



International  
Specialised  
Skills  
Institute



Department of  
Education & Training

# SHOULD BIM BE REGULATED IN AUSTRALIA?

An International Specialised Skills Institute Fellowship.

**ANAGHA KARANDIKAR**

Sponsored by The Higher Education and Skills Group

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# 1. Acknowledgements

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The Fellow would like to thank the following individuals and organisations who generously gave their time and their expertise to assist, advise and guide her throughout this Fellowship program.

## Awarding Body – International Specialised Skills Institute (ISS Institute)

The ISS Institute plays a pivotal role in creating value and opportunity, encouraging new thinking and early adoption of ideas and practice by investing in individuals.

The overarching aim of the ISS Institute is to support the development of a “Smarter Australia”. The Institute does this via the provision of Fellowships that provide the opportunity for Australians to undertake international skills development and applied research that will have a positive impact on Australian industry and the broader community.

The International Specialised Skills Institute was founded 28 years ago, by Sir James Gobbo AC, CVO, QC, and former Governor of Victoria, who had a vision of building a community of industry specialists who would lead the up-skilling of the Australian workforce. The Fellowship Program builds shared learning, leadership and innovation across the broad range of industry sectors worked with. Fellows are supported to disseminate learning's and ideas, facilitate change and advocate for best practice through the sharing of their Fellowship learning's with peers, colleagues, government, industry and community.

Since its establishment 28 years ago, ISS Institute has supported over 450 Fellows to undertake research across a wide range of sectors which in turn has

led to positive change, the adoption of best practice approaches and new ways of working in Australia.

The Fellowship Programs are led by investment partners and designed in a manner which ensures that the needs and goals desired by the partners are achieved. ISS Institute works closely to develop a Fellowship Program that meets key industry priorities, thus ensuring that the investment made will have lasting impact.

For further information on ISS Institute Fellows, refer to [www.issinstitute.org.au](http://www.issinstitute.org.au)

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## Fellowship Sponsor - The Higher Education and Skills Group

The Victorian Government, through the Higher Education and Skills Group (HESG) of the Department of Education and Training, is responsible for the administration and coordination of programs for the provision of training and further education, adult education and employment services in Victoria and is a valued sponsor of the ISS Institute. The Fellow would like to thank them for providing funding for this Fellowship.

## Employer Support

Swinburne University of Technology has generously supported this Fellowship by providing time to travel to undertake the Fellowship and additional mentoring as required. Anagha Karandikar particularly acknowledges:

- » Geoffrey Hoare      Director, Graph Design Pty Ltd.
- » Joan Whelan        Project Manager, Business Skills Viability
- » Terry McEvoy       Director, Department of Trades and Engineering Technology, Swinburne University
- » Ron Bronson        Manager, Advanced Construction Technology, Swinburne University
- » Joel Martin         Strategic Project Manager, Department of Trades and Engineering Technology, Swinburne University
- » Jane Clancy         Senior Educator, Advanced Construction Technology, Swinburne University

## Personal Acknowledgement

Anagha Karandikar would also like to thank the following:

- » Rebecca De Cicco      Director, Digital Node, Australia
- » Simon Vaux            Director, Digital Engineering, TfNSW, Australia
- » David Philp            Director of BIM, AECOM, UK
- » Jaimie Johnston        Global Partner, Bryden Wood, UK
- » Andrew De Silva aka 'Das'   Director, David Miller Architects, UK
- » Alexandra Bolton       Deputy Director, Cambridge University's Centre for Digital Built Britain, UK
- » Amelia Burnett         Head of Engagement, Cambridge University's Centre for Digital Built Britain, UK
- » Dr. Homeira Shayesteh    Senior Lecturer, Construction Architecture and BIM at Middlesex University, UK

Lastly, my family for being patient and supportive throughout my travel and research.

## 2. Executive Summary

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Building Information Modelling or BIM as it is widely referred, is a collaborative process involving all consultants working on a 'live' model from the very beginning of a construction project. This process is underpinned by digital technologies which aid in design, procurement and construction, as well as maintenance of the asset (an asset refers to the building as well as its architectural, engineering and construction digital information).

BIM is facilitating collaborative architecture, engineering and construction (AEC) projects on a global platform and stimulating the global economy, sharing in many opportunities and challenges for stakeholders. Increasingly, project teams consist of consultants from around the world as firms strive to win project accounts, and gather resources, alongside global competitors.

Australia is falling behind the world standard in the global and industry wide goal to effectively implement BIM. Whilst the Australian AEC industry has access to technology, and can communicate effectively between sectors, countries such as the UK, USA and Singapore are implementing contemporary models such as BIM and reaping the benefits. One of the major benefits includes Return on Investment ROI – due to a collaborative and holistic approach, there are opportunities for long term ROI. Other benefits include retaining and exploiting information or 'project knowledge' gained during a construction project before it has an opportunity to be undervalued or lost, reduced errors and omissions, reducing re-work as well as offering new services to clients such as walkthrough and flythrough.<sup>1</sup>

Around the globe, many countries have established industry standards and regulations surrounding BIM implementation, and invested in BIM education whilst Australia continues 'dipping our toe in the water' of the available technological solutions at our disposal. The benefits of BIM are well known throughout the industry, Australia remains unable to enjoy the positive impact of BIM investment that these countries enjoy. The Australian AEC industry needs to examine international BIM models in order to identify effective strategies for its implementation. BIM can reward all stakeholders involved in the lifecycle of a building or of an infrastructure project. Australia must decide if BIM should be mandated on all infrastructure projects or projects over a certain dollar value.

This report summarizes the extensive research conducted on the impact of mandating BIM for projects undertaken by The Fellow, Anagha Karandikar. As part of the fellowship granted by ISS Institute and sponsored by the Department of Training and Education, the Fellow travelled to the UK and Denmark in 2018.

The Fellow spent three weeks in the UK meeting a cross section of experts from large and small architectural firms, educational institutions including Cambridge and Middlesex universities, as well as meeting with one of the BIM task group founders, David Philp. This gave the Fellow the opportunity to develop her understanding of the industry-wide effect of mandating BIM, how different sectors negotiated the transition to a mandated policy, and how existing workers were reskilled to accommodate the BIM model. This gave the Fellow greater insight

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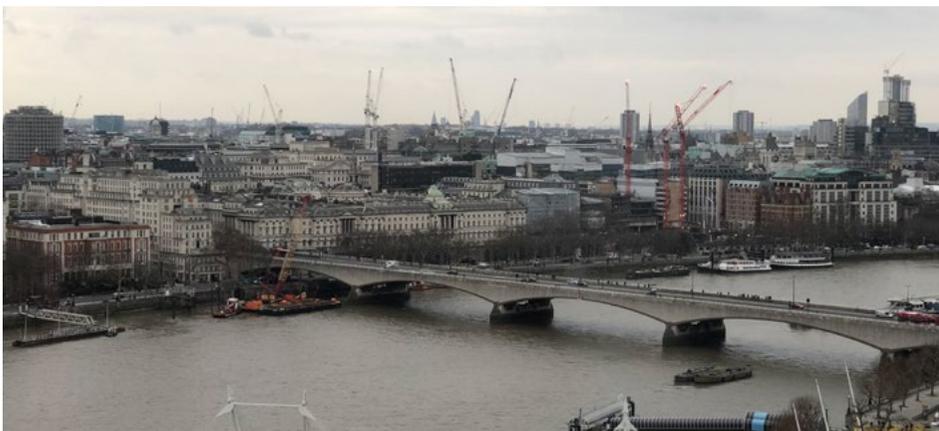
<sup>1</sup> Conference: The 9th International Conference on Construction in the 21st Century (CITC-9) Revolutionizing the Architecture, Engineering and Construction Industry through Leadership, Collaboration and Technology, Dubai, United Arab Emirates. March 5th-7th, 2017.

into how Australia might manage our existing task force in order to regulate and manage BIM driven projects, and to ensure the survival of smaller Australian firms. The Fellow also travelled to Denmark to gain understanding of how BIM implementation has encouraged development in Danish construction industries.

The Fellow spent time prior to travel connecting with Australian experts to develop her knowledge of the local drivers for mandating BIM, and any potential barriers that may hinder its success. Although the meetings with local and international experts concluded that BIM cannot be mandated in Australia due to the disjointed nature of the Australian Government, BIM can be made compulsory in all government infrastructure projects.

Upon her return, the Fellow disseminated her learnings to department heads at Swinburne University and provided evidence for the need to develop an accredited BIM course. This request was considered, and a current Associate Degree in BIM is now in development with an approximate launch date set for early 2020 involving a pilot program of 25 students. The Fellow also met with the Associate Director of the Victorian TAFE Association - Andrew Williamson to discuss her research and findings.

*Status of construction works in London February 2018*



*London Skyline February 2018*

# 3. Fellowship Background

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## Objectives

The objectives of the Fellowship were to glean knowledge from countries that have mandated the BIM structure, how they prepared for this new process through the skills development of their existing workforce, and how this may translate into the Australian VET curriculum.

- a. To identify how the UK managed the transition to a BIM regulatory environment (demand driven)
- b. Determine how they enhanced the skills of their workforce (BIM supply side) – existing as well as fresh graduates
- c. Investigate their current building and construction qualifications that were upgraded to include BIM
- d. Making recommendations to industry and the Australian Government on how to strengthen the return on BIM investment.

## Methodology

The Fellow conducted meetings and interviews with Australian experts on their opinion and vision surrounding the proposed adoption of a BIM mandate. Based on these findings, the Fellow then interviewed international industry experts, predominantly in the UK, targeting questions toward key areas such as education and professional training, how informal task groups were established that then

drove BIM implementation and mandate in the UK, and how individuals across all AEC sectors were affected by this mandate.

## Period

The fellowship was conducted throughout the year and the travel was undertaken in the month of February 2018.

## About the Fellow

Anagha Karandikar is a qualified Architect, a registered Building Designer (BDAV), a registered Building Practitioner (VBA) and a certified BIM Manager.

Anagha completed her Bachelor of Architecture from Mumbai University in India. Upon migrating to Australia, she has worked in Architectural practices and has extensive knowledge in the design and execution of small to medium scale projects including residential housing, mixed use development, student accommodation and retail outlets. During this time, she noted that although proficient in design software, many new graduates lacked a basic understanding of the subject matter. Hence, she decided to pursue a career in teaching and is currently associated with Swinburne University's Advanced Construction Technology department, teaching the new generation of building designers. The Fellow's passion for education led her to the BIM structure that she studied further, following the journey toward a mandated BIM in the UK, she then decided to research and investigate how she could aid in the development of an accredited BIM qualification here in Australia.

## Abbreviations/Acronyms/Definitions

<b>AECOM</b>	Architecture, Engineering, Consulting, Operations, and Maintenance
<b>BDAV</b>	Building Designers Association of Victoria
<b>BIM</b>	Building Information Modelling.
<b>BSI</b>	British Standards Institution
<b>DBB</b>	Digital Built Britain
<b>IES</b>	Integrated Environmental Strategy
<b>ISO</b>	International Organisation for Standardisation
<b>PAS</b>	Publicly Available Specifications
<b>TfNSW</b>	Transport for New South Wales
<b>VBA</b>	Victorian Building Authority

## 4. Fellowship Learnings

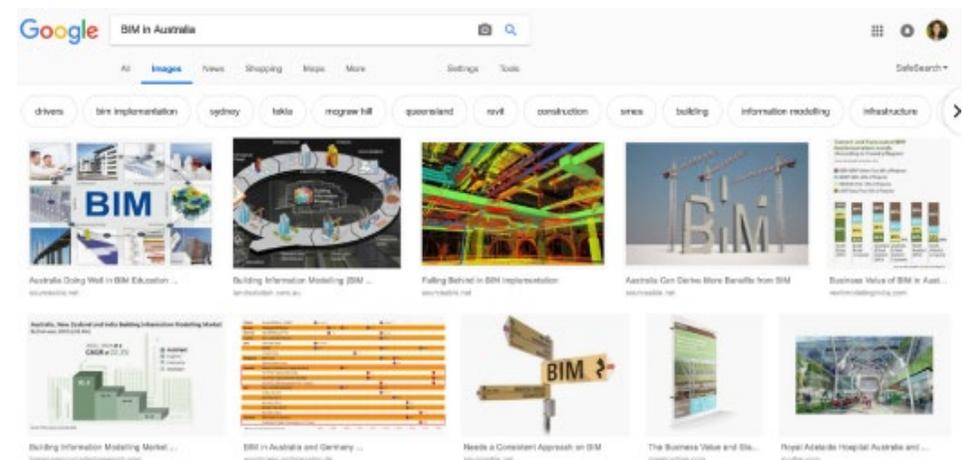
### Australian Context

Australia is a cosmopolitan country with varied AEC related firms and offices, both large and small, employing consultants from across the globe. This globalization has been a boon for connecting people, making expert consultation readily available, and creating collaborative work environments. However, due to the disparate nature of languages and process' amongst the international BIM fraternity, much confusion can result. The reason being that the UK, US, Europe, and Asia all practice BIM application in different ways to suit their particular requirements. Further confusion arises for Australian BIM advocates returning from overseas where they have trained using the BIM structure. Each brings their respective BIM learnings and attempts to implement them here. Given that Australia doesn't have its own methodology of BIM practice, these varying perspectives have created confusion across the industry.<sup>2</sup>

BIM terminology has also created confusion. Certain terms may differ in meaning, multiple meanings may be applied to others depending on their geographic location.<sup>3</sup>

It is the Fellow's belief that the Australian construction industry is closely aligned with that of the UK, and it should be an obvious decision to follow in their footsteps when implementing and regulating BIM education and practice. However, some political and cultural barriers exist: Political barriers refer to the fragmented political setup of our country where every state has their own set of construction codes/

standards/rules rather than a federal set up. Cultural barriers refer to old school processes and mentalities.



*The above images from an internet search for 'BIM in Australia' reveal the inconsistent nature of the definition of BIM across the Australian AEC industry (Ref: Google images, 2018).*

2 Aecmag, "BIM Skills & Training – Creating Consistency."

3 Aecmag, "BIM in Australia – Are We There Yet?"

## Interviews

### Study 1:

Rebecca De Cicco is the director of Digital Node, an Australian and UK BIM consultancy firm and the founder of Women in BIM, an organization that promotes collaboration between women in key roles across the AEC industry.<sup>4</sup> With her vast experience in the UK’s BIM mandate application, De Cicco is considered to be the ‘go-to’ person for BIM promotion.

Based in the UK, De Cicco returned to Australia to focus on promoting and implementing BIM, opening Digital Node offices in South Australia. After comparing the implementation of the BIM model in the UK to current Australian collaborative approaches.

De Cicco observed that the Australian AEC industry lacks in technology usage and standardization. She believes that state departments are acting competitively rather than working in collaboration to bring about industry-wide benefits. State governments should work towards improvising and encouraging on collaboration and standardization – by establishing best practice exemplars, creating BIM procedures/processes, setting up methods for cost reduction in projects, preparing resources for companies – BIM libraries, etc. She is tirelessly working towards pursuing her dream of BIM implementation, with a view to placing the Australian AEC industry in the global technological arena.

Having experienced the UK BIM mandate, De Cicco offered two important pieces of advice: BIM education should focus on process rather than technology. Our skill gap predominantly lies in how BIM is seen and perceived, despite BIM awareness. The Australian industry must adjust training methods to address the skill gaps, and establish a consistent approach towards achieving training goals so that we can provide support to other nations with our skilled workforce.

### Study 2:

Simon Vaux is the director for Digital Engineering for the department of Transport for New South Wales (TfNSW) and is the Chair for the National Digital Engineering Working Group. This group is the first of its kind in Australia, they are now considered essential in design and construction projects, enhancing BIM skills and knowledge. Simon is actively involved in all current projects that the TfNSW is undertaking. Upon interviewing Vaux, it became clear he has a strong belief in the 3 Phases diagram below.



*BIM knowledge and skills framework for Australian AEC Industry*

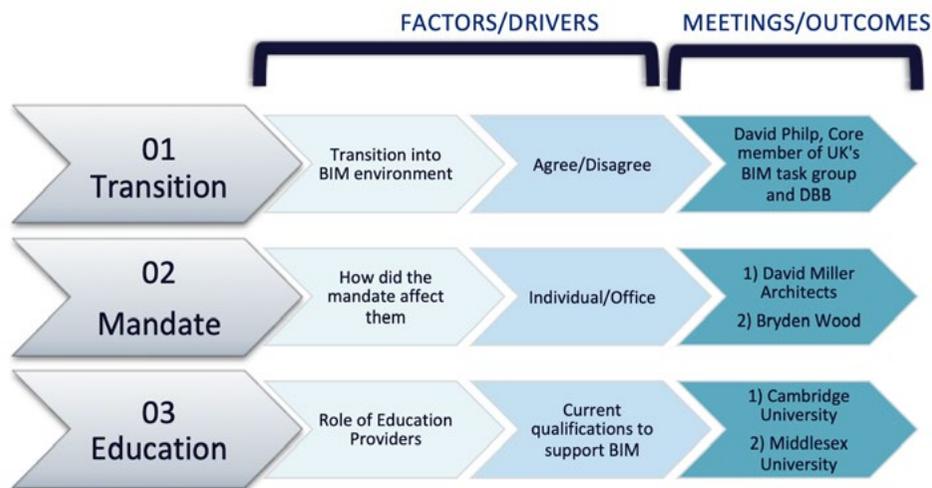
Vaux suggests that this 3 phases diagram can offer a BIM knowledge and skills framework as the current Australian AEC industry operates with these phases blurred. Vaux believes that people are not aware of their strengths or weaknesses and are unwilling to work on them. He suggests that these three phases be an integral part of any BIM qualification, allowing graduates to identify their skills and preferences, and specialize accordingly.

The Fellow believes that the 3 phase structure is an excellent starting point for

educational institutions like Swinburne University to develop curriculum that integrates and addresses a broad spectrum of BIM needs and requirements. Across various levels, the phases can be broken down for different stakeholders/ areas based on their function for eg: educating students about strategic skills, operational skills as well as technical skills during the course of their studies along with other required tools. This also gives students an opportunity to be exposed to a variety of these skills and their preference rather than be unaware and compelled to work on something they've not been prepared for.

## The UK Experience

The Fellow's trip to the UK was centered around the following factors:



### 01. Transition:

David Philp is the Director of BIM at Architecture, Engineering, Consulting, Operations, and Maintenance (AECOM), the head of BIM implementation for the Scottish Government,<sup>5</sup> and a member of Cambridge University's Centre for Digital Build Britain. He was a valuable member of the BIM task group as well as the BIM industry working group. The Fellows Interview with him gave her a great insight into how the government transitioned local firms into the BIM environment.

After the release of the British Government's Construction Strategy in 2011, BIM task groups were established across the nation. The strategy brought architects, designers, the public sector, government officials and academia together to assist in unlocking efficient and collaborative asset management strategies.

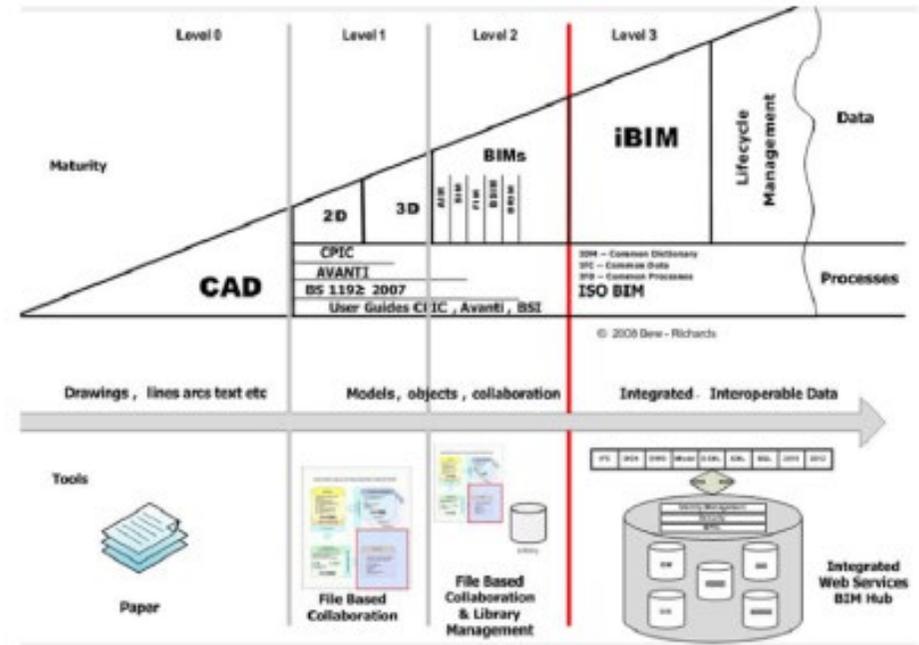
These task groups provided technological support and brought about behavioral change in British construction firms and the individuals working within them. Eighteen regional hubs were established, with champions for BIM in each task group.

The BIM industry working group was created by the cabinet office to monitor and observe the construction and post occupancy (asset management) benefits for the British building and infrastructure markets. The champions from each BIM task group, would provide feedback and recommendations to the industry working group, thus creating a robust implementation.

The first project introduced by the Ministry of Justice was the Level 2 Mandate in April 2016. This level 2 mandate was implemented in its stipulated time frame. A Level 2 mandate refers to a "federated" model which is a mandatory requirement for all government projects.

The British government has added value to the Level 2 mandate by injecting 10 tests of success. Some of these tests include open BIM (firms may use the software of their choice), plain language questions (using uncomplicated terms), soft landing (strategies designed for a smooth transition from construction to occupation phase of the project), security of assets (cyber security of digital information), BIM task groups, BIM working groups etc. The refurbishment of the Manchester Library was an introductory BIM structured project that kept the asset lifecycle in mind, thus facilities management was considered an integral part of BIM training. The Fellow believes that integrating the industry within the introduction of BIM was an excellent strategy, integral to the mandate's success.

expectations across the different stakeholders, this diagram helps the supply chain identify its deliverables, the client to identify what the supply chain's offering.



**“The biggest danger is that we get bogged down in a technical discussion, when BIM is a behavioural change programme more than anything else”**

David Philp – Head of BIM Implementation Cabinet Office



Cabinet Office BIS | Department for Business Innovation & Skills

Ref: David Philp, presentation at BIM and the 'ologies breakfast workshop in 2014

One vital part of the UK mandate was to establish a BIM maturity level (defining level 2 BIM) which implies that the model should be “federated” (include 3D as well as data). As shown in the diagram below (BIM Maturity Model or the Wedge), which forms a part of UK's document standards and acts as a tool in communicating

Top: The UK's BIM Maturity Model or sometimes also referred to as the Wedge as developed by Mark Bew and Mervyn Richards.



Left: Level 2 BIM model example; Image ref: <https://bim-level2.org/>

## 02. Mandate:

### Study 01: David Miller Architects:

David Miller Architects is a small architectural practice with offices in London and Liverpool. The Fellow visited their London office, and had had the privilege to meet and interview one of the Director's, Andrew De Silva also referred to as Das. The fellow also briefly met Practice Director and wife of Architect David Miller, Fiona Clarke. Given that they were undergoing their International Standards Organization (ISO) audit during that time, David and Fiona were extremely busy.

David Miller Architects undertake many projects around Westminster. They used Dynamo and AutoCAD software for all their documentation prior to 2007. They believed that Revit (BIM specific software) was used for quality purposes and for 'live' projects where all consultants could work on the same model remotely.

From 2007-2010 the firm went through a challenging time making the transition to Revit. For the first year, their turnover and overhead costs did not alter, however, through persistence and patience their business improved with turnover taking a rise. They set the goal that by 2010 every project undertaken by the firm would employ the BIM structure. Due to the costs involved, it is believed that the BIM approach is not as advantageous for smaller firms. Being a small practice dealing in residential projects at the time, David Miller Architects changed that belief by being one of the first firms to transition into BIM.

By 2013, they had implemented BIM Level 2 on all their projects. Some projects, such as the Mayfield School in London, were designed and built in as low as 17 months, taking only six weeks from concept stage to planning. The involvement from all stakeholders involved in the project added efficiency and value to the decision to implement the BIM approach.



Image ref: <https://www.david-miller.co.uk/projects.php>

While some projects like Anstey Hall Barns in Cambridge were not as straightforward, the BIM protocols were successfully used in the completion of this project.

Currently, the team of 24 young, dynamic architects are agile, focused, adaptable to changes, and enthusiastically embrace emerging technologies.

### Study 02: Bryden Wood:

Jaimie Johnston is Board Director and Head of Global Systems at design, architecture and engineering firm Bryden Wood.<sup>6</sup> He has been associated with

Bryden Wood for over twenty years. The history of the firm also dates back over 23 years, starting with three partners who shared a view of changing the industry. Bryden Wood was ahead of its time, prototyping, and simplifying manufacturing well before BIM was introduced and mandated. Prior to BIM, all their projects were data coordinated models that focused on waste reduction and laser technology.

Heathrow Airport was one of the first projects they developed, for which, due to security issues their productivity was low. However, the firm decided to manufacture materials themselves, offsite, increasing productivity. In 2004, Heathrow's Terminal 5 was their landmark project. The offsite construction, and employing a non-construction workforce to build, proved cost and time efficient. The components were constructed nearby, thus saving time and avoiding security issues around the airport. Additionally, this intelligent methodology allowed the firm to provide fully coordinated models, removing the need for specialist tradespeople, offering employment to local business.



Image ref: <https://www.brydenwood.co.uk/projects/london-heathrow-t5/s3770/>

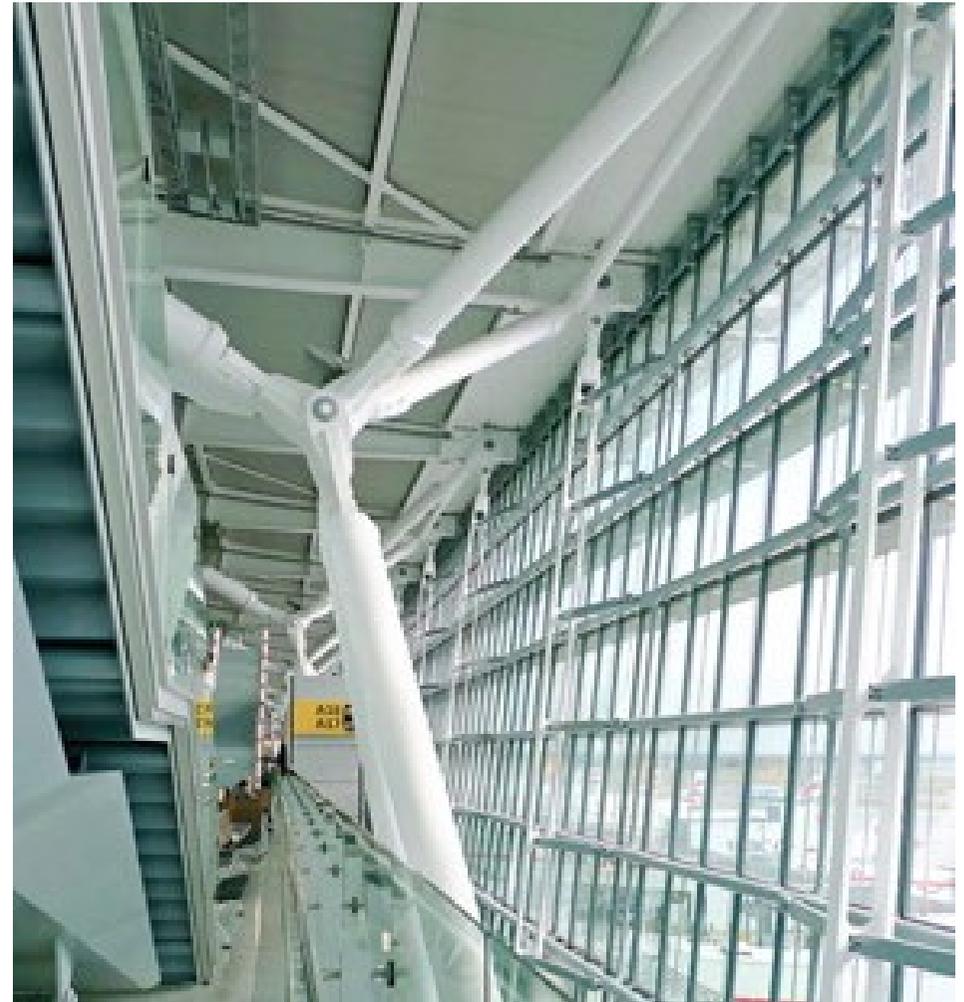


Image ref: <https://www.brydenwood.co.uk/projects/london-heathrow-t5/s3770/>

In 2008, Bryden Wood underwent a shift stepping into healthcare with designing and executing their first hospital project. The brief provided by the client for this project was extremely thorough and detailed. This helped the team to prepare

a detailed flowchart of activities prior to designing. The overall project was built 28% cheaper than the anticipated budget and was delivered 20% faster than the anticipated time frame. During the time the Fellow interviewed Johnston, the firm were working on an inmate built, prison project<sup>7</sup> that produced zero waste and was also ahead of schedule.



Image ref: <https://www.brydenwood.co.uk/projects/glaxosmithkline-betabuilding-prototype/s1317/>

Bryden Wood also allows clients and consultants to utilize their office space for collaboration across certain days of the week, bringing collaborators under the same roof during the designing and documentation stages, saving time and cost.

Bryden Wood provided the Fellow with a great demonstration of a contemporary firm using the BIM approach successfully. The Fellow would love to see Australian firms operate in this way.



Image ref: <https://www.brydenwood.co.uk/about-us/how-we-work/s2125/>

### 03. Education:

#### Study 01: Cambridge University:

The Fellow met with the Deputy Director of Cambridge University's Centre for Digital Built Britain, Alexandra Bolton. She was welcoming of the Fellow, and the Fellow was thankful for her time. The Centre was established in August 2017, with a view to provide BIM research, with the support of the Ministry of Justice. Cambridge University chose to associate with Digital Built Britain in order to create a balance, providing research and development opportunities to coincide with BIM implementation locally and internationally.

The Centre has seven core objectives related to BIM, Digital Built Britain and the Built Environment which are summarized as follows:

1. To be the center point for UK's BIM and Digital Built Britain Programs and be recognized locally and internationally

2. To liaise, maintain and amend standards/protocols relevant to Digital Built Britain
3. To be the academic hub for research and development for built environment and make an impact locally and internationally
4. To engage in any technological developments that will impact the built environment and minimize the carbon impact on built environment
5. Encourage and support academics and leaders in adopting and implementing new digital approaches
6. Encouraging design firms/AEC industry to integrate and adopt BIM into their business models for better outcomes
7. To co-ordinate and research BIM level 3 and 4 adoption



*Fellow outside Cambridge University's Maxwell Centre*

The Fellow discussed the delivery methods and software considerations for undergraduate courses in BIM as this would be the foundation of post graduate studies. Dr. Homeira's student's use a building on Middlesex University's campus for assignments. Here, students model their projects in Revit, and then transfer them to Integrated Environmental Systems for thermal simulation. This is a cost-effective software for most students. Often with BIM education in Australia, it is the software that has created a majority of confusion. The Fellow will counteract this confusion through selecting one basic software package and using 'plug-ins' (additional features) for other parts of the project, rather than transferring documents across a variety of software.

Another preferred approach taken by Dr. Homeira is to integrate environmental and architectural strategy by modelling through an Integrated Environmental Strategy (IES). Dr. Homeira creates Agile working spaces for BIM learning. Agile spaces refer to those flexible and adaptable to different needs and activities (fit for purpose). When creating a brief that has all the required information, Dr. Homeira consults industry professionals so that the students are connected with the current terminology and trends required for a professional brief presentation.

With regards to post graduate studies, BIM management's technical, operational and strategic skills are taught to students through subjects involving business processes and procurement and the process of pain share and gain share.

Students are exposed to open book contracts and documents, and change management is taught within the same project.

In terms of BIM education and delivery, Cambridge University only offers PhD courses in BIM. However, with the growing demand for BIM throughout the AEC industry, they are considering the development of post graduate BIM courses.

### **Study 02: Middlesex University:**

The Fellow met Dr. Homeira Shayesteh who is a senior lecturer in Construction Architecture and BIM. She was associated with the Level 3 Document for Digital Built Britain and is currently involved with the delivery of BIM courses to undergraduates and post graduates at Middlesex University.

## 5. Impact of Fellowship

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This Fellowship was a great personal, professional and educational experience. The things that the Fellow learnt throughout the Fellowship journey have not only helped her grow as a human being but have also helped her view the world from a completely different perspective.

On a professional level, every place the Fellow visited, every person the Fellow met, taught her something new. She found it fascinating to understand the individual journey of those she interviewed, how they've played a role within their country's AEC sector, and how they are continuing to make a difference each passing day.

The Fellow enjoyed meeting and interacting with every person. Interviewing David Philp (one of the pioneers behind BIM in the UK) was a standout experience. Although not everything can be recorded, his experiences added value to my knowledge and learning.

Jaimie Johnston – one of the few people who've inspired the Fellow with the work their office does. The Fellow was impressed by their dedication and passion. They truly care about what they're doing and, most importantly, follow a code of ethics. The Fellow recalls Johnston mentioning a client who approached them for a project, after conducting a feasibility study, they convinced the client not to go ahead with the large-scale project similar to the one they had approached Bryden Wood to currently work on. The Fellow believes that these ethics and principles make a difference in the industry, especially in today's commercially driven world, it is refreshing to know and meet passionate professionals.

David Miller and Andrew De Silva at David Miller's office made the Fellow feel warm and spent a lot of time explaining every important project in their office that has been pivotal in the BIM journey.

Amelia Burnett from Cambridge University's CDBB is the head of engagement. Every time the Fellow corresponds with her, Amelia is certain to respond within 24 hours.

It has been a really great experience for the Fellow to connect and interact with these professionals.

On a personal level, the Fellow was grateful to meet different people while travelling, connect with them, share stories and create memories. Most importantly, spend time and bond with my husband and also work as a team – he was my photographer, tour guide and carried all my paperwork around wherever we went.

## 6. Recommendations and Considerations

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Upon travelling and reviewing the status of BIM education, mandate and implementation in the United Kingdom, I see Australia in a slightly different situation. Australia may not be in a position to mandate BIM due to the constructs of our political system. However, the Fellow believes that we can anticipate to soon establish BIM standards that are consistent with ISO 19650 that the BSI have established which are consistent with Publicly Available Specifications (PAS) 1192 (Ref: <https://bim-level2.org/en/standards/>) which all BIM professionals should be familiar with.

### Industry:

The AEC Industry in Australia needs to undergo a cultural change, an approach to be BIM inspired by the UK. The Fellow believes that the Australian AEC industry are too scared to let go of traditional methods and practices of design and construction; we are too scared to let go of 2D methods of documentation because we are not willing to develop our professional understanding or upgrade our technology. Many larger firms have adopted contemporary practices but do not have the support that standardization and uniformity can provide. Many will continue to endure losses. The government is also unsure about IP and security issue of who owns the digital asset and information and how to manage that information post-handover.

Working groups such as the UK's National Digital Engineering Working Group, consisting of experts from a cross section of industry departments, should be established with government funding. These working groups should have champions and should collaborate with academia and the government to resolve overarching issues of standards and knowledge upgrades, thus preserving assets.

### Education:

Swinburne's planned Associate Degree in BIM will be a great way to provide basic BIM knowledge that is relevant and consistent across the Australian AEC industry. This will enable undergraduates to enter the industry with a holistic understanding of BIM and most importantly it will put them in a competitive position amongst graduates from other BIM driven countries like the UK and Singapore. The 2020 pilot program will begin the process of bringing Australia up to date with contemporary practices already being implemented around the world. This will also set a precedence for other universities and TAFE institutes to follow suit. Additionally, in the long term, this associate degree could serve as a pathway to a higher education of masters or PhD, thus adding further value.

With regards to training existing workers across the AEC industry, it is the Fellow's belief that a new generation of staff will be confident BIM practitioners, with enough knowledge and motivation to drive cultural change, and inspire existing staff to upgrade their skills and knowledge. The Fellow believes that it is more important to bring about a long overdue cultural change in the Australian AEC industry.

University of Canberra currently offers Building Information Modelling (10144.2) [https://www.canberra.edu.au/coursesandunits/unit?unit\\_cd=10144](https://www.canberra.edu.au/coursesandunits/unit?unit_cd=10144)

However, this degree has a pre-requisite of Bachelor of Building and Construction Management and Digital Environment. The Swinburne course does not have any pre-requisites at this stage. It is planned to be open for all and cater to a wider range of candidates willing to learn and explore their potential/skills with BIM. This qualification will also be open for candidates within the industry who would like to

build on their existing knowledge and skills. It is deemed to be an AQF level 6 with more hands-on experience integrating authentic project examples.

## Government:

The Victorian Government has recently adopted a BIM initiative for their rail infrastructure projects. This has been a good start. However, while these infrastructure projects were established without clear understanding and guidelines, a gap remains in their execution. While the necessary trial and error takes place implementing BIM across these projects, there is much improvisation that can exhaust resources. The Fellow recommends that the government support and work closely in establishing Swinburne's Associate Degree in BIM course. This will enable Swinburne to understand the government's requirements for infrastructure projects and integrate those needs into their course materials. This will also ensure the future AEC workforce are adequately trained in 21st Century methods. It is the Fellow's hope that through further research and development, the government may eventually subsidize this course to promote a skilled workforce that are prepared to meet future challenges.

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**ISS Institute**  
Level 1, 189 Faraday Street  
Carlton VIC 3053

**T** 03 9347 4583  
**E** [info@issinstitute.org.au](mailto:info@issinstitute.org.au)  
**W** [www.issinstitute.org.au](http://www.issinstitute.org.au)

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