXML for infrastructure.

HONG KONG

Education/Training

Various Universities and Colleges are providing a total of 19 BIM courses as part of their degree programmes.

The Vocational Training Council (VTC), including the Institute of Vocational Education (IVE), and HKU Space, are providing a total of 20 BIM related courses either as modules to their construction related Higher Diploma programmes or as individual training courses.

The Construction Industry Council (CIC) is collaborating with training institutes to increase BIM capability for the frontline workforce and professionals and to increase the capacity of BIM model developers.

The CIC has been providing 8 BIM courses, targeting trainees to executives, through the Management and Safety Training Centre.

The CIC also organise BIM promotional activities in collaboration with industry stakeholders to raise the industry's awareness and understanding of BIM.

Initiatives/Organisations

In order to address the needs and enthusiasm of the Hong Kong construction industry, in relation to BIM, a Working Group was established under the Committee on Environment and Technology of the CIC and chaired by Ms Ada FUNG, the Deputy Director of Housing (Development and Construction) of the Hong Kong Housing Authority.

The group was tasked with the job of setting out an industry-wide roadmap and implementation strategy for achieving market transformation with respect to the application of BIM in the construction industry.

In September 2014, the Working Group issued the *Roadmap for BIM Strategic Implementation in Hong Kong's Construction Industry*, in which 17 initiatives, under the following 9 areas, were suggested for the industry-wide implementation of BIM in Hong Kong:

- Collaboration.
- Incentive and Proven Benefit.
- Standards and Common Practices.
- Legal and Insurance.
- Information Sharing and Handover.
- Promotion and Education.
- Sufficient Digital Capability and Vendor Support.

- Risk Management.
- Global Competitiveness.

The Roadmap recommends the following imminent actions to be taken by the industry:

- ESTABLISHMENT OF STANDARDS - Devise a set of common standards, good practice or reference documents.
- PROMOTION - Carry out more promotional activities.
- TRAINING - Build up BIM capacity by providing training with respect to three areas: BIM model development, management of BIM and use of BIM models.

The CIC has commissioned a set of BIM standards for industry-wide adoption and Phase One of the BIM standards has been completed.

This phase of standards covers a brief introduction of BIM project execution plans, recommended modelling methodology, definition and specifications of Levels of Development (LOD), component presentation style and data organisation.

Moreover, the CIC is currently carrying out a feasibility study of statutory submission using BIM processes.

Awareness/Uptake

Most major developers have adopted BIM to some extent and the Real Estate Developers Association encourages their members to adopt BIM.

Some public-sector clients have been using BIM and the Development Bureau is exploring the types of public construction projects to which BIM can be effectively applied.

The majority of major contractors have been using BIM for items such as site safety, construction analysis, cost control, work scheduling, etc.

Architects, engineers and surveyors are preparing themselves for the adoption of BIM with some practices already experienced in its use.

JAPAN

Education/Training

Very few Universities provide courses for BIM in Japan. Some technical colleges have BIM training courses.

There are many training programs available for specialists.

Initiatives/Organisations

The Ministry of Land, Infrastructure, Transportation and Tourism (MLIT) established BIM guidelines in 2014.

The focus is now on using BIM, starting from the schematic programming stage right up to maintenance after completion of the project.

Some initiatives are underway, including the establishment of BIM construction guidelines and a study of LOD corresponding to each stage of LCC.

Awareness/Uptake

More and more design firms and construction companies are initiating BIM technology in the private sector. Use of BIM is increasing not only as a tool for simulation, presentation and modelling for drafting in design firms but also as a tool to study work sequencing in construction companies. However, BIM collaboration between companies is hardly ever achieved.

BIM collaboration is increasing though, especially for in-house design firms of Japanese style construction companies. Also, the construction of the main stadium for the 2020 Tokyo Olympic Games is expected to utilise BIM.

NETHERLANDS

Education/Training

BIM is taught in all three technical Universities of the Netherlands at both Bachelor and Master levels. For most technical colleges, BIM education is common place even though no commonly agreed curriculum exists to date.

Various initiatives are creating education training facilities. There is no collective BIM educational program yet in place. The organisation, BIM kiosk, is planning to play a role in this development.

Initiatives/Organisations

The Building Information Council (BIR) is very active in the development of strategic policies for BIM in the construction and civil works industry.

The BIM Kiosk organisation was set up to bring together all 'open standards' used in BIM. The 'kiosk' is a one stop shop for industry when it comes to standards necessary for BIM projects.

This organisation was set up in 2015, with most of the standards added by early 2016.

The CB-NL (Concept Library) project has been initiated and agreement has been reached with buildingSMART International on collaboration with buildingSMART Data Dictionary (bsDD). The project will run for 2 years, with funding of 5 million euro (2 million cash, 3 million in-kind).

The Netherlands construction industry as a whole is involved in the project, over 200 people. It will cover construction, civil works and geospatial environment, with new technology and new content being developed.

The result will be a concept library with semantic structure and developed, validated and usable content

Awareness/Uptake

The development of knowledge cards by the BIR is helping to create greater awareness in the industry about opportunities and possibilities created by using BIM.

At this moment 5 knowledge cards have been developed. Two of which have been translated into English and they relate to the UK BIM maturity wedge.

www.bouwinformatieraad.nl/wp-content/uploads/2014/10/kaart01-ENG.pdf

www.bouwinformatieraad.nl/wp-content/uploads/2015/03/BIR-Leaflet-no.-2-Open-BIM-Standards.pdf

NEW ZEALAND

Education/Training

BIM is taught by a several tertiary institutes and Universities. Some software suppliers also provide specific training. A number of one-off industry presentations and seminars have also taken place.

Construction Information Limited (CIL) have provided a series of seminars to product manufacturers.

Initiatives/Organisations

The 'BIM Acceleration Committee' is a government – industry partnership coordinating some of the industry's BIM development efforts and provides resources to help raise awareness of BIM in New Zealand.

'BIM Best Practice New Zealand' is a collaborative effort by five industry organisations to provide practical industry training for practitioners engaging with BIM. Initial 'Train-the-trainer' workshops have been completed in 2015. Profession-specific training materials have been prepared to support industry organisations to start training their own professional members.

Designed to disseminate the learnings of the highly successful 2015 'BIM Best Practice New Zealand' seminars, nine 'BIM101 workshops' were held across six New Zealand locations during August/September 2016. This provided industry attendees a base view of BIM, while discussing the need to change current construction design, documentation, and delivery practices. Removing barriers to BIM adoption is one of the key aspects of BIM101, hence the workshops were provided free.

Awareness/Uptake

The Masterspec BIM survey provides a good picture of the status of BIM in New Zealand. The survey results show that 98% of respondents were aware of BIM and 57% are currently using BIM. The results of the survey can be found at the following link: www.masterspec.co.nz/news/reports-1243.htm BIM education and training was identified in the survey as the number one 'Roadblock' for broader BIM adoption.

An Eboss BIM Survey 2016 provides baseline information on the use of BIM across the New Zealand construction industry. These surveys are in a five-year series that will chart the progress of accelerating the introduction of BIM in New Zealand. The 2016 edition is the 3rd in the series.

NORWAY

Education/Training

There are at least seven faculties that are running openBIM courses and several colleges that have special BIM studies.

There is no central government requirement for BIM education at a tertiary level. A few engaged teachers are driving openBIM

education in colleges and Universities and buildingSMART Norway (bSN) has initiated a programme to support the teachers who are using BIM in their classes.

The collaboration will support, coordinate and raise awareness of digitalisation of the industry.

In June 2014 bSN released an educational program. The program focused on quality assurance of content and output of courses. Three teaching plans (Basic, AEC and Client) have been released by bSN, specifying the minimum requirement for BIM training at two basic levels.

Several private companies have developed courses based on these teaching plans. The teaching plans do not include specific software training but focus instead on how to behave in a multi-discipline openBIM environment. The plans are free to use for bSN member organisations.

In addition, bSN has established a web-based multiple-choice user certification system, allowing users to get a diploma for their openBIM knowledge.

Initiatives/Organisations

In March 2015 bSN released the BIM Guideline database. The bSN guide allows clients to specify requirements for BIM deliveries without having specialised BIM expertise in the organisation.

The client can configure the requirements with an intuitive wizard, according to the intended BIM usage.

Several Norwegian organisations are involved in the development and revision of National and International standards for digitalisation of business processes.

bSN has 80+ member organisations, representing 25% of the total AEC industry turn-over. bSN coordinates most industry initiatives and BIM User Groups for all disciplines, in a series of arenas.

Awareness/Uptake

Government for Municipalities and Modernisation and its legislative body the Norwegian Building Authority are fully aware of the need for digitalisation.

The Building Authority runs and supports several initiatives in collaboration with the industry.

The projects using and making benefit of openBIM can be counted in the hundreds, from the large openBIM award winning project "New Østfold Hospital", to small residential refurbishments.

The next frontier is to digitalise construction product information and FM/operational documentation.

SINGAPORE

Education/Training

There are 11 Institutes of Higher Learning (IHLs) providing a total of 33 full-time programmes and 20 part-time programmes with BIM curriculum. Third-party BIM software educational vendors were also crucial in training, especially for professionals. As of mid-2016, more than 2,500 full-time students and 8,500 professionals have been trained in BIM.

The Institute of Technical Education (technical college) have integrated BIM, mainly on software capabilities, into their skill qualification programmes for architectural space design, civil & structural engineering design and facility systems design.

Four out of five polytechnics provide BIM modules in the three discipline streams and beyond, such as in sustainability-related programmes.

Five out of six Universities offer BIM modules in their bachelor and master programmes. Nanyang Technological University and the National University of Singapore have also launched Centres of Excellence in BIM to focus on nurturing BIM R&D capabilities.

The Building and Construction Authority's education and research arm, the BCA Academy, takes the lead, going beyond BIM, and into collaboration and the use of Virtual Design and Construction methodologies for its curriculum.

The BCAA conducts two specialist diplomas in BIM and VDC, six certification courses on BIM Modelling (for Architecture, Structural and MEP), Management, Planning for Owners and Facility Managers, and MEP Coordination. The BCAA also collaborated with the University of Newcastle, Australia, to conduct a joint

construction management (building) programme at bachelor degree level, focusing on the use of BIM in construction management.

BIM is also incorporated into 11 BCAA specialist diplomas, 10 BCAA diplomas covering all disciplines across the construction value chain, and a joint degree programme between BCAA and SIM University, Singapore. BCAA also organizes the Stanford CIFE-BCA Advanced Management Program for VDC and short courses and workshops on Optimising Project Delivery with VDC, Introduction to Parametric Design focusing on BIM and BIM Quantity Take-Off.

More than 700 full-time students and 3,700 professionals have been trained through the BCAA's BIM-related programmes. The BCAA also launched the Centre for Lean and Virtual Construction (CLVC) in end 2015 as a first-of-its-kind immersive and experiential facility for BIM, VDC and Lean Construction, to encourage IHLs and industry firms to utilise the Centre for training and experiential learning purposes.

The Singapore Contractors Association Limited (SCAL) Academy has also trained more than 200 students from its member firms in BIM software. The Singapore Institute of Architects also holds programmes engaging their members in BIM management and implementation.

Initiatives/Organisations

The Building and Construction Authority formulated the 1st BIM Roadmap in 2011 to drive the adoption of BIM under 5 areas:

- Public sector taking the lead.
- Promoting success stories.
- Removing impediments.
- Building BIM capability and capacity.
- Incentives for BIM adopters.

By 2015, the 1st BIM Roadmap achieved BIM adoption in most of the larger consultants and contractor firms in the industry. The 1st BIM Roadmap also saw the adoption of BIM in 102 public projects, 181 projects meeting mandatory BIM electronic submission requirements, SGD20 million committed to more than 700 firms who achieved an average of 21.5% efficiency gain, launch of the Singapore BIM Guide, Essential BIM Guides, BIM e-Submission guidelines and software-specific template guidelines.

The 2nd BIM Roadmap was launched in 2015, to advance the use of BIM in an integrated manner over the building life-cycle under 4 areas:

- Focus on VDC:
 - . Driving BIM collaboration throughout value chain.
 - . Building BIM capability of specialist contractors.
 - . New training programmes and facilities (such as the Centre for Lean and Virtual Construction) at all levels.
- BIM for Design for Manufacturing and Assembly (DfMA).
- BIM for Facilities Management and Smart Buildings.
- Research & Development.

The Building and Construction Authority also engages industry leaders through the BIM Steering Committee and subgroups, as well as practising BIM experts from various disciplines both upstream and downstream through the BIM Managers Forum.

The International Panel of Experts on BIM also convene bi-annually to review and provide valuable inputs on the BIM Roadmap.

Awareness/Uptake

BIM is an important feature in the annual Singapore Construction Productivity Week (SCPW), one of the Building and Construction Authority's key sectorial events to engage industry stakeholders and raise awareness on construction productivity.

The International BIM Competition is organised with various student teams representing educational institutions in Singapore and overseas, such as Turkey, South Korea and Australia, working with mentors who are BIM managers from their respective countries, to demonstrate BIM innovation and collaboration over a limited period of time.

A local BIM Shoot-out is also held annually to test the BIM modelling capabilities of students and is quite popular among students from technical colleges.

Other events include the Government BIM Symposium which congregates government representatives and BIM experts from 15 countries to share and brainstorm on BIM implementation experiences, as well as the incorporation of BIM themes in the Build Tech Asia expo and Build Smart Conference, to

reach out to the experts as well as the layman in public, on the benefits of BIM.

SOUTH AFRICA

Education/Training

Many South Africans in the built environment can agree that there is slow productivity growth within the private and public sectors when it comes to rolling out BIM upskilling in South Africa.

To really start making major gains through digital design technology, pressure needs to be put on industry professionals and academia to demonstrate to both professionals and graduates within the industry that there are local companies who are already aggressively driving BIM upskilling within their organizations due to the shortage of skills on certain projects.

Some University faculties are widening their vision and raising their game by introducing BIM processes within their course modules. Architectural design software vendors are also becoming more innovative by marketing BIM more aggressively within various commercial streams.

Initiatives/Organisations

The BIM Institute, with its partners, has been leading the development of intuitive BIM education in South Africa. With the support of its international BIM training partner, WhiteFrog, it is helping to promote BIM accreditation in South Africa.

The BIM Institute completed its first National BIM survey in Dec 2016. A summary of the results and the challenges currently faced in South Africa in regards to BIM can be found at the link below.

<http://www.biminstitute.org.za/sa-bim-survey-reveals-local-industry-technology-laggard/>

Recent developments have seen discussions among various private and public sector bodies to provide a list of companies that have or are currently upskilling internal resources and upgrading technologies in response to BIM best practice. The long-term vision for this strategy is to create public awareness of companies who are not only optimizing the technical operation side of business but also creating a platform for private and public

companies to start engaging with BIM compliant organizations.

The BIM Institute has recently announced its intention to put in place a “company listing” page on its website, listing companies that are upskilling its resources or are BIM accredited through the BIM Institute’s maturity assessment program.

Awareness/Uptake

It needs to be taken into account that most organizations in South Africa still require basic upskilling on the fundamentals of BIM, this includes some software vendors who also need basic upskilling as they lack the understanding of BIM life cycle processes.

It is recognised that contractors in particular have made very little headway in achieving BIM upskilling, but there are exceptions that have made certain leaps and bounds in driving BIM with internal methodologies.

The challenge of promoting BIM education still lies with companies’ traditional conservatism, with many still holding back from implementing new and improved digital construction technologies. This could also be due to high costs for software licences.

SWEDEN

Education/Training

Construction related University teaching programs in Sweden have, with only few exceptions, adopted BIM in their respective curricula. Engineering Bachelor programs at University colleges have the highest general representation of BIM subjects in the curricula. The adoption of BIM in architectural schools is, however, significantly limited.

The degree of BIM adoption differs significantly between the respective teaching programs. Only a few Universities have adopted BIM as an integrated subject in courses that deal with general construction related issues. The predominant approach is however to implement BIM subjects as discrete teaching modules, i.e. stand-alone courses, in which BIM is regarded as a technical tool rather than a facilitator for process integration and organisational development.

There are about 50 national institutions of higher education in Sweden, of which 10

Universities and 8 University colleges provide construction related teaching programs. Together, these institutions represent a total of 36 (4 M.Arch, 7 M.C.E, 23 B.C.E and 2 M.C.E+M.Arch) different teaching programs and 109 courses (92 in 2013) with syllabuses that relate to various BIM subjects.

The general picture of all teaching programs show that generation of drawings and visualisation from the BIM-model are the most prominent teaching objectives:

- Drawings (generation of drawings): 49% (51% in 2013).
- Visualisation (communication, render): 32% (32% in 2013).
- IFC (data exchange): 11% (9% in 2013).
- Construction management (4D, 5D): 7% (7% in 2013).
- Business strategies (implementation): 1% (1% in 2013).

81% of the courses use 3D CAD and 19% use only 2D CAD at Universities in Sweden.

Only 1% of the BIM related ECTS-credits provided concern matters of business strategies, in relation to the implementation of BIM, as its principal learning objectives. This crucial aspect of BIM integration in existing, as well as new processes, new forms of collaboration, new roles and responsibilities, new ways of communication, etc. is clearly under-represented in the Swedish University curricula.

One Masters program (in Jönköping) has been developed specialising in Sustainable BIM as a topic. Since 2013, 11 of the 18 new courses on advanced level BIM have focused on BIM coordination or BIM strategies.

Initiatives/Organisations

Since 2013 there has been national investment for digitalization for research and development in construction. The governmental program of Smart Built Environment has started which has a number of knowledge packages to develop education with digitalization.

BIM Academy Sweden, as a part of BIM Alliance was started in 2016 for knowledge transfer between Universities.

Awareness/Uptake

There is a considerable discrepancy between the technically oriented BIM curricula at the Universities and the more process and change

oriented approach to BIM represented by the industry.

Besides, the industry emphasises the importance of BIM implementation in urban planning and real estate management, which currently is more or less neglected in curricula at Swedish Universities.

The large consultancies and contractors drive the Swedish BIM movement and are ahead of the Universities concerning BIM awareness, maturity and competences.

UNITED KINGDOM

Education/Training

The BIM Academic Forum (BAF – discussed later) published [Embedding building information modelling \(BIM\) within taught curriculum](#) in 2013 and “Current position and associated challenges of BIM education in UK higher education” in 2015. The latter report indicated that BIM is now becoming widespread across the various levels of higher education, albeit ad hoc and without consistency. In the main, this tends to be driven by individual academics or schools/departments that have a particular interest in the area of BIM and recognise its importance in the education of professionals.

Over the last few years, a number of BIM specific programmes at Masters level have emerged. A number of BIM specific BTEC level programmes have also now begun to emerge. Apart from architecture and construction related disciplines, there are overall low levels of interest in BIM incorporation in teaching across built environment related disciplines. At the cutting edge where BIM is fully embedded into programmes/modules, architecture maintains a significant edge over all other built environment disciplines.

BAF held its first international conference at Glasgow Caledonian University, 13th-15th September 2016. This brought together delegates from both industry and academia to discuss aspects around Education & Training, Process & Standards, Strategy & Implementation, Knowledge Management & Decision Support, BIM Maturity & Assessment, Asset Handover & Operational Management, Technology. The programme also included a workshop to explore establishing a European BIM Academic Network to bring together the European national BIM academic forums. BAF

are currently focusing on taking the first report of embedding BIM within the taught curriculum forward by drilling down to disciplinary perspectives at the undergraduate level. BAF are also aligning their activities in support of the UK BIM Alliance, and the Upskilling work stream, in particular.

Since 2015, the [BIM Regions](#) have been actively seeking partnerships with local Higher Education Institutions. The London and SE BIM Region formed a partnership with the University of Westminster and ran a [series of free BIM Events](#) aligned to its Masters programme. [thinkBIM](#) is run by the Centre for Knowledge Exchange at Leeds Beckett University in partnership with the Yorkshire and Humber BIM Region. The South West BIM Region is run in partnership with University of West England. The [BIM Academy](#) is partnered with Northumbria University.

[Design, Engineer and Construct](#), run by Class of Your Own, is an accredited learning programme for secondary-school age students and has been expertly developed to create and inspire the next generation of Built Environment professionals. Class of Your Own are leading the [BIM4Education](#) initiative. This initiative has recently been awarded [CITB](#) funding to get teachers and students excited about BIM and construction.

There are now many providers of BIM training within the UK. As identified above, the BIM Regions have partnered with local Universities to provide free events. Other providers of paid for content include:

- Professional Institutions:
 - . Royal Institution of Chartered Surveyors (RICS).
 - . Chartered Institute of Architectural Technologists (CIAT).
 - . Chartered Institute of Building (CIOB).
 - . Institution of Civil Engineers (ICE).
 - . Building Services Research and Information Association (BSRIA).
 - . Building Research Establishment (BRE).
 - . Construction Industry Training Board (CITB).
 - . National Federation of Builders (NFB).
 - . British Standards Institute (BSI).
- The [BIM Campus](#) provides a six-week intensive course.
- The B1M is an online video resource which includes a [BIM for Beginners](#) programme.

Many of the AEC companies have run their own in-house training programmes which are compulsory to attend and require a certain level of attainment.

There is significant body of research being undertaken into BIM. Each Higher Education Institution has its own research programme and there are also numerous Knowledge Transfer Partnerships (KTPs) being undertaken. [KT4BIM](#) involves BIM4SME acting as a client to a virtual project with numerous KTPs; the objective is to achieve a Level 2 compliant project.

Initiatives/Organisations

The UK Government influenced a significant movement within the UK AEC industry by requiring the use of BIM on public sector projects in its [2011 Government Construction Strategy](#). The primary objective of the strategy was to sustainably reduce the construction costs incurred by the public sector. BIM was identified as one of the principal initiatives to achieve the objective and was supported by the creation the [BIM Task Group](#). [Training and Education](#) was one of the Task Group's four work-streams and a key output was the [BIM Learning Outcomes Framework](#). As a consequence, there has been a significant increase in the provision of formal academic qualifications, training, accreditation and research.

The subsequent [Government Construction Strategy 2016-2020](#) maintained the emphasis on developing digital and data capability in construction, although the BIM Task Group was no longer funded to support the wider adoption of BIM. The formation of the [UK BIM Alliance](#) has taken on the mantle from the BIM Task Group and there is a work-stream dedicated to upskilling the industry. The Alliance was formed in late-2016 and is in the process of consulting on its proposed plans.

The BIM Task Group instigated a community of special interest groups with the aim of raising "awareness of BIM and promoting a shared understanding of the value proposition and issues affecting the implementation of BIM" as stated in the [BIM4 Community Charter](#). Each group determines their own approach and certain groups are seen to be significantly more active e.g. [BIM4SME](#) and the [BIM Regions](#).

The BAF is the BIM4 Community special interest group representing Higher Education. Formed in 2011, BAF consists of a group of representatives from a large number of UK Universities, with the aim of creating a dynamic collaborative group to enhance and promote teaching and learning together with the research aspects of BIM, therefore serving as a conduit between industry demands and BIM education in higher education institutions.

Scotland's BIM Delivery Group is acting on Government's requirement to implement the majority of recommendations to encouraging the adoption of BIM across Scotland's public sector by April 2017. It recognises the diverse range of interests which pose significant questions for Scotland's built environment educators and training providers in developing appropriate pedagogies. Research is being undertaken to investigate the potential of the Scottish Qualifications Framework (SCQF) to act as an overarching paradigm for education/training in addressing the many challenges raised by aspirations to digitise Scotland's construction sector.

Awareness/Uptake

The government's BIM requirements and the subsequent activity of the BIM Task Group and the wider BIM community has significantly influenced the awareness and take up on BIM within the UK. This is evidenced above by the broad range of support and resources available to via the UK BIM Task Group Website, the BIM Regions and BIM4 groups such as BIM4M2 and BIM4SME. This is supported by a frequent programme of conferences run by amongst others the professional institutions and in 2016, the second [Digital Construction Week](#).

In addition, institutions and industry related journals have sections on their websites specifically focused on BIM, which together with the plethora of BIM-specific resources such as [BIM Plus](#), support the growing awareness of BIM within the UK.

The proposed programme of the UK BIM Alliance includes a work-stream focused on Awareness and being the champion for BIM Level 2.

The [Government Construction Strategy 2016-2020](#) indicates that progress has been made in "developing digital capability in design and construction, with all departments on target to procure assets using Building Information Modelling (BIM) Level 2 by 2016". The

strategic objective within this strategy is "increasing BIM Level 2 maturity across government will enable departments to gradually move to BIM Level 3, which would support a fully integrated and collaborative process" (point 25). Further guidance is set out in [BIM-Level2.org](#).

The Government in conjunction with industry will develop the next generation of digital standards to enable BIM Level 3 adoption under the remit of the [Digital Built Britain Strategy](#).

UNITED STATES

Education/Training

30 Universities in the USA are accredited to provide undergraduate programs in all three of the AEC disciplines and all of which offer some 'BIM courses' as part of the syllabus. However, none are yet fully collaborative courses across all three AEC disciplines.

The Associated General Contractors of America (AGC) has developed - in conjunction with leading BIM practitioners, technology firms and educators - a BIM Education Program designed to prepare construction professionals at all experience levels to successfully implement BIM on a construction project.

The program comprises the following four units:

- [Unit 1 | An Introduction to Building Information Modeling - Revised Edition](#)
- [Unit 2 | BIM Technology-Revised Edition](#)
- [Unit 3 | BIM Contract Negotiation and Risk Allocation](#)
- [Unit 4 | BIM Process, Adoption, and Integration](#)

The highly interactive program provides 32-hours of instruction and training to get construction industry professionals at all levels ready to take advantage of the benefits of BIM. After participants complete all four units in the program they become eligible to sit for an exam to earn the [Certificate of Management—Building Information Modeling \(CM-BIM\)](#).

The AGC certificate is an assessment-based certificate credential that denotes knowledge and understanding of concepts related to BIM adoption, practice and process transformation outlined in the AGC BIM Education Program.

Successful candidates will carry the CM-BIM designation.

Awareness/Uptake

Research published by McGraw-Hill Construction (now Dodge Data & Analytics) in 2012 showed a rapid increase of BIM usage by architects, engineers, contractors and clients in North America. The percentage of companies using BIM was recorded at 71%, a jump from the 49% recorded in 2009 and the 28% recorded in 2007.

The latest SmartMarket Report by Dodge Data & Analytics was published in 2015, titled *Measuring the Impact of BIM on Complex Buildings*. This report indicates that 40% of owners report an accelerated project completion due to the use of BIM. 41% of contractors report that BIM reduced final construction cost by at least 5% and the 67% of contractors report improved productivity by using BIM.

The full results of the 2012 research were published in *The Business Value of BIM* in the North America SmartMarket Report published in November 2012.

CONCLUSION

As reported in previous years it is clear from the responses received that BIM education and BIM awareness/uptake is still at different levels of implementation across the globe.

The level of BIM education being provided by higher education institutions is progressing and is being developed further each year, with more courses being provided by Universities and technical colleges. Most countries are now reporting that some form BIM education is being provided by their higher education institutions.

Many institutions are providing BIM education on both an undergraduate and postgraduate level, with countries such as Australia, Singapore, Sweden, the UK and the USA reporting a significant volume of courses and subjects available. Many vocational education institutions are also providing BIM education to the industry's workforce.

Whilst the majority of BIM education being provided tends to focus on the use of particular BIM software packages. It can certainly be observed that training for both graduates and professionals in openBIM concepts, BIM management and working in collaborative BIM environments, appears to be increasing but still has a long way to go in most countries.

Countries including Australia, Hong Kong, Norway, Singapore, Sweden, the UK and the US have reported training and education being available in these topics.

BIM awareness and BIM uptake appear to still be on the rise. However, this is not strictly a consistent global trend, with BIM being widely adopted, and even required by government, in some countries, whilst still only being considered in others.

A trend towards training and accreditation/certification programmes to validate the BIM experience/education of professionals in industry is also being observed with countries such as Australia, Canada, New Zealand, the UK and the US all having or developing accreditation/certification programmes of one type or another. Registers of BIM competency are also starting to appear, with countries such as South Africa commencing such initiatives.

It is clear that BIM education is moving in the right direction, spearheaded by progressive higher education institutions and educators. Liaison between education providers and industry is also improving, to coordinate the training provided with the needs of industry, the aim being to provide a graduate workforce with the collaborative BIM skills required for the future industry of which they will be part.