CitA
Construction IT Alliance

Building Information Modelling **in Ireland 2019**

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Building
Information
Modelling
in Ireland
2019

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Professor Roger West
Roger is an Associate Professor in the Department of Civil, Structural and Environmental Engineering at Trinity College Dublin. Roger sits on the Irish Concrete Consultative Committee (National Standards Authority of Ireland) and is Chairman to the Irish Concrete Society Durability Committee. Roger is a Chartered Engineer and a Fellow of Trinity College Dublin. He is a former Head of Department and is currently Director of the Structural Laboratories. His main research interests are concrete technology, construction innovation and structural mechanics. He has pubished widely on IT in construction.

Pictured from left to right:
Dr. Alan Hore
Dr. Barry McAuley
Professor Roger West

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Executive Summary

Grangegorman Academic Hub
O'Donnell & Tuomey

Harcourt Square:
Henry J Lyons Architects

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Executive Summary

The BIM in Ireland research team are delighted to provide an update on the state of Building Information Modelling (BIM) in Ireland in 2019. The report demonstrates the interest that BIM has gained in Ireland in recent years and the remarkable progress that Ireland's construction industry has made in BIM.

Understanding the process of using BIM is critically important for the Irish construction industry. BIM provides the opportunity for all stakeholders to achieve better project outcomes by using data that is fully coordinated by working with predominately 3D models instead of 2D drawings.

The report provides an upbeat assessment of the outlook for the industry in the medium to short term despite the well-publicised challenges of labour shortages, a crisis in housing supply and the liklihood of a no-deal Brexi looming.

The inclusion of BIM in the remit of the Construction Sector Group demonstrates that the Irish government recognises the importance of BIM for the sector and sees the benefit of how it brings together technology, process improvements and digital information to radically improve project outcomes and asset operations.

The momentum of the UK digital construction programme is unrelenting and continues to have an impact throughout the world, and its influence on Ireland cannot be underestimated. The authors selected Estonia in 2019 as an exemplar of a country which is currently successfully developing their digital construction support programme.

Despite the fact that the Irish government has not yet resourced and funded a strategic digital construction programme, the report documents significant momentum by a suite of stakeholders, eg. CitA, NSAI, Dublin City Council, NDFA, CIF, HEIs, etc.

It is clear from the surveys facilitated by CitA that the larger tier 1 contractors and design companies are routinely working with BIM technologies and processes in 2019. We are delighted that the Head of Digital Construction Estonian at the Ministry of Economics Affairs and Communication will be providing a keynote address at the CitA BIM Gathering conference in Galway and that we were in a position to include an update on the Estonian government's initiatives in respect to the use of digital in construction.

It is evident in this report that progress has been made with the diffusion of BIM in Ireland and that the Government's digital construction programme is gaining momentum with the current well-publicised plans for a new Centre of Excellence with a remit for digital construction.

This report will demonstrate that Ireland's construction industry is as mature as any country in the developed world when it comes to BIM proficiency and diffusion.

It is, however, disappointing that, despite the fact that the National BIM Council published its Roadmap in late 2017, no funded resources have yet been put in place to implement the vision of the Council.

Dr. Alan V Hore,
TU Dublin and CitA

> "Building information modelling (BIM) is about getting benefit through better specification and delivery of just the right amount of information concerning the design, construction, and management of buildings and infrastructure, using appropriate technology tools. The standard is about good practice throughout the whole project and asset management team. It applies throughout the whole life cycle of an asset, including construction, refurbishment, operation, decommissioning, and it applies to all types of asset in the built environment – buildings, infrastructure, and the systems and components within them"[1]

[1] UK BIM Alliance, (2019), Information Management According to BS EN ISO 19650, Guidance Part 1: Concepts published by UK BIM Alliance, Centre of Digital Built Britain and BSI.

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Irish Construction Prospects
Challenges Facings the Irish AEC Sector
Government Response
Construction Sector Group
The Digital Agenda in Irish Construction

Context and Challenges

Selection of BIM Projects:
OBFA Architects

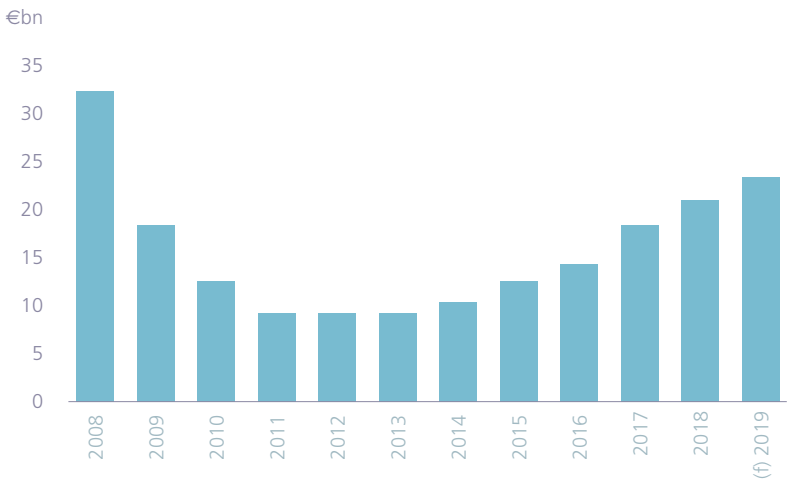
Irish Construction Prospects

The Construction Industry Federation (CIF) reported a 20 % increase in investment in construction during 2018, with €26 billion expended during the year. Housing investment alone has increased by 24 % in 2018[2]. The Construction Information Service (CIS) further reports that there was a 9% increase in planning applications during this period[3].

To mitigate Brexit's impact on UK activity, many Irish contractors have looked to mainland Europe, the UAE and the USA to develop and grow markets. This resulted in €2.5 billion from exported construction services in 2018, up more than 54% from 2017. This has resulted in the combined turnover for Ireland's top 50 construction contractors increasing by 25% to €8.39 billion from 2018[4].

The Central Statistics Office Labour Force Survey also shows that direct employment in construction which stood at 144,000 in Q4 2018, has had an increase of 22,900 in just two years[5].

Figure 1:
Value of construction output 2008 - 2019



Ireland Handbook, Knowledge Centre, Linesight, pp. 17.

Even though the vast majority of activity is concentrated in the Dublin region, the Irish Construction Sector continues to see a revival, with the sector's expected output to rise to between €22.5 and €23.5 billion in 2019[6].

> "The steady rise in construction prices, which has occurred in line with the recovery in output, means that this year, prices will be back to where they were at the peak of the boom."
>
> Derry Scully,
> Group President, Linesight
> Ireland Handbook 2019

[2] Construction Industry Federation (2019), An Examination of Productivity in the Irish Construction Industry, CIF Economic & Policy Research 2019.
[3] CIS (2018) CIS Q4 2018 construction activity report, CIS.
[4] Irish Building Magazine (2019), Leaders in Construction, Irish Building Magazine, Iss 2, pp15-85.
[5] CSO (2019) Central Statistics Office Labour Force Survey Q1 2019, CSO.
[6] Linesight (2019) Ireland Handbook, Knowledge Centre, Linesight.

> To overcome the skills gap in the immediate term, the industry will source foreign labour to meet demand. In the medium term, it is imperative that the education and training system produce more suitable graduates to ensure we retain the talent, experience and the IP produced in the construction industry over the next decade."

Tom Parlon,
Director General of the CIF.
Opening Statement on priorities for Budget 2019

> Engineers are in high demand and skills shortages have the potential to undermine the delivery of housing and other engineering-led solutions. We must therefore innovate to increase the capacity and productivity of our sector and collaborate to promote the rewarding careers engineering has to offer."

Caroline Spillane,
Director General of Engineers Ireland, The State of Ireland 2019.

Even with growth moderating after 2020, the Department of Finance has predicted investment in the sector will increase to €41 billion by 2023. These figures may yet prove to be conservative given that the Irish government has launched its €116bn Project Ireland 2040 initiative, with €2 billion allocated for urban regeneration and €1 billion allocated for rural regeneration, as well as a call for the analysis of existing retrofit actions[7]. All in all the prospects are good in the medium term for the overall sector.

Challenges facing the Irish AEC Sector

Despite Ireland's continued surge in construction output, the availability of people with the right skills, climate change, and the risks arising from Brexit remain the key challenges going forward towards 2020[8].

The SCSI/PwC Construction Market Monitor 2019 report outlines that attracting and retaining vital talent is the single key constraint hampering growth in the Irish construction sector. The survey highlights widespread skills shortages, with over 80% of survey respondents reporting shortages of plumbers, carpenters, bricklayers, and quantity surveyors. Over 60% of the respondents cannot secure sufficient numbers of electricians and civil engineers, despite attempts to source labour from abroad. Commentators agreed that a sustainable solution to bridge the skills gap has yet to be found[9/10]. The skills shortage is further challenged through ongoing diversification issues with minimal numbers of females training in apprenticeship schemes[11] .

The CIF reports that the cost of construction rose by 7.7% in 2018 and is forecast to rise by 6.5% in 2019. The CIF report indicates that these increases are being caused by the high demand for construction services, skill shortages in the sector, and wage increases. Increasing tender levels pose another pertinent concern domestically, as construction inflation levels run well ahead of general inflation rates, driving the price of construction projects significantly upwards. *The joint CIF/ PwC Report on Brexit and the Irish Construction Industry* warns that, as Brexit looms, the potential risks to the Irish economy are unknown. The negative impacts on Irish construction companies may have a multiplier effect on the Irish economy and society. Delays to infrastructure delivery, housing and the specialist

[7] Government of Ireland, (2019), Project Ireland 2040, Build Construction Sector Performance and Prospects 2019.
[8] AECOM (2018) Taking The Long View: Ireland Annual Review 2019, Aecom.
[9] SCSI/PwC (2019 Construction Market Monitor 2019, SCSI/PwC.
[10] Murphy, R, (2018), Employment Opportunities and Future Skills Requirement for Surveying Professions 2018-2021, June 2018.
[11] Solas, (2018), Review of pathways to participation in apprenticeship, November 2018.

construction that attracts and retains multinational FDI could all threaten Irish economic growth post-Brexit[12].

Despite the current uplift in home building, housing shortages persist around the country and particularly in Dublin. *The Engineers Ireland State of Ireland 2019 Report* focused on Ireland's housing sector which was allocated a 'D' grade – highlighting the engineering expert view that the capacity, condition and connectivity of Irish housing is of grave concern and requires immediate action. The report also found that 52% of professional engineers surveyed believe Ireland's overall infrastructure is not in good condition and does not have the capacity for future development. The report included a clear reference to the vital contribution that Modern Methods of Construction (MMC) including BIM, can play in expediting the delivery of housing provision in Ireland[13].

Government Response

The Government has responded to industry concerns most recently by stimulating the sector through its *Project 2040 and Climate Action Plan initiatives.*

The Project 2040 initiative is the Irish government's long-term overarching strategy to make Ireland a better country for all of its people[14/15]. The National Development Plan detailed within Project Ireland 2040 changes how investment is made in public infrastructure in Ireland, moving away from the approach of the past, which saw public investment spread too thinly and investment decisions that did not align with a well-thought-out and defined strategy.

The Climate Action Plan 2019 will support the ambition emerging within the European Union to achieve a net-zero target by 2050, with the plan presenting in detail the changes required to adopt such a goal in Ireland. These two initiatives will serve as the cornerstone of Ireland's future investments[16].

The continued growth of the digital economy is detailed within the Action Plan for Jobs 2018 in which there was a key theme that digital technologies are becoming increasingly disruptive and pervasive, in particular, robotics and artificial intelligence (AI); internet of things (IoT); augmented/virtual reality; blockchain; autonomous mobility; and digital fabrication. For the government, this presents both opportunities and challenges in key policy areas such as employment,

> "The built environment accounted for 12.7% of Ireland's greenhouse gases in 2017. It is important that we improve the energy efficiency of our buildings, including our homes, workplaces and schools, by meeting higher energy performance standards and by increasing retrofit activity. This will not only reduce Ireland's dependence on fossil fuels, but will also improve our living standards by making our buildings more comfortable, healthier, safer, and less costly to heat."
>
> Climate Action Plan:
> To Tackle Climate Breakdown (2019)
> pp. 74

[12] CIF/PwC (2019) Brexit and the Irish Construction Sector, CIF/PwC.
[13] Engineers Ireland (2019) State of Ireland 2019, Engineers Ireland.
[14] Government of Ireland (2018), Project Ireland 2040, Building Ireland's Future.
[15] Government of Ireland (2018), Project Ireland 2040, National Development Plan 2018-2027.
[16] Government of Ireland (2019) Climate Action Plan 2019 To Tackle Climate Breakdown, Government of Ireland.

Government Response (continued)

> "Digital transformation is a key component to business success. For a business to succeed it needs to constantly evolve, adding new products or services to respond to changes in the market. The adoption of technology allows businesses to do this and to perform core processes faster with a higher quality and a lower cost."
>
> Tony Donohoe,
> Chairperson, EGFSN.

productivity, competitiveness and sustainability[17]. In response, to prepare the sector the government has proposed new pathways for reskilling into ICT/Technology roles at apprenticeship level and put in place provisions to attract and retain talent, promoting Ireland as a destination for high-level ICT skills, and ICT education and training[18].

Project Ireland 2040 introduced a vehicle to ensure regular and open dialogue between the government and the construction sector by the establishment of a Construction Sector Working Group (CSG). The CSG consists of representatives of key industry bodies, as well as senior representatives of relevant government departments and agencies with responsibilities for policy and the delivery of infrastructure. Part of the group's remit will be to consider matters such as:

- data/trends relating to the construction sector in Ireland;
- supply of necessary skills and enhancing capacity;
- the role of Building Information Modelling and adopting other technologies and innovative practices in driving improved productivity and efficiencies;
- use of sub-contracting and the level of self-employment;
- productivity of the construction sector.

Construction Sector Group

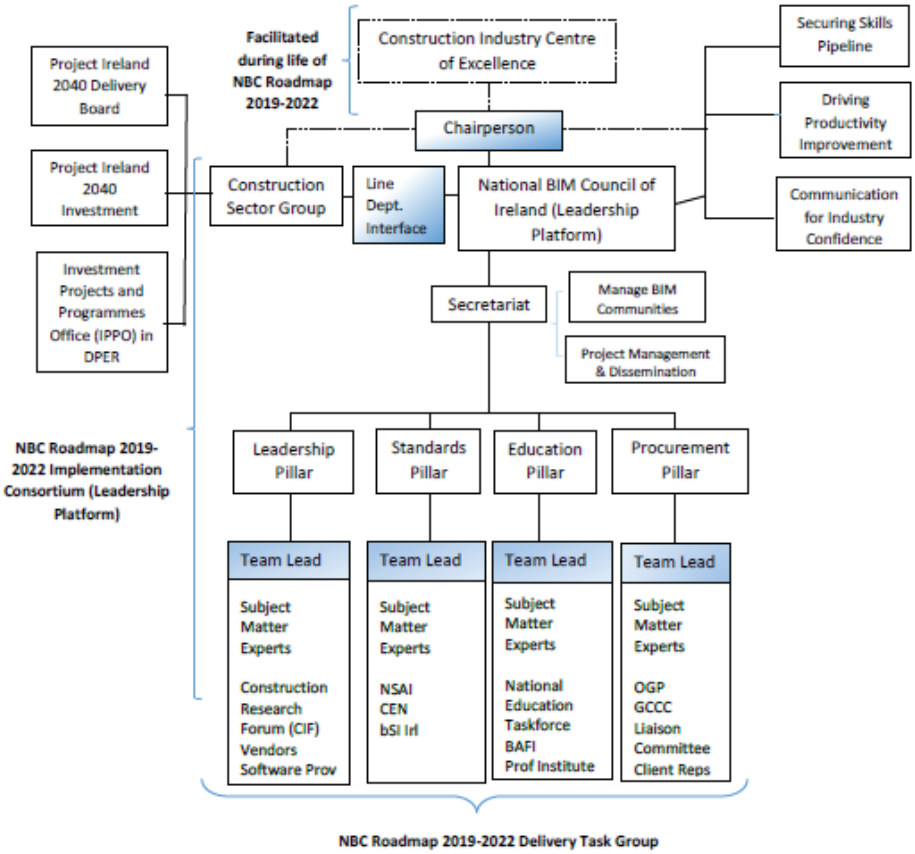
The CSG formed a sub-group to specifically look at growth and productivity. The Department of Public Expenditure & Reform in collaboration with the CSG has commissioned KPMG, Future Analytics Consulting Ltd. and TU Dublin to carry out an economic analysis of productivity in the construction sector and provide advice on future policy and industry strategy.

As detailed in the Department of Public Expenditure & Reform BUILD report[19], headline CSO data indicates that there has been little productivity growth in the Irish construction sector over the period 2000 to 2016.The goal of this research is to identify and assess actions which are relevant to the construction sector in Ireland and to set out clearly defined and implementable steps for the Irish construction industry and policymakers. It is envisaged that this report will be published in late September 2019.

[17] Government Publications, (2018), Action Plan for Jobs, published by the Stationary Office.
[18] Technology Skills 2022 Ireland's Third ICT Skills Action Plan.
[19] Department of Public Expenditure and Reform (2019). Build Construction Sector Performance and Prospects (BUILD).

In addition to the productivity report commissioned, the CSG sub-group prepared a detailed proposal on potential options in the establishment of a Construction Centre of Excellence, supporting all stakeholders working in the built environment[20]. The report recommended that the Centre of Excellence should focus on achieving the targets as set out in the National BIM Council (NBC) Roadmap as a starting point. The CSG sub-group has presented its vision for the structure and linkages for the proposed Centre (Figure 2).

Figure 2: Proposed Centre of Excellence Structure and linkages (CSG, 2018)



It is envisaged that the newly proposed Centre of Excellence will be a significant catalyst to tackle the root problems of poor productivity in the Irish construction industry.

> "BIM is fast becoming an essential requirement for informed consumers of construction services internationally, and many countries have established BIM requirements at a national level".
>
> Paschal Donohue,
> Minister for Public Expenditure and Reform.

[20] Construction Sector Group, (2019), A response by CSG industry members to the CSG Sub-Group on Growth & Productivity, June 2019.

The Digital Agenda in Irish Construction

> "Hot topic areas, organisations and phrases such as digital strategy, international open standards, digital twinning, 5G, the National Infrastructure Commission, CDBB and the Geospatial Commission are all stimulating debate and enabling change. We need to put BIM into context within these changes, and ensure that it does in fact remain appropriate and valid."
>
> Dr Anne Kemp,
> UK BIM Alliance Chair.

The digitalisation of the construction sector is increasingly recognised as a potential game-changer in Ireland. Over recent years the theme of digital transformation has featured in event programmes facilitated by the CitA Digital Transformation Series, CitA BIM Gathering conferences and by the CIF Digicon conferences. The focus on digitisation is demonstrated by a key remit given to the CSG, namely focusing on the potential of BIM and adopting other technologies and innovative practices in driving improved productivity and efficiencies in the Irish AEC sector.

The 2019 European Construction Sector Observatory report estimated that full-scale digitalisation in non-residential construction would lead to annual global cost savings of EUR 0.6 trillion to EUR 1.0 trillion in the engineering and construction phases and EUR 0.3 trillion to EUR 0.4 trillion in the operations phase[21]. Given the government's commitment to BIM (as outlined earlier), there is no longer any doubt of its relevance and the impact it is having on the Irish Construction Sector presently.

The Expert Group on Future Skills Needs (EGFSN) which advises the Irish government on the current and future skills needs of the economy confirm that prefabrication and the use of BIM systems will have a substantial impact on the sector over time. However, they warn that construction has been slow to embrace digitisation and the way contracts are put together, with many organisations and individuals being involved is acting as a barrier to the use of BIM[22].

Despite the fact that the *National BIM Council (NBC) of Ireland's roadmap to digital transition for Ireland's construction industry 2018 – 2021* has not to-date been implemented, there remains a recognition by the CSG to include its vision in any future implementation initiative[23]. To-date, a number of significant milestones within the Roadmap have been achieved, but there remain many vital objectives outstanding that will need funding. *The Construction Sector Performance and Prospects 2019 Report* states that the gap in productivity growth rates since 2000 between the construction sector and the other domestic sectors of the economy can be valued at €3.1 billion. To move away from these inhibiting statistics, Ireland's construction industry must embrace digital technologies more proactively[24]. The well respected *Farmer Report* on the UK construction labour model warned that the industry must modernise or die[25]. The report outlined BIM as being a critical change agent for the industry. Ireland, on its own journey, should acknowledge these findings as it continues forward on its BIM journey.

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[21] European Construction Sector Observatory (2019) Building Information Modelling in the EU construction sector, EU Commission.
[22] Expert Group on Future Skills Needs (2018) Digital Transformation: Assessing the Impact of Digitalisation on Ireland's Workforce, Department of Business, Enterprise and Innovation.
[23] National BIM Council, (2017), Roadmap to Digital Transition for Ireland's Construction Industry, December 2017.
[24] Department of Public Expenditure and Reform (2019). *Build Construction Sector Performance and Prospects (BUILD).*
[25] Farmer, M. (2016) The Farmer Review of the UK Construction Labour Model: Modernise or Die, Construction Leadership Council.

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Global BIM
World Economic Forum
United Kingdom
Special Feature: Estonia

Learning from others

Trinity Business School, Dublin
JJ Rhattigan.

Global BIM

BIM is heavily adopted in countries across the world. Today, many countries have BIM mandates and standards in place regarding the BIM level used in projects. CitA is currently working on an update of their CitA Global BIM Study (Figure 3) which will be published in late 2019[26].

With the recent publication of the international standard ISO 19650, countries across the globe now have a platform for managing information over the whole life cycle of a built asset using BIM. When it comes to government BIM standards, different BIM levels are often applied to various project types. These levels refer to the level of BIM maturity. It is generally accepted globally that Level 0 means no collaboration at all while Level 3 BIM means full team collaboration using a single shared project model.

The United States of America (USA) has a staggered implementation, for example with Wisconsin, New York City Department of Design and Construction and the State of Ohio BIM Protocol all having BIM mandates. In a recent survey, it was recorded that 82% of BIM users in the USA say they have achieved a positive return-on-investment, with another 14% breaking even[27].

While there is no regulatory requirement for BIM in Canada, its construction industry continues to persevere with the use of BIM. According to the Candian 2019 Annual BIM Report, nearly 90% of the participant organizations have adopted BIM in their current operational workflow. The majority of the respondents believe that BIM will continue to grow in prominence in the upcoming years[28].

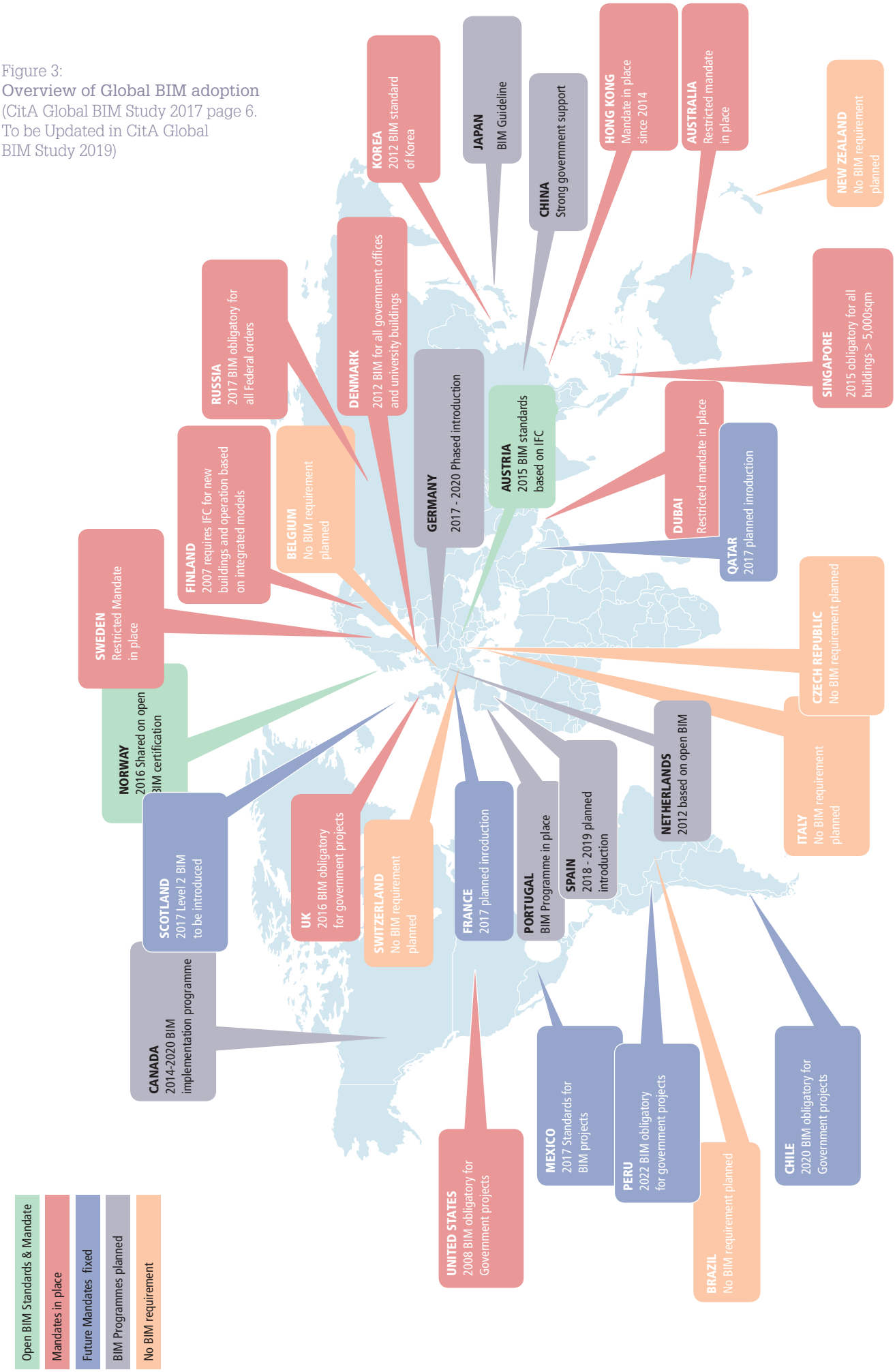
The European Commission has supported, promoted and developed several policies and initiatives aiming to foster the digitalisation in the construction sector. These include inter alia the strategy for the sustainable competitiveness of the construction sector and its enterprises (EU 2012)[29], the EU BIM Task Group and the upcoming EU Digital Construction platform. The digitalisation of the construction sector is also integrated into other policy areas such as the EU directive on public procurement (2014), which promotes the use of BIM in construction projects.

Since 2017, BIM is mandated in France. The official French standardization roadmap was made public in April 2017 as part of the French strategy for "digitizing" the construction industry. The objectives include improve the quality of exchanged data, improved deadlines while reducing overall project costs.The German construction industry has been slower to adopt BIM than some other countries, but also here project owners report the need for BIM in their projects and by the end of 2020, BIM will be mandatory for all transportation projects.

> "BIM acts as the centrepiece of the industry's digital transformation, as it powers new technologies, such as prefabrication, automated equipment and mobile applications for team collaboration."
>
> World Economic Forum 2018

[26] Construction IT Alliance Global BIM Study, 2017.
[27] Dodge Analytics (2018) Leading the Future of Building Connecting Teams, Dodge Analytics.
[28] McCabe, B., Shahi, A., Zhang, L.H., Whitell, M. and Cao, Y. (2018) 2nd annual BIM report: Canada Wide Survey, University of Toronto.
[29] European Commission (2012). Strategy for the sustainable competitiveness of the construction sector and its enterprises.

Figure 3:
Overview of Global BIM adoption
(CitA Global BIM Study 2017 page 6.
To be Updated in CitA Global
BIM Study 2019)



Australia has introduced a mandate in Queensland where all government construction policies with an estimated capital cost of at least $50 million will be required to use BIM. The system will then be applied to all new major government construction projects by 2023[30] .

The *2018 BIM in New Zealand Industry-Wide View* states that almost half of clients surveyed are integrating digital asset or spatial information with asset management systems despite no mandate[31].

Not all global construction sectors are as mature on their BIM journey, with less than 30 % in the Middle East using BIM processes[32]. While Asian countries Singapore, Hong Kong, South Korea and China continue to embrace BIM, most of the other developing countries in Asia namely, Thailand, Malaysia and Vietnam have low levels of BIM implementation in their respective regions, but the benefits of using the technology are recognised[33].

This is similar to Africa with Nigeria and South Africa using BIM on several high profile case studies with the benefits yet to permeate to other African countries[34]. Other counties like India have become leaders in BIM work-sharing with a variety of BIM services outsourced to Indian companies[35].

> "To support productivity growth, regulators can mandate the use of BIM to build transparency and collaboration across the industry; reshape regulations to support productivity; create transparency on cost across the construction industry; publish performance data on contractors; and consider labor interventions to ensure the development of skills instead of relying heavily on a low-cost transient migrant workforce."
>
> McKinsey Global Institute,
> Reinventing Construction: A Route To Higher Reproductivity (2017)

[30] Biston, D. (2018) Queensland mandates BIM on large government projects..
[31] BIM Acceleration Committee (2018) BIM in New Zealand — an industry-wide view 2018, BIM Acceleration Commitee.
[32] Ullah, K., Lill, I. and Witt, E. (2019) An Overview of BIM Adoption in the Construction Industry: Benefits and Barriers, Emerald Reach Proceedings Series, Vol. 2, pp. 297–303.
[33] Ismail, N.A., Chiozzi, M. and Drogemuller, R. (2017) An Overview of BIM Uptake in Asian Developing Countries, Proceedings of the 3rd International Conference on Construction and Building Engineering, Indonesia, 17th August. Pp1-8.
[34] Ogwueleka, A.C and Ikediashi, D.I (2017)The Future of BIM Technologies in Africa: Prospects and Challenges, Integrated Building Information Modelling, 2017, pp 307-314.
[35] Zigurat Global Institute of Technology (2018) Adoption Of BIM in India: Architecture and Infrastructure Projects. .

World Economic Forum

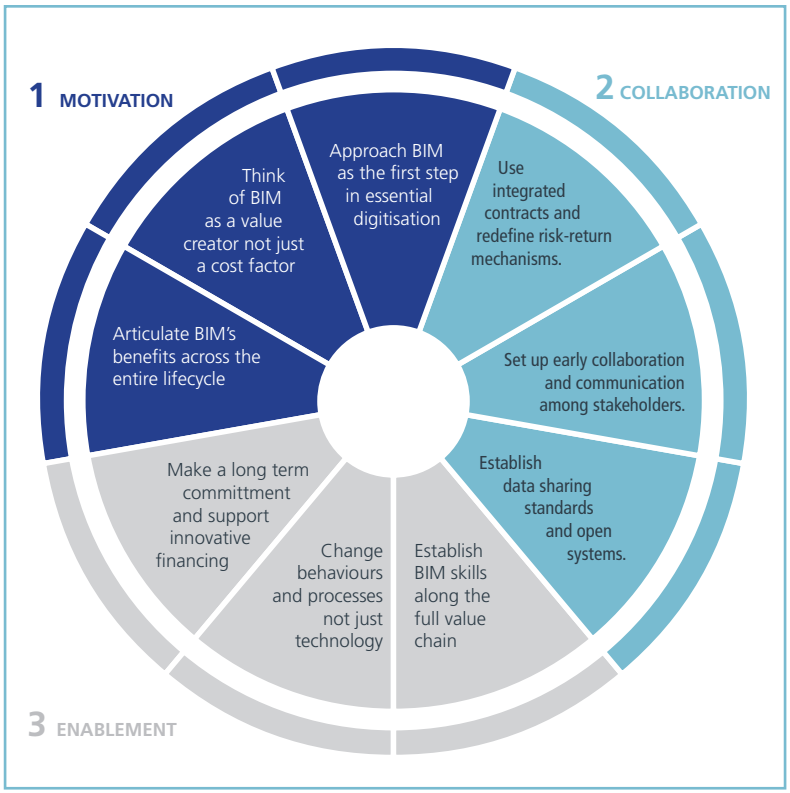


Figure 4:
WEF BIM Adoption Circle
(Graphic edited for clarity)

A 2018 report from the World Economic Forum (WEF) titled *An Action Plan to Accelerate BIM Adoption* expressed concerns that BIM adoption varies significantly by country and level of economic development. In more advanced economies, most firms use BIM, though not on all projects and not at the highest levels[36]. On an EU scale if nothing is done to tackle the barriers, then it might become difficult for BIM latecomers to adopt BIM and work at the same standard as the BIM early adopters. This may hinder cross-border projects and collaboration[37].

To advance the global BIM Agenda, the WEF has released a framework (Figure 4). This framework sets out three critical criteria that must be addressed, namely 1) Set the right motivation for BIM adoption 2) Enhance collaboration on projects, and 3) Enable all stakeholders. For one to set the right motivation for BIM adoption, the benefit of BIM must be articulated across the entire lifecycle which requires a long-term commitment and innovative financing to get the technology into the hands of stakeholders who need it.

BIM must be viewed as a value creator, not as a cost. Companies and industry associations must create benchmarks against which BIM costs and benefits can be measured with comprehensive return on investment (ROI) assessments. BIM must be approached as the essential first step to infrastructure and urban development digitalisation to ensure successful and sustainable adoption of related applications.

To enhance collaboration on projects, WEF suggested the use of integrated contracts and redefining risk-return mechanisms. To set up early collaboration and communication among

[36] World Economic Forum (2018) An Action Plan to Accelerate Building Information Modelling (BIM) Adoption, World Economic Forum.
[37] Charef, R., Emmitt, S., Alaka, H. and Fouchal, F. (2019) Building Information Modelling adoption in the European Union: An overview, Journal of Building Engineering, Iss 5.

stakeholders, companies must revise their corporate and organisational structures and processes to allow for more comprehensive and efficient cooperation. There is also a requirement to establish data-sharing standards and open systems. Finally, to enable all stakeholders, BIM skills must be developed along the full value chain, and education must be reformed to provide prospective employees with necessary BIM skills. One must also change behaviours and processes, not just technology, therefore adopting a comprehensive change management programme.

The WEF concluded that BIM would only succeed if stakeholders work together towards a joint vision through a standard plan. The application and results of this framework within the Irish AEC Sector will be discussed later in the report.

> "Over the next decade, advances in BIM will combine with the IOT, data analytics, data-driven manufacturing and the digital economy to enable us to plan new buildings and infrastructure more effectively, build them at lower cost, operate and maintain them more efficiently and deliver better outcomes to the people who use them."
>
> Dr Jennifer Schooling,
> Chair of the Research Strategy Advisory Group for the CDBB.

United Kingdom

The UK Government mandate has been in effect now for three years with the industry now pushing to make digitisation business as usual[38].

The 2019 NBS report found that the mandate has been a huge "pull" driver for the UK industry with the number of events and publicity surrounding BIM helping to carry the momentum. The report also stated that while the UK government can take credit for setting the industry on the right path with BIM, respondents did not feel that the government had been successful at maintaining the momentum[39].

The BIM Regions, BIM4s and other BIM related Special Interest Groups form a collective known as the UK BIM Alliance Communities which enable the Alliance to understand key industry concerns. To help disseminate key BIM learnings, the Alliance in 2018 released the Winfield Rock Report[40] which is a review of BIM legal and contractual issues. Other essential publications include Going Digital, which sets out a path for clients into the use of BIM[41], A Fresh Way Forward for Product Data[42] and more recently, Guidance Notes on ISO 19650[43].

Another essential entity in providing a critical BIM resource is the Centre for Digital Built Britain (CDBB), which is a strategic partnership between the UK government and the University of Cambridge. CDBB has secured funding for feasibility studies,

[38] Kemp, A., Penney, M., Bhandal, P., Holmes, S., Hartwig, R and Glennon,D (2018) UK BIM Alliance Report, UK BIM Alliance.
[39] NBS (2019) National BIM Report 2019, NBS.
[40] Winfield, M. and Rock, S., (2018),The Winfield Rock Report, Overcoming the Legal and Barriers of BIM, Published by UK BIM Alliance.
[41] UK BIM Alliance, (2018), Going Digital: A guide for construction clients, building owners and their advisers.
[42] UK BIM Alliance, (2018), A Fresh Way Forward for Product Data.
[43] UK BIM Alliance, CDBB and BSi, (2019), Information Management according to BS EN ISO 19650, Guidance Part 1: Concepts.

United Kingdom (continued)

research projects and experimental development projects ranging in value from £50,000 to £250,000[44]. The CDBB has launched the Research Bridgehead which aims to build effective relationships with the research community to harness value, enabling results of innovative academic research to inform the development of Digital Built Britain. The centre is also establishing a Digital Twin Hub, a collaborative web-enabled community for those who own, or who are developing digital twins within the built environment. They have published the first output of its Digital Framework Task Group, The Gemini Principles, which sets out a guide for the national digital twin[45].

While Level 3 BIM has not yet been fully defined, the UK government's Level 3 Strategic Plan sets out key measures which include international Open Data standards, a new contractual framework, creation of a cultural environment and the training of the public sector client[46].

Special Feature: **Estonia**[47]

Development of the e-construction platform in Estonia was driven by the strategic objective to increase Estonian construction sector productivity to the EU average level by 2030 (Figure 5)[48].

Improving work processes and information flows is one of the most important activities needed to increase the added value per employee in the construction sector. Therefore, the long-term vision of e-construction entails effortless exchange of digital information and strong cooperation between stakeholders to achieve a common goal (Figure 6).

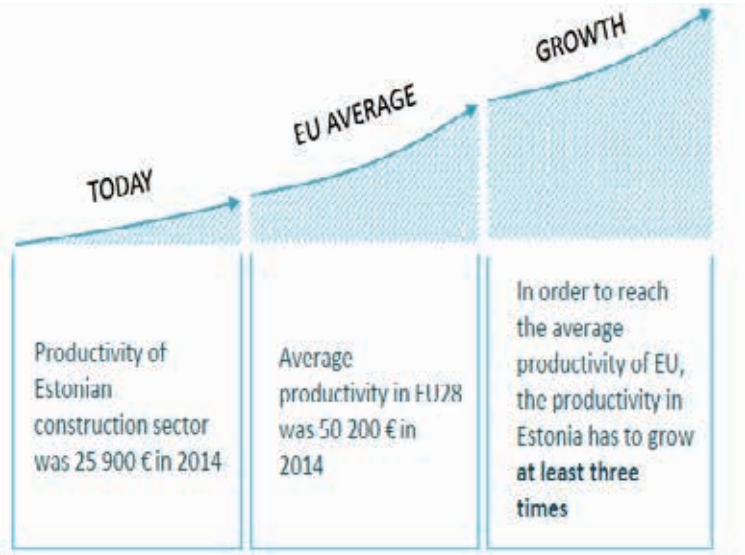


Figure 5:
Strategic Objectives of Estoian Construction Sector

[44] University of Cambridge (2019, May 28th). Transforming infrastructure through smarter information. Retrieved from Government announces new Centre for Digital Built Britain at Cambridge, available at https://bit.ly/2jz5cdT.
[45] Centre for Digital Built Britton (2019). Centre for Digital Built Britain. Retrieved from BIM: www.cdbb.cam.ac.uk/BIM.
[46] HM Government (2015) Digital Built Britain Level 3 Building Information Modelling - Strategic Plan, HM Government.
[47] Contribution from Jann Saar Head of Digital Construction Estonian Ministry of Economics Affairs and Communication..
[48] European Construction Sector Observatory. Country Profile Estonia, March 2018; European Construction Sector Observatory. Country Profile Romania, June 2018.

Figure 6:
eConstruction Long-Term Vision
(Graphic edited for clarity)

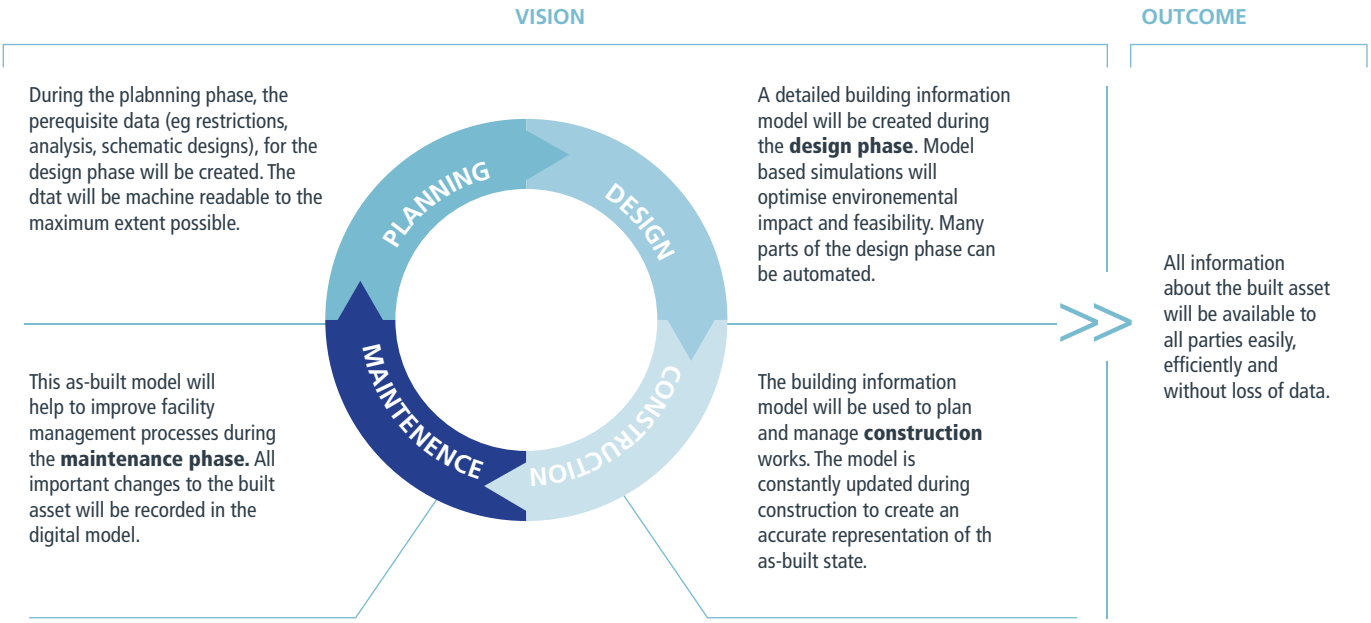
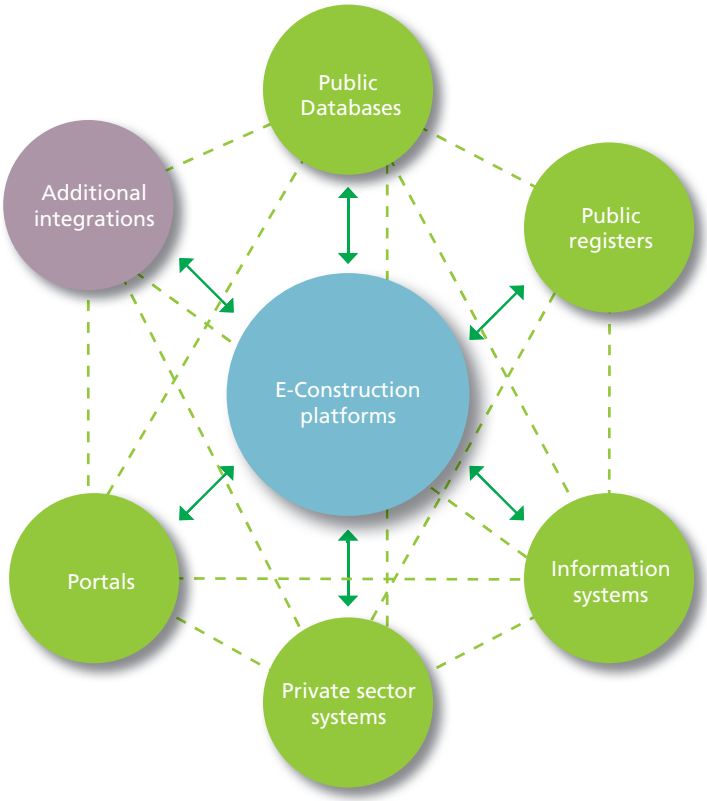


Figure 7:
eConstruction Platform Connections



Estonia (continued)

When developing the concept of the e-construction platform, the following principles were taken into account:

- The data will be entered only once and reused throughout the building lifecycle. Sharing of data with other parties will be done through the platform without any need for repeated data entry.
- The platform will be the main entry point for using public services connected to the building lifecycle. The exchange of information between the user and public sector will be integrated into the platform, minimizing the need to use several systems in parallel.
- The data provided through the platform will be up to-date. Nevertheless, the data will not be saved on the platform, but retrieved from various registers and systems.
- The data available on the platform will be correct and of high quality. The data complies with requirements, is reliable and can be used in their work by stakeholders in the building lifecycle.
- The data entered to and retrieved from the platform will be machine readable.
- Development of the platform supports adoption of innovative solutions by the stakeholders in the building lifecycle.

The e-construction platform will be an integration platform that provides the interface to various other systems. The platform will be developed as a flexible system to support innovation through the addition of new private and public sector services. As a result, the platform will constantly evolve and provide added value to the sector by linking together information from different sources and providing user-centric services.

The e-construction platform allows users to exchange information with relevant parties faster and without loss in data content. The core services of the e-construction platform are:

- Information request – data related to an object will be displayed using a 3D model. This includes among others planning information, underground infrastructure (networks of cables and pipework), information about neighbouring properties and detailed information of the object itself.
- Information entry – users can enter information about objects that is needed for permission applications and approvals. The platform is also used for information exchange between stakeholders.
- Implement procedures – the platform will enable the automation of procedures using standardised data models. Technical parameters and their compliance to regulations and requirements can be verified by the system before manual inspection, reducing human time and work load.
- Supervision – it will be possible to add and review data related to supervision and facility management activities, eg. information about technical inspections carried out during maintenance.
- Manage custom data catalogues – data related to specific objects can be stored in custom catalogues. This can include among others extracts from information requests, building information models, documents and guidelines.
- Provide support and guidance – the platform will provide relevant and available information about legislation, standards, manuals and guidelines related to an object.

BIM in Ireland

Sandyford Student Accommodation
C+W O'Brien Architects

Enterprise Ireland

Enterprise Ireland continues to be a driving force for innovation in Irish construction. Enterprise Ireland provides a Lean Business Offer, which is designed to encourage clients to adopt lean business principles in their organisation to increase performance and competitiveness. The Lean Business Offer is made up of three levels of support; 1) LeanStart 2) LeanPlus and 3) LeanTransform. Increasing levels of capability characterise each level of support in implementing lean business principles, and other best practice approaches to drive company awareness, adoption, and integration of lean tools and techniques[49]. More than three out of four companies participating in Enterprise Ireland's lean programme have reported improvements in productivity and/or capacity increases.

Their *BIM Enable* and *BIM Implement* programmes continue to provide critical funding support to the industry. The *BIM Enable* programme is a 7-day strategic consultancy programme designed to heighten BIM knowledge across business functions and ultimately delivers a bespoke roadmap to Level 2 BIM proficiency based upon a company's vision and resources. The maximum grant funding available from Enterprise Ireland is €6,300. The *BIM Implement* programme represents the training phase of the BIM induction offer supporting knowledge transfer leading to increased competencies in BIM and a deeper understanding of supply chain implications. The aim is to embed BIM skills and knowledge across an organisation and equip the appropriate staff members with the competencies to successfully manage a BIM project. Assignments may vary in size and scope but will typically be of 6 months duration but may not exceed a total project cost of €70,000[50].

Enterprise Ireland also funded the *BIM Innovation Capability Programme* (BICP) for Ireland which successfully captured the maturity of the Irish AEC Sector from 2016 - 2017,[51]as well as sponsoring innovation vouchers focused on BIM technologies. They were also a vital driving force in establishing the *National BIM Council* (NBC) in Ireland and in the preparation and dissemination of the *Roadmap to Digital Transition for Ireland's Construction Sector*.

With the continued uncertainty now facing the Irish construction sector regarding Brexit, Enterprise Ireland has introduced a 'Be Prepared Grant' which offers up to €5,000 in funding to support exporting client companies develop a Brexit action plan. A condition for accessing this funding is to have used the "Brexit Scorecard" diagnostic tool which is designed for SMEs who would benefit from further research and the use of external expertise in developing this plan[13]. Irish AEC businesses who wish to export their products and services in the future will need to possess a skillset in the use of digital tools, in particular, BIM if they are to compete with their international counterparts.

[49] https://www.enterprise-ireland.com/en/funding-supports/Company/Esetablish-SME-Funding/Lean-Transform.html
[50] https://www.enterprise-ireland.com/en/funding-supports/Company/Esetablish-SME-Funding/Building-Information-Modelling.html
[51] http://www.bicp.ie/

"Building information Modelling is at the heart of the Construction Industry's drive to industrialisation.

In Ireland and across the globe, government is re-connecting with the sector and playing a key role in its evolution. If implemented effectively, the ISO 19650 standard for managing information across the whole asset life cycle offers the potential for genuine scalability… and not just to the incumbent product and service suppliers but to the community of technology entrepreneurs and providers we will need to connect with. A new scale of opportunity that can cross many sector verticals and international markets will have the potential to attract nationally significant levels of investment."

John Hunt
Senior Market Advisor, Construction and Digital Services, Enterprise Ireland

"As awareness of digitalisation continues to gather momentum across the Irish Built Environment sector key to future success will be its adoption on both the supply and demand sides of the market. Digitalisation can truly shift the dial on both innovation and competitiveness of the sector as we seek to grow opportunities both domestically and internationally. The recent announcement of the government & industry commitment to development of the "Digital Build Project" is a major positive step on this journey."

Stephen Hughes,
Head of Construction,
Enterprise Ireland

National BIM Council Roadmap to Digital Transition

> "This industry roadmap is an initiative that advocates more productive ways of working that improves competitiveness at home and overseas. This roadmap not only seeks to increase efficiency and the productivity of the industry, but also seeks to support an SME community that makes up almost 95% of the sector both in Ireland and across the wider European Union."
>
> Heather Humphreys,
> Minister for Business, Enterprise and Innovation, 7th December 2017

In 2017 the National BIM Council (NBC) published the Roadmap to Digital Transition for Ireland's Construction Industry 2018 – 2021. This industry roadmap is an initiative that advocates more productive ways of working that improves competitiveness at home and overseas. The roadmap not only seeks to increase efficiency and productivity in the industry but also aims to support an SME community that makes up almost 95% of the sector both in Ireland and across the broader European Union.

The roadmap was divided into four key pillars; leadership, standards, education and training and procurement (Figure 8).

The leadership pillar specified that a central national resource to support the roll-out of digital tools and processes across client groups and the supply chain in Ireland be established. It was also stated that a suitable individual/executive to lead the implementation programme should be agreed upon, who would then commission the Implementation Task group.

The standards pillar requested support for Ireland's involvement in international and European standards development, as well as for NSAI Certification. Other key milestones in regards to standards included online tools and supports and to align planning control with these standards. The education pillar set out milestones that included the delivery of broad awareness and upskilling learning frameworks for both educators and industry through a National Education Taskforce.

Other essential milestones included an online BIM L2 self-assessment tool for companies and a base level of learning outcomes targeted at alternative NFQ levels. There was also a request for the inclusion of content on Digital Design and Construction in the second-level curriculum.

The procurement pillar called for the development of online supports for public clients to receive, review, manage, and assess BIM on their projects. Other requests included the BIM contract requirements for the public sector to be determined and a Government Mandate for BIM In 2019. There are encouraging signs that the Irish Government, with the assistance of the CSG, is engaged in a strategic consultation programme which it is hoped will lead to the implementation of the Roadmap through their BUILD initiative.

CitA
Construction IT Alliance

Digital Roadmap 2021
Construction Sector

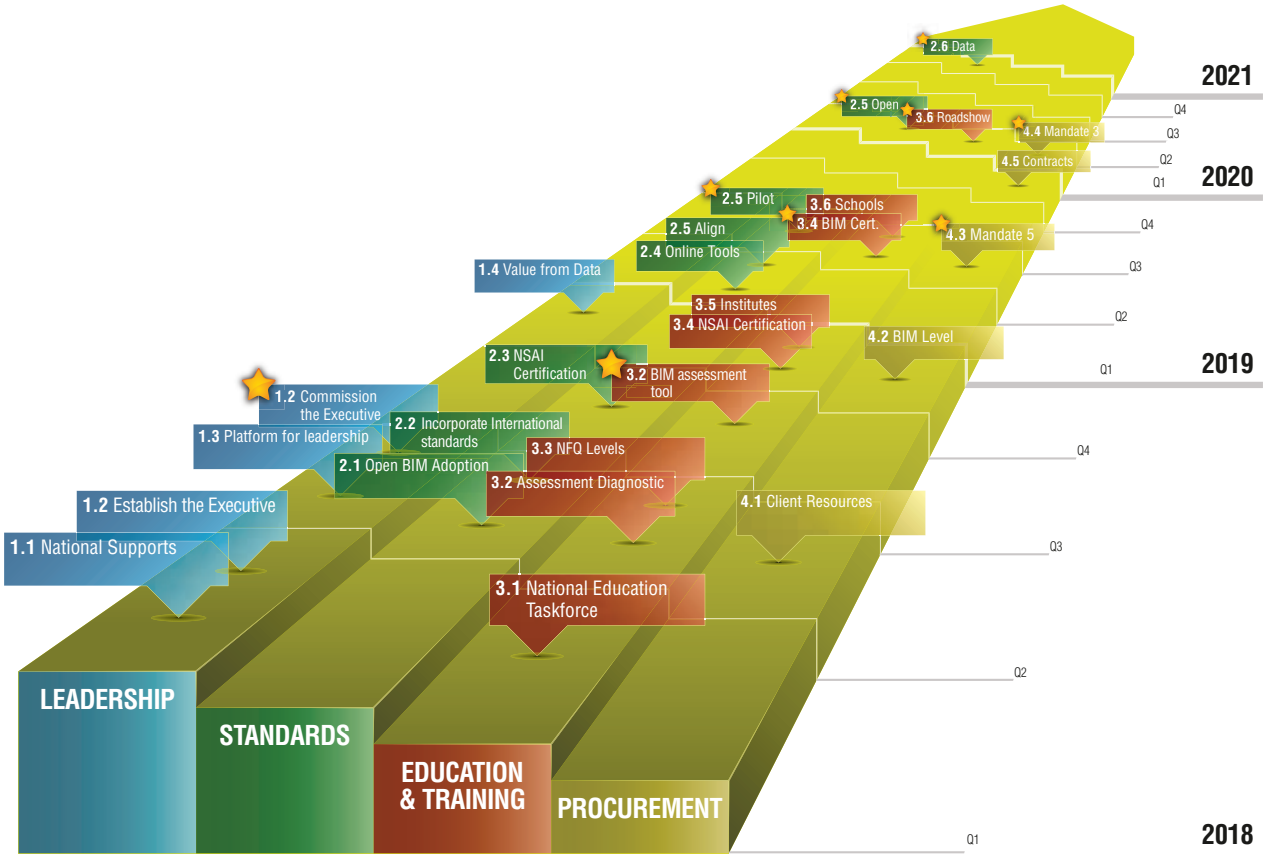


Figure 8:
NBC Roadmap to Digital Transition for Ireland's construction industry

National BIM Surveys

> "Ireland is one of those countries undertaking their own digital transformation, and during 2019, NBS and CitA (Construction IT Alliance) undertook our first BIM survey, specifically for design professionals in Ireland. We had 116 responses to the survey from across all of the Irish regions. Those respondents were from a mixture of disciplines, including architects, architectural technologists, BIM managers, building services engineers and structural engineers, among others. Thank you to everyone who took part.."

Ralph Montague,
Market intelligence coordinator, NBS

In 2019 CitA and NBS formed a strategic partnership to support Ireland's digital transformation and to assist with BIM, knowledge and training initiatives across the industry. A crucial part of this partnership was a BIM survey, specifically for design professionals from a mixture of disciplines, including architects, architectural technologists, BIM managers, building services engineers and structural engineers, amongst others. The results revealed that awareness of BIM in Ireland matches awareness levels in the UK. All of the respondents to the Irish BIM survey stated they were aware of BIM.

In Ireland, 76% of respondents have adopted BIM; which again is broadly similar to the UK's adoption levels. However compared to the adoption of BIM by practice size and project type, the use of BIM contrasts with the UK, with small practices (those employing 15 or fewer people) significantly less likely to have adopted BIM within Ireland. Results show that BIM is being used more often on public sector projects, such as health projects, and it is less likely to be used on one-off new houses, extensions, or alteration-type projects.The results from the survey show that 15% of respondents are using BIM on all projects and a further 27% are using BIM on more than three-quarters of their projects.

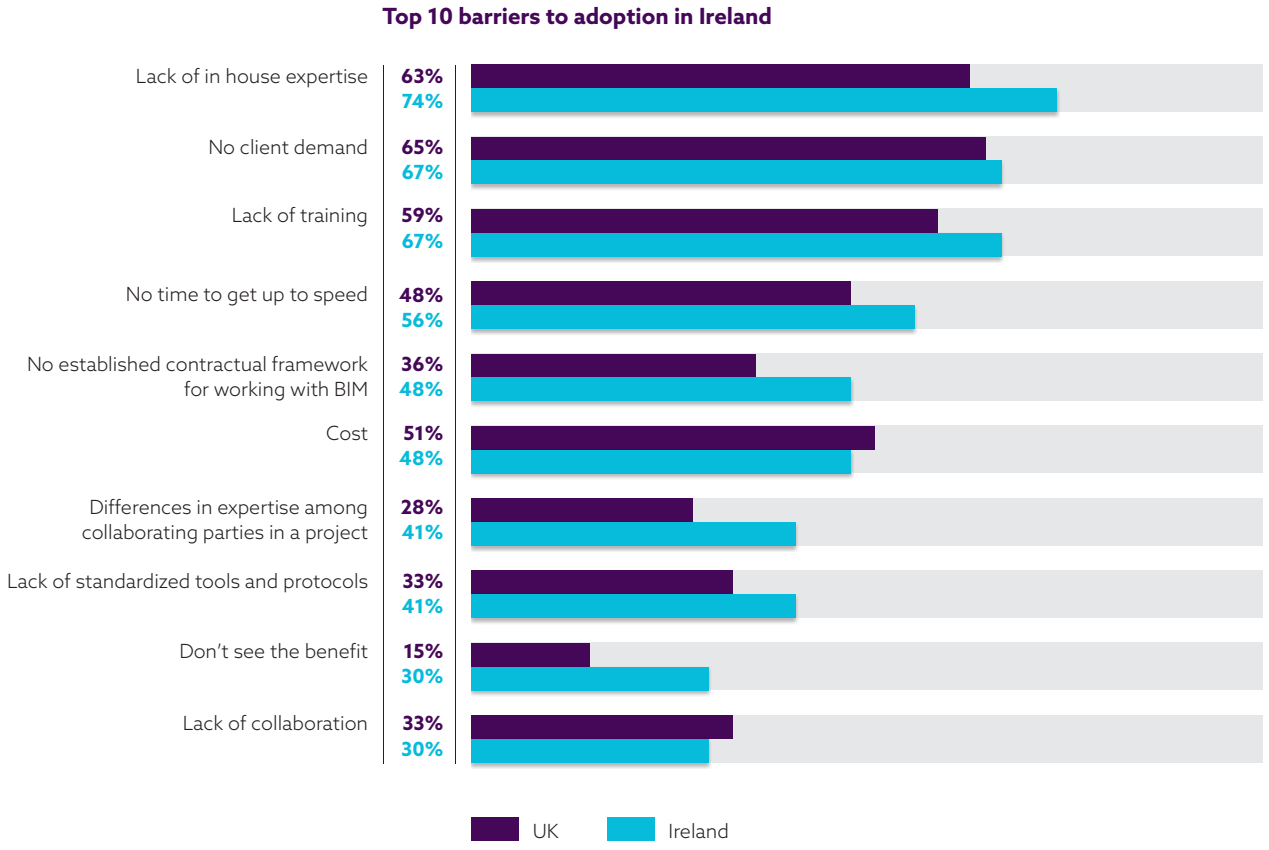
Compared to the UK, fewer Irish respondents (65%) claim that the highest level they have reached on a project is Level 2 BIM (compared to 71% in the UK). Access to information and support is crucial to ensure BIM's effective adoption. For seven out of ten respondents, professional institutes or industry organizations are essential sources of information. Most prominent among these are the NBS (81%), CitA (79%) and BuildingSMART (68%), with respondents reporting that they are very or quite likely to turn to these organizations for information.

When it came to the impact of the Irish government's BIM Adoption Strategy, only 27% believed it to be very or quite successful. However, the NBC Roadmap 2018-2021 launch has resulted in a better response with 44% thinking it has been very or quite successful. This is seen as a positive start even though the NBC Roadmap has not yet attracted any government funding.The primary barriers for BIM implementation in Ireland are a lack of in-house expertise (74%), no client demand (67%) and a lack of training (67%) (Figure 9). The absence of an established contractual framework for working with BIM is also seen as a key barrier.

Despite these barriers, the respondents, especially those who are already using BIM, recognise the advantages that BIM adoption brings. A total of 83% of users believe that BIM increases the coordination of construction documents and 64% state that it brings cost efficiencies. Perhaps more importantly, though, both current users and non-users believe that clients and contractors will increasingly demand the use of BIM. The survey results are promising for Ireland and while it is clear that Ireland is at an earlier point in its BIM journey, as evidenced by fewer people achieving Level 2 BIM, the benefits of BIM adoption are widely recognised due to the number of successful projects that have applied Level 2 BIM processes. There is an expectation that both clients and contractors will increasingly insist on BIM, and therefore, nine out of ten respondents expect to be using BIM within the next one to five years[52].

[52] Archer, J (2019) NBS (2019) National BIM Report 2019, NBS.

Figure 9:
Barriers to BIM in Ireland and the UK



Construction IT Alliance

CitA was founded as a not-for-profit organization in 2005 and soon added education and training activities to its offering. Since the publication of the BIM in Ireland 2017 Report, CitA has continued its push to promote BIM and other digital innovations within the construction sector.

To complement the NBC Roadmap, CitA ran a series of workshops in 2018 under their successful Digital Transition Series programme. These events focused on driving innovation within the construction sector and celebrated the success of BIM through case study presentations. The CitA TECH LIVE Conference took place in the same year and was used as a platform to showcase the latest construction technologies that are revolutionising the Irish AEC sector[53].

In 2019 CitA commissioned a further series of workshops to explore innovative and transformative approaches to the delivery of housing, health, education infrastructure and utility projects which are all envisaged under the Ireland 2040 plan. These workshops will be complemented by the 4th CitA BIM Gathering to take place in Galway on the 26th September[54]. In both 2018 and 2019, CitA commissioned its Tech Trend Series which is designed to explore how technology is disrupting both the property and the construction industry.

Since 2008 CitA has secured funding from Skillnet Ireland in the design and delivery of industry-led training, much of which has focused on BIM. The CitA Skillnet network continues to be successful, providing funding towards training and upskilling costs to member companies throughout 2019 and beyond. CitA also launched the CitA Academy Portal, a central learning solution to meet industry, academic, and government skills development needs[55].

To further expand its reach to the sector, CitA has formed strategic partnerships with both NBS and the BRE Academy. These partnerships present an opportunity to connect and leverage existing learning and framework tools to help the Irish construction industry with its transition to digital now and into the future. CitA also continues to maintain strong relations with Enterprise Ireland who previously funded its BIM Innovation Capability Programme initiative and acted as the secretariat for its NBC framework.

CitA's strategic vision is to continue to build a broad network of active members across the country, drawn from industry, government, and academia and to continue to be recognised as the home of digital construction in Ireland.

[53] https://www.citatechlive.com/
[54] https://www.bimgathering.ie/
[55] https://www.cita.ie/product/operam-academy-portal/

CitA BIM Regions

In 2015 CitA were invited to become honorary members of the UK BIM Regions Network.

CitA quickly established three BIM regions, which have now expanded to eight throughout the country (Figure 10).

The purpose of the regions is to raise awareness of BIM, promote a shared understanding of the value proposition, share experiences of working with BIM on local projects and address the challenges of implementing BIM. The regions now include sharing knowledge and expertise of digital construction to reflect the Irish construction industry's digital transition.

The regions are seeking to develop a consistent message and provide valuable feedback to the CitA BIM Group, which currently has over 10,000 members.

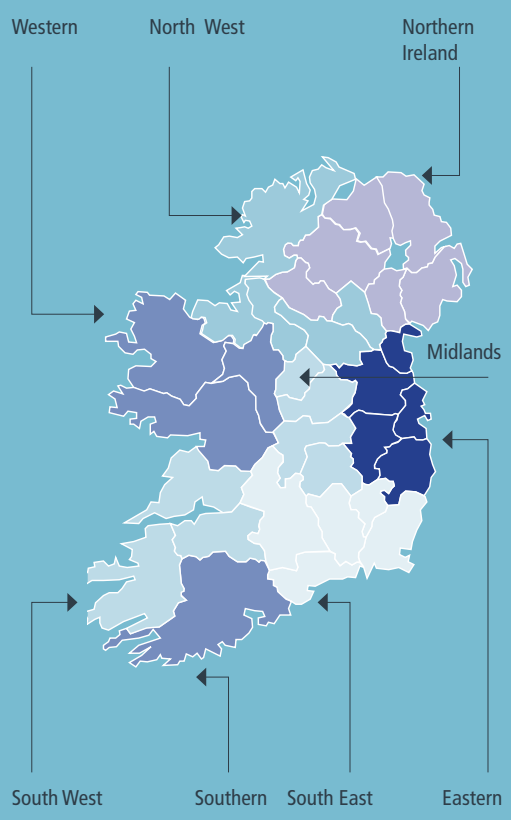
Table 1 – Ireland's BIM Region Groups

Region	Chair
CitA BIM Group (National)	Ralph Montague
CitA BIM Region Coordinator	Emma Hayes
CitA Eastern Region	Cillian Kelly
CitA Western BIM Region	Mark Costello Michelle Fahey
CitA South East BIM Region	Brian Dempsey
CitA South West BIM Region	Paul Vesey Tim Segal
CitA North West BIM Region	Anne Boner Gary O'Connor
CitA Midlands BIM Region	Mel McGerr Finola Deavy
CitA Southern BIM Region	Ger O'Sullivan
Northern Ireland BIM Region	Melanie Dawson

"The BIM Regions are a national BIM and Digital Construction resource which provide the construction industry with regular updates on trends and developments. With this fast-paced emerging construction process it is important for the industry to stay up to date with these trends and the BIM Regions are a reliable source for these developments. A knowledgeable network of members share case studies and technology updates to keep the industry informed of current and future trends."

Emma Hayes,
Digital Built Consultants/ CitA Director
25th July 2019

Figure 10 – Irelands BIM Regions



BIMIreland.ie

"BIMIreland.ie has become the 'go-to' resource for all things related to BIM, Digital Construction and Lean Construction in Ireland. If you want to know what leading companies are doing in the industry, BIMIreland.ie is definitely your first 'port-of-call'."

Ralph Montague,
Arcdox

"BIMIreland.ie is an excellent resource for keeping up to date with what is happening in the world of BIM. I find that the articles and interviewees cross such broad areas and disciplines that there's always something new to learn from them."

Louise Kelly,
Solution Consultant Invicara

"BIMIreland.ie is Ireland's only BIM and Digital Construction resource which provides the construction industry with regular updates on BIM trends and developments. With this fast paced emerging construction project process it is important for industry to stay up to date with these trends and BIMIreland.ie is a reliable source for these developments. Project case studies, BIM People interviews, articles from around the world and technology updates keep the reader informed of current and future trends."

Emma Hayes,
Managing Director, Digital Built Consultants

BIMIreland.ie has become an established source for information on BIM Digital Construction for the Irish BIM Community and BIM enthusiasts worldwide. BIMIreland.ie is an Irish building magazine resource. Over the past 4 years, BIMIreland.ie has published BIM news and views from the construction industry as it has embraced digitisation.

Irish building magazine has a readership of well over 30,000 in print and digital format. Online, Irishbuildingmagazine.ie has over 20,000 visits per month, and BIMIreland.ie has over 10,000. BIMIreland.ie has over 3,300 Twitter followers and is active on LinkedIn with over 1,400 followers and is now on Instagram. BIMIreland.ie and Irish Building regularly rank as the most active and influential Twitter accounts for national industry events. 64% of BIMIreland.ie Twitter followers are male, and 36% are female. 45% of BIMIreland.ie followers are from Ireland, 26% from the United Kingdom and 5% from the United States, with the remaining 24% coming from countries around the world.

The reason for this popularity is the quality of content. BIMIreland.ie has covered BIM news, technology, companies, projects, BIM jobs, and BIM People. BIM adoption has been one of the main topics in the Irish construction industry over the past 4 years. It has covered the progress of Irish companies' BIM adoption and the Irish construction industry's digitisation. The biggest names in the international BIM community have featured on the site's BIM People segment, including Paul Doherty, Chairman of theBIMcompany and President and CEO of the Digit Group, inc; Bill East, owner of Prairie Sky Consulting; Fred Mills, Co-Founder, and Director of The B1M. Over 50 interviews have been featured, many with Irish BIM experts working in a variety of roles in industry and academia. Irish construction companies are selling their services and products around the world and their BIM and Digital Construction skills are helping them enter new markets and win work, which is reflected in the BIM People interviews. Autodesk University London was a showcase for this work. Irish Building magazine and BIMIreland.ie were guests of Autodesk at AU London 2019 and witnessed the prominent showcasing of Irish construction companies, with attendees praising the work of the companies presenting. BIMIreland.ie has played a part in presenting Irish companies' capabilities to the world. Irish Digital Construction has also been showcased at the Irish Construction Excellence Awards (ICE Awards) over the past two years.

BIMIreland.ie and Irish Building magazine are the media partners for the ICE Awards. Over the past two years, they have reported on the best of Digital Construction at the ICE Awards, interviewing the Finalists and Winners in the BIM Excellence and Construction Innovation categories.

CitA's activities have featured prominently over the past 4 years, and readers can find reports from the events and details of programmes on BIMIreland.ie, including the 2015 and 2017 CitA BIM Gatherings, CitA breakfast meetings, the BIM Innovation Capability Programme (BICP), CitA Tech Live 2018 and the CitA regional events. Not only has BIMIreland.ie covered BIM, it has also covered associated topics, including Virtual Reality, Augmented Reality, drones, and Lean Construction.

BIM in Ireland Umbrella Forum

The BIM in Ireland Umbrella Forum, co-ordinated by CitA, was launched in January 2019 and provided an additional neutral and holistic environment for the sharing of information for review or comment between the different professional institute's digital construction / BIM subcommittees (Figure 11).

In the absence of a funded umbrella group to co-ordinate activities this forum has been a critically important initiative in 2019. It is hoped that a more formalised forum will be recognised and funded in 2020 and beyond.

Figure 11:
BIM in Ireland Umbrella Forum

The Forum has provided updates to the Irish AEC industry on work being performed by the individual professional institutes with regards to digital construction. A brief summary of each of these groups and their contact point is shown in Table 2. Dr. Barry McAuley of the School of Multidisciplinary Technologies in TU Dublin chairs the Forum.

Table 2 – BIM Interest Groups in Ireland

Group	Outline Description and Contact Point
Association of Consulting Engineers (ACEI)	The ACEI BIM Committee is now working on a number of tasks including the CIC's BIM Vision including an Irish Plan of Digital Works. **Forum representative: Brian Lahiff, Garland Consultancy**
BIM Academic Forum Ireland (BAFI)	The group's mission, similar to the UK BIM Academic Forum, is to create a dynamic group to develop and promote the training, learning, and research aspects of BIM through active collaboration and cooperation. The group will foster integrated collaborative working on projects over the asset lifecycle through academic involvement and enhancement of BIM. **Forum representative: Dr Alan Hore, TU Dublin**
BIM Regions	The BIM Regions have organised a number of events to raise awareness of BIM, promote a shared understanding of the value proposition, share experiences of working with BIM on local projects and address the challenges of implementing BIM. **Forum representative: Emma Hayes, Digital Built Consultants, Paul Vesey, Limerick IT, Mark Costello, RPS and Ger O Sullivan, DPS Group**
BRE	BRE are providing the NSAI team with auditor exam-based training. BRE is offering a certification pathway scheme that offers individual and company BIM certification, which is continually validated through ongoing appropriate BIM training criteria and third-party assessment through a combination of audit and CPD requirements. **Forum representative: John Whyte, BRE Group**
CitA BIM Group	The CitA BIM Group, is a working group of members of the CITA network, with a particular interest in BIM. The group comprises consultants, end-users and software vendors and has official representation from a number of industry stakeholder groups (RIAI, CIAT, ACEI, IEI, CIES, iStructe, CIBSE, iSCS, CIF, CIOB, Law Society, OPW, etc.). The express purpose of the group is to investigate the benefits of BIM and to generate ideas for the general advancement of BIM for the Irish Construction Industry, through information sharing, collaboration and training, and to report findings back to the CitA Network. **Forum representative: Ralph Montague, ARCDOX**

Table 2 continued

Group	Outline Description and Contact Point
Construction Industry Federation (CIF)	The CIF Construction 4.0 committee launched a series of industry guides to help in upskilling their staff. These documents include 1. BIM Policy and Standards Guide: The purpose of this guide is designed to present contractors with a technical glossary containing a plain English explanation of the common BIM standards and information protocols. 2. Bidding for BIM Guide: This document sets out with the objective of streamlining and mitigating the inefficiencies during the prequalification BIM tender construction procurement process. 3. BIM Starter Pack: This is a guide for contractors, enabling them to meet projects digital needs as the construction veers more and more towards the use of these modern methods and innovative techniques. Forum representative: Cillian Kelly, John Sisk and Son
Construction Industry Council (CIC)	The CIC's vision for the industry brings together 6 Irish major industry bodies to lead and accelerate Ireland's transition to digital for the sector. These include the RIAI, ACEI, Engineers Ireland, CIF, SCSI and the Building Materials Federation (BMF). The CIC embraces BIM and actively encourages the Irish Construction and Built Environment Sector to continue to take full advantage of current and emerging information and communication technologies to remain at the forefront of the industry in Europe. Forum representative: David O Connell, McAuley Daye O'Connell
Engineers Ireland	Engineers Ireland's BIM Advisory Group drives the professional body's contribution to public policy on digitalisation and productivity in construction. Engineers Ireland holds CPD training courses on BIM across Ireland. Director-General, Caroline Spillane, chaired the National BIM Council which produced the Roadmap to Digital Transition for Ireland's Construction Industry 2018-2021. Contact: Dr. Richard Manton, Engineers Ireland
Leica Geosystems	Lecia is currently working with the Chartered Institute of Engineering Surveyors (CICES), Society of Charted Surveyors (SCSI) and Northern Ireland BIM Steering Group in promoting BIM. Forum representative: John Kerrigan, Leica Geosystems
National Standards Authority of Ireland:	NSAI, Standards is in the process of seeking approval from the NSAI Board to develop a National Annex for I.S. EN ISO 19650-2; approval of this work item is expected in mid-September'19. The development of the National Annex will be undertaken by NSAI/TC 047/SC 22/WG 01 "Guidance for implementation of I.S. EN ISO 19650-2". Currently, three national BIM experts are contributing to three Working Groups/Task Groups under CEN/TC 442 (Building information modelling): • BEP and EIR (WG 3/TG 2); • Infrastructure (WG 6); and • Support data dictionaries (WG 4). Forum representative: Patrick Hayes, NSAI, Standards

Table 2 continued

Group	Outline Description and Contact Point
Public BIM (PB)	The PB hosted a Hackathon from the 10th -12th May that promoted Open BIM. The Hackathon was a great success with 13 teams entering, each with innovative solutions. There will be four follow-on workshops in the autumn. The PB will advise the Construction Sector Group (CSG). Forum representative: Mary Flynn, Dublin City Council
Revit Users Ireland Group (RUIG)	The RUIG which is a multidisciplinary "Community of Innovators," meets once every quarter, sharing information, ideas, tips, and tricks, to promote the more efficient use of Revit and related BIM tools across the disciplines, exploring ways to improve collaboration. The goal is to establish Revit users in Ireland as world leaders in the implementation of BIM. Forum representative: Ralph Montague, ARCDOX
Royal Institutes of Architect Ireland (RIAI)	The RIAI has released a BIM Pack that provides a set of comprehensive advice notes and templates for organisations and individuals considering undertaking a project in BIM. All documentation has been prepared for compliance with PAS1192 standards published by the British Standards Institute (BSI) and guidance documents by the CIC. The materials cover all project stages, including briefing, pre-contract submissions, appointment, and post-contract documentation leading to handover. The RIAI aims to release BIM guidance documents for small practices, and Handover Strategy, which is being prepared for release in 2019. Forum representative: Michael Earley, Dublin Airport Authority
Society of Chartered Surveyors Ireland (SCSI)	The SCSI working group is planning to create guidance material to assist in how model information will need to be customised to ensure the QS can use the data. The Society is in the process of reviewing the RIAI BIM Pack regarding establishing potential synergies. Forum representative: Dr. Avril Behan, TU Dublin
Transport Infrastructure Ireland (TII)	The Metrolink project post public consultation phase is preparing for Railway Order (planning permission) for submission Q2 -2020. A LUAS depot extension project to include office accommodation is being initiated and will be delivered in BIM. An etenders Contract notice was issued in late June to provide a Common Data Environment Solution for the MetroLink project. with further potential TII projects. (The contract has a 120 month -10 year duration). The Dunkettle interchange project has being design led by Jacobs in BIM. The project is held at a procurement project gate stage. Forum representative: John Duffy, TII
Women in BIM (WiB)	WiB is an organisation that aims to draw together women in key strategic positions relating to technology and architecture and allow a portal for shared information and interaction. WiB has launched a database of women around the world who work in BIM. Forum representative: Emma Hayes, Digital Built Consultants

Insights into BIM Implementation in Ireland

The BIM in Ireland research team applied the WEF 2018 BIM Adoption Circle of actions designed to accelerate the adoption of BIM in international markets. This framework was discussed previously in the Global BIM section.The WEF report identified actions that companies, industry bodies and governments could take responsibility for to accelerate BIM adoption and better capitalise on delivering better project outcomes (see figure 4). Specific activities are further delineated in twenty-seven actions with responsibility apportioned to each of the following stakeholders 1) Companies 2) Industry bodies and 3) Government.

A total of six representatives from each of the above stakeholder groups were targeted. The sample consisted of senior/middle management who had a particular responsibility, knowledge and interest in the digital transformation of the Irish construction industry. Table 4 is a summary of the organisations that participated in the survey.

Table 3 High Level Actions

Pillars	ActionsOrganisation
Motivation	Articulate BIM's benefits across the entire lifecycle. Think of BIM as a value creator, not as a cost factor. Approach BIM as the essential first step to IU digitization.
Collaboration	Use integrated contracts and redefine risk-return mechanisms. Set up early collaboration and communication among stakeholders. Establish data sharing standards and open systems.
Enablement	Establish BIM skills along the full value chain. Change behaviours and processes, not just technologies. Make a long-term commitment and support innovative financing.

Table 4 Participant organisations

Category	Respondent
Company	Arcdox Undisclosed BAM Ireland Undisclosed Ardmac Varming Consulting Engineers
Industry Bodies	Construction Industry Federation Engineers Ireland Society of Chartered Surveyors Ireland Association of Consulting Engineers of Ireland Royal Institute of Architects in Ireland
Government	Department of Housing, Planning and Local Government National Standards Authority of Ireland Dublin City Council Transport Infrastructure Ireland Irish Water Grangegorman Development Agency

"Successful BIM adoption requires a high level of collaboration among stakeholders. Steps toward that include increased use of integrated contracts and open standards for data sharing. Adoption also requires a coordinated effort to attract new talent with digital and BIM skills, upskill existing workers, and changing corporate cultures to support new processes. As major owners of built assets, governments must make a long-term commitment to the technology by piloting it in public works projects and creating regulations conducive to its acceptance, including backing innovative forms of financing."

World Economic Forum, 2018

Insights into BIM Implementation in Ireland continued

"Yes to articulating the benefits of BIM and seeing BIM as a value creator. DHPLG priorities would be foremost to address housing, building standards and planning needs, including prioritising the delivery of housing with value for money and efficient programme to address the current urgent national housing crisis'."

"Education, CPD events, seminars etc so that people start to become comfortable and familiar with BIM as BIM can be daunting for non-bimmers or people on the periphery."

"Standardised government led guidelines are needed to support the implementation of any BIM mandate to ensure its adoption consistently, otherwise its adoption becomes fragmented, confusing to the industry and by default loses any potential value from the mandate intent."

The respondents were broadly asked to comment on the WEF BIM Adoption Circle looking at their motivation, collaboration, and enablement framework and how they might make changes to these implementation tactics.

In respect to the motivational pillar, half of the respondents suggested changes to the three broad actions but no change was specified. Regarding the collaboration and enablement pillar, it was found from the feedback that the three measures presented in the model will need to be refined further. It was evident amongst all three pillars, from the respondents, that the government needs to play a critical role in driving the adoption of BIM in Ireland by encouraging collaboration through incorporating BIM practice in future government public works and upskilling in BIM workflows and technologies. Respondents were also of the opinion that the government needs to commission an entity to manage the digital transition programme and sustainably fund the NBC Roadmap moving forward.

The second phase of the survey involved presenting to the respondents a more detailed breakdown of the twenty-seven actions together with how the WEF envisaged the particular stakeholder taking responsibility for those actions.

It is clear from the feedback that there was a broad agreement concerning the WEF actions envisaged in 2018; however, a more comprehensive consultation process would need to be carried out to refine the steps and better identify the responsibilities for those actions. Respondents were clear in their feedback that no action plan will have 'teeth' unless the programme is funded and managed by a central entity.

While the sample selected in this study was relatively small, the results show that there is broad agreement on the applicability of the implementing the WEF model in Ireland but that there would need to be further refinement by whichever organisation is given the task to produce such an implementation programme.

The role of each of the stakeholders should not be underestimated, and it will take a coordinated effort to put in place a robust implementation plan for an order to be brought to the formal introduction of BIM in Ireland. It is also crucial that any such implementation plan should be compatible with the vision and objectives set out in the 2017 National BIM Council of Ireland Digital Transition Roadmap (2018-2021).

The second phase of the survey involved presenting to the respondents a more detailed breakdown of the twenty-seven actions together with how the WEF envisaged the particular stakeholder would take responsibility for those actions.

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Government BIM Adoption

In Ireland, the first formal reference to BIM was included in a 2013 Forfás report which focused on Ireland's Construction Sector[56]. Specific mention was made of BIM in the report as an advanced technology that will ensure increased competitiveness and innovation in the sector. This was followed in 2014 by the Construction 2020 Strategy which aimed at restoring a properly functioning, sustainable, and dynamic construction sector, operating at an appropriate level for the size of the economy[57] . The report outlined two specific actions which included implementing a BIM staged development programme to support companies advancing to level 2 BIM capability, which subsequently led to the development of the BIM Enable and BIM Implement support programmes for Enterprise Ireland clients.

In January 2017, the government launched its Action Plan for Jobs 2017. A particular action flowing from this plan included a requirement for the Office of Government Procurement and Enterprise Ireland to prepare a strategy for the adoption of BIM across the public capital programme and to mandate how it is to be adopted.

Table 5: Timeline for Public Sector BIM Adoption
(Figures below relate to months)

Dept./Body	Sub Sector	Band 5	Band 4	Band 3	Band 2	Band 1
Ag. & Marine		–	–	–	+36	+18
Defence		–	+18	+24	+36	+48
Education	Primary	–	+18	+24	+36	+48
	Secondary	–	+18	+24	+36	+48
	Third Level	–	+18	+24	+36	+48
Health	HSE	+12	+18	+24	+36	+48
	Vol. Hospitals	+12	+18	+24	+36	+48
Housing	Housing	–	+18	+24	+36	+48
	Non-Housing	+12	+18	+24	+36	+48
OPW	Heritage	+24	+30	+36	+48	–
	Flood Risk Management	–	–	–	+36	+18
	New Build	+12	+18	+24	+36	+48
Transport	Rail	+12	+18	+24	+36	+18
	Road	+12	+18	+24	+36	+18

BIM Level 1

BIM Level 2

[56] Forfás, (2013), Ireland's Construction Sector: Outlook and Strategic Plan to 2015.
[57] Government Publications, (2014), Construction 2020, A Strategy for a Renewed Construction Sector, published by The Stationary Office, May 2014.
[58] Government Publications, (2017), Action Plan for Jobs, published by the Stationary Office, May 2017.

Government BIM Adoption

across the public sector[58]. Following consultation with public bodies engaged in public works projects, the government Construction Contracts Committee (GCCC) prepared a position paper in 2017 for the purposes of inviting responses from industry. Titled A Public Sector BIM Adoption Strategy, it outlined the context and rationale for the adoption of BIM on Irish public works projects and put forward a proposed timeline for adoption, ranging from 12 - 48 months, for projects to adopt BIM. The strategy recognised five different project types which represent the disparate project types procured across the public service. Band 1 represents projects with straightforward operation and maintenance requirements, while Band 5 represents complex projects with a specialist operation and maintenance regime. These requirements were subsequently enforced through the government's Strategy to Increase use of Digital Technology in Key Public Works Projects.

The government strategy has a two-fold objective, firstly to manage the adoption of BIM in an orderly fashion across the public capital programme, reducing the disruption that such change processes can bring both within the public sector and to the consultants and contractors that are engaged there under, while the second objective is to act as a catalyst for its wider adoption across the industry.

Despite no strategic funding being provided to-date from the government, some public sector organisations, such as, the Grangegorman Development Agency, Dublin City Council, Transport Infrastructure Ireland, Office of Government Procurement, Irish Water, Office Public Works, National Development Finance Agency, amongst others, all continue to embrace BIM albeit in an unregulated environment. Above all what is needed is a national support programme for public sector clients, such as the programme adopted by the Estonian government that was outlined earlier in this report.

BIM Standards and Certification

In January 2019 the ISO 19650 standard was released which represented a standardised approach to using BIM for the delivery phase of assets. The standard contains all the same principles and high-level requirements as BIM Level 2 and is closely aligned with the current UK 1192 standards. The first two international standards of the series are

- IS EN ISO 19650-1: Organization and digitization of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Concepts and principles

- IS EN ISO 19650-2: Organization and digitisation of information about buildings and civil engineering works, including building information modelling -- Information management using building information modelling: Delivery phase of the assets.

One of the key recommendations within the NBC Roadmap was to specify training, educational, and certification support initiatives to develop the core BIM capabilities of the industry. The Roadmap suggested that government, the NSAI, and other recognised institutes develop industry training and certification programs around current best practice standards. In response, NSAI has now developed a BIM certification program[59]. This is aligned with the publication of IS EN ISO 19650 parts 1 and 2. NSAI will also develop a proposal to establish a National Annex for I.S. EN ISO 19650-2 which will be submitted to the NSAI Board for approval. The development of the National Annex will be undertaken by NSAI/TC 047/SC 22/WG 01 "Guidance for implementation of I.S. EN ISO 19650-2".

NSAI now offers third-party certification to IS EN ISO 19650 part 2. The certifications scheme is being provided to three main categories of organisations: Employers, Designers, and Contractors. All applicants must be able to demonstrate that they comply with the appropriate duties and responsibilities for their activities as set out in ISO 19650. An organisation may apply for one, two, or all three roles providing that they can demonstrate application as appropriate. The audit process will broadly follow other similar management system certifications with a stage 1 and stage 2 registration process followed by annual surveillance and three-year reassessment.

> "Organisations that have already aligned to the UK 1192 series should have a smooth transition. This is because the UK 1192 series is at the heart of the international standard. However, some organisations think they have aligned with UK 1192 series, but they may have not interpreted it correctly. ISO 19650 is more usable and the responsibility assignment is clearer."
>
> Paul Shilcock (2017),
> Managing Director Operam, BIMIreland.ie

[59] http://www.bimireland.ie/2019/04/17/nsai-to-deliver-bim-certification-scheme/

BIM Standards and Certification

BRE also offers a certification pathway scheme for individual BIM certification, which is continually validated through ongoing appropriate BIM training criteria and third-party assessment through a combination of audit and CPD requirements.

BRE BIM Level 2 Business Systems Certification assesses business capability to utilise advanced 3D modelling tools and ensure that the standards, methods, procedures, skilled staff and infrastructure are in place to meet the requirements of PAS 1192-2:2013 and Section 4.2 table 8 of the PAS 91:2013 prequalification questionnaire document. Other prestigious BIM certifications include BSI Kitemark and Lloyds.

There is ongoing work by professional bodies which are in the process of adopting current BIM templates to meet ISO requirements, as well as investigating how an Irish scope of services could be aligned with those described in the standard. Some of the organisations within Ireland to achieve BIM Certification include RPS, Roadbridge, SISK, BAM, Jones, TJ O Connor and Associates, John Paul Construction, Mercury, McEvoy Group, Scott Tallon Walker, MAC, BDP, amongst others.

Higher Education

Ireland's HEIs continue to respond to a demand by industry for BIM related training. A sample of programmes titles, modes of delivery, and levels reported by Irish HEIs are listed in Table 6 below.

Table 6 BIM Programmes in Ireland

HEI	Title of Programmes	Mode of Delivery
Athlone Institute of Technology (IT)	BIM modules incorporated into all four years of the Quantity Surveying (QS) course and some of the Civil Engineering programme.	Full Time
Cork IT	• BSc (Hons) in BIM & Management (BIM+M) • Cert in BIM Technologies / Cert in MEP BIM Applications • BIM enabled interdisciplinary project module/ Various BIM modules exist on the Architerural Technology (AT) Civil Eng (CE), Structural Eng, Construction Management (CM) and QS courses	Full Time
Dundalk IT	• 8 Week PT Industry-Related BIM / Revit Course • BIM Modules embedded into the AT,CM & Building Surveying Courses.	Part-Time & Full Time
Galway Mayo IT	• Higher Diploma in Engineering in BIM • BIM Modules incorporated into the AT, CM, QS and Economics, and CE courses.	Part-Time & Full Time
IT Carlow	• Level 9 Certificate in BIM and Construction Project Management • BIM Management module on the MSc in Management in the Built Environment	Part-Time & Full Time
IT Sligo	• PG Cert in BIM and Lean Construction Management • BIM modules on the PGD/ MSc in Project Management (PM), BSc Hons Construction Project Management (CPM), BSc CM, BSc / BSc Hons QS (All PT) • BIM modules on the BEng/ BEng (Hons) CE, BSc Hons CPM, BSc / BSc Hons QS, BSc Hons CPM and Applied Technology, BSc Advanced Wood and Sustainable Building Technology (All FT)	Part-Time & Full Time
IT Tralee	• Certificate in BIM with Revit	Part-Time
Letterkenny IT	• Certificate in BIM (Revit) / Certificate in 4D BIM (Navisworks) • BIM Graphic Communications module • Integrated BIM Project module	Part-Time & Full Time
Limerick IT	• CM and BIM module in year 2 on the BSc (Hons) CM and BSc (Hons) CE Management Degrees. • BIM with Revit Architecture	Full Time
Ulster University	• Common 1st year module delivered to QS, AT, Construction Eng, Energy, Building Surveying, Architectural Eng CE and Safety Eng • Collaborative BIM learning takes place in year 2 of the QS and AT • Postgraduate modules within the MSc in Construction Business and Leadership include salient BIM implications.	Full Time
University College Cork	• MEngSc in Information Technology in Architecture, Engineering, and Construction	Full Time
University City Dublin	• BIM based design module for undergraduate Civil Engineers and Architects	Full Time
Technological University Dublin	• MSc in applied BIM & Management / Postgraduate Diploma in Collaborative BIM / Postgraduate Certificate in BIM Technologies • BIM Modules on the AT, QS, M&E, and CE courses. BSc (Hons) in BIM (Digital Construction)	Part-Time & Full Time
Trinity College Dublin	• BIM modules on the MSc in façade Eng. and third year on the Bachelor Programme in CE.	Full Time
Waterford IT	• Higher Diploma in Science in BIM • BSc in Architectural Technology / BSc [Honours] in Architectural and BIM Technology • The WIT School of Enginering has developed a suite of modules at various levels	Part-Time & Full Time

> Demand for computing and engineering graduates will increase rapidly in the coming years, driven by the continuing growth of the technology sector."
>
> Expert Group on Future Skills Needs (2018)

> Introducing anything digital to young people, in the age of smartphones and online collaboration, is destined to be successful. I believe that all young people are highly capable of operating in the digital world as they progress through school towards employment, so giving them the tools to do it now can only reap rewards in the future."
>
> Allison Watson OBE (2017)
> Class of Your Own, BIMIrleand.ie

There has been a surge in research within the domain of BIM since 2017 with a number of Horizon2020 projects commissioned. The Horizon 2020 BIMcert project aims to develop more efficient and relevant training programme materials that integrate concepts of sustainability and renewables with practical application and integration with technology, as based on real-life industry needs and limitations. The consortium (including Irish partners TU Dublin, Belfast Met, Future Analytics Consulting and CITB) put forward a proposal to enable the development of a method, materials and micro accreditation for upskilling across the construction supply chain to allow BIM techniques and technologies to be utilised to address energy efficiency requirements. The BIMcert online training platform will be launched in October of this year[60]. Limerick IT is involved in the Horizon 2020 BIMZeED project, which intends to create new educational content and resources to address critical knowledge and skills gaps in the field of BIM and net zero energy buildings (NZEB)[61].

Currently GMIT leads the National Forum for the Enhancement of Teaching and Learning for the BIM Futures Project which aims to develop a competency framework and suite of learning resources for academic staff, students, and industry stakeholders[62]. UCC is developing a BIM-based toolkit for efficient renovation of buildings under the BIM4EEB project which aims to support designers in the design and planning phase. DCU has made funding available for a Postdoctoral Scholar to investigate how Industry Foundation Classes can be used for digital planning and building regulation control submissions. UCD have ongoing BIM based research initiatives in Model View Developments (MVDs) for building energy management and thermal comfort analysis, as well as building control systems. TU Dublin continue to investigate a number of BIM focused research themes including synergies with Blockchain and maturity frameworks .The original BICP team from TU Dublin, Trinity College Dublin and CitA also continue to carry out important research on the maturity of BIM in Ireland.

A significant milestone for BIM education in Ireland is the awarding of a gold medal in the first ever BIM Worldskills 2019 competition to a team consisting of students from TU Dublin and Waterford IT students.

A crucial milestone in the NBC Roadmap is for the inclusion of Digital Design and Construction in the second-level curriculum. A successful international example of this has been the Class Of Your Own and Built Environment Information Modelling Craft (BeIMCraft) initiatives. A Class of Your Own delivers the Design Engineer Construct Learning Programme, an accredited learning programme for secondary-school-age students. The programme develops vital skills such as research, understanding context, generation of ideas and development of solutions through to final modelling, an understanding of materials, as well as an insight into post-construction management and behaviors[63]. BeIMCraft, based on the globally successful Minecraft platform, has been created by Ulster University academics, in conjunction with an external consultant, to help young people better understand the built environment. BeIMCraft is a modification of the existing Minecraft platform and closely aligns to aspects of the BIM process, as it allows the players to become comfortable working in a 3D environment, appreciate how costs can be assigned to the asset and think about timings, site constraints and aspects of sustainability[64]. The Irish Construction Industry can take the learnings from Class of Your Own and BeIMCraft to help in targeting the skills shortage in the industry.

[60] https://energybimcert.eu/
[61] http://bimzeed.eu/
[62] https://bit.ly/2JCmC80
[63] Class of Your Own (2019) <https://designengineerconstruct.com/>
[64] Beimcraft (2019), available athttps://www.beimcraft.com/

Industry Feedback

The BIM in Ireland Research Team released a survey in June 2019 to capture the opinions of persons who have a particular responsibility for BIM in Irish architecture, engineering, construction, and facility management businesses. A total of 33 organisations responded to the survey (50 individual responses). The key findings from the survey included that 92% of the respondents reported they had seen an increase in the importance of BIM as an improvement tool deployed by their business in the past few years. Some of the reasons for this included more engagement by the client and a better understanding of the benefits of BIM as a construction tool. BIM has now become a deliverable on large scale projects with contracts mandating that subcontractors are BIM capable. Respondents reported that BIM is becoming more common to use on projects with additional benefits now being realised, such as for take offs, scheduling and asset management.

50% of the respondents claim that they have sought or secured BIM certification in recent years. The most popular answers included respondents who were either fully certified or in the process of obtaining NSAI ISO Certification, BRE BIM Level 2 certification, and BSI Kitemark. Many of the respondents were in the process of seeking ISO 19650 accreditation.

When asked what particular BIM protocols or standards does their company currently deploy, the overwhelming response was PAS 1192 with specific reference to the CIC BIM Protocol. A number of respondents stated that they were using the RIAI BIM templates.

54% of the respondents confirmed that their organisation had been influenced by the Roadmap to Digital Transition for Ireland's Construction Industry 2018 – 2021. Some of the positive comments included that organisations are using both the timeframes and the principles underpinning the Roadmap for the implementation of their BIM strategy. Other remarks noted that the Roadmap is used as a reference point for internal strategies and to inform management on what way industry is moving. The Roadmap has also helped to add additional focus on the skills that employees require if they are to be involved in BIM projects.

A number of comments voiced the concern that the Roadmap has stalled as many of the target dates for each of the tasks listed under the pillars have passed with little notification to the industry of any progress being made. There is a fear that this will render the Roadmap irrelevant if it continues to keep missing targets.

The questionnaire also sought to identify which projects are using BIM technologies and processes within the respondent's organisation. A number of organisations which responded to the survey stated that while they were using BIM technologies and processes on many projects, they did not have permission to divulge this information. A number of data centres, pharmaceutical, and public works sector projects were reported as adopting BIM by respondents. A number of respondents provided an honest assessment of the struggles which they have experienced in working in an environment that is effectively unregulated.

Participating Organisations

Ardmac
Arcdox
Asgard Cleanroom Solutions
BAM Ireland
Carroll Estimating
Cundall
C+W O'Brien Architects
Dublin City Council
Dublin City University
Engineering Documentation Ltd.
Glan Agua
Grangegorman Development Agency
HSE Estates
Henry J Lyons
Irish Water
J. B. Barry And Partners Limited
JJ Rhatigan & Co
John Sisk & Son
Kirby Group Engineering
Leica Geosystems
Linesight
LMC Group
Malachy Walsh & Partners
McCauley Daye O'Connell
ORS
O'Brien Finucane Architects
Pentagon Solutions
Quinn Architects
Roughan & O'Donovan
Taylor McCarney Architects
Transport Infrastructure Ireland
William Farrell Ltd.

"Everything we do involves BIM."

Ralph Montague,
Arcdox Director

Industry Feedback

"…it all fell apart when senior members of the other consultancies resorted to exporting revit views to AutoCAD and reverting to the old way of doing things, even hand sketched markups were used and issued for construction in some cases. It was at this point that the missed opportunities for efficiency and design coherence became glaringly obvious and it was very frustrating as it seemed that the obstacles and shortcomings in BIM experience could have been easily overcome if the mindset of senior decision makers in the extended design team hadn't been so resistant to change."

John Buckley,
Quinn Architects
Architectural Technologist / BIM Manager

"Both building information modelling and management has been used to improve a large number of our processes, including but not limited to: increased coordination; a reduction in the number of RFIs received; improved quality of information and a reduction in the time required to deliver this information; enhanced communication; an increase in automation; and so on."

David Lamon,
BIM Manager
C+W O'Brien Architects

Organisations that provided specifics included Cundall who have adopted a practice-wide BIM strategy to assist them in producing world-class projects, such as, the Palatine Centre, Two Snowhill in Birmingham and the International Convention Centre Sydney. Grangegorman Development Agency is using BIM processes on their 09AH Academic hub, 08WQ West quad, 29LH Lower house, and 07E2 Energy center. DCU Estates Office intends to support academic areas of the university by delivering state-of-the-art innovative living laboratory spaces as part of the new FutureTech Building capital project.

Also, DCU's Masterplan project, which has specific BIM requirements, should support and help embed organisation efficiency, safety, security, and sustainability as a critical driver in its operations.

Trinity College Dublin used BIM, linked to its FM operations, on its recently opened Trinity Business School and the Printing House Square and E3 Learning Foundry projects currently under construction.

BAM are using BIM to deliver Bolands Quay, which will provide three new landmark buildings and converted existing buildings providing residential, retail and cultural space. BAM is also applying BIM processes to deliver Horgan's Quay Development, a significant rejuvenation scheme which includes 3 office blocks, apartments built across 4 blocks and a hotel with a rooftop restaurant. Other projects that BAM are applying BIM technologies and processes to in Ireland include the National Children's Hospital and Satellite Centres, Ireland Museum of the Future, Brewery Quarter Development, Vartry Water Supply Project in Wicklow, M25 Bridge and the Visual Control Tower in Dublin.

Henry J Lyons are using BIM for a number of their office developments, as well as the Cherrywood Town Centre development which represents a €2 billion investment that will turn a dormant site at Cherrywood in South Co. Dublin into a substantial and largely self-contained suburb.

ORS have been using BIM in a phased manner over the past two years and have adopted collaborative BIM processes on a warehouse in Huntstown and for a refurbishment project for the HSE in MRH Portlaoise. This has led to an expedited shop fabrication process for the contractor due to the level of detail, which was shared for co-ordination purposes.

BIM has been utilised for preliminary options by Arups on the TII Metrolink. It is expected that the Metrolink Technical design phase will see a heavy focus on BIM.

The Kirby Group was responsible for the installation and commissioning of all mechanical and electrical services for the Pilot Plant and BIM Ring Facility in Dublin. The Kirby Group implemented 3D BIM co-ordination, which ensured successful project delivery.

O'Brien Finucane Architects are using BIM capable software to deliver the drawings and models for the renovation and extension of St Michaels College to help better understand the client's requirements.

Ardmac reported that they are using AR technology to manage asset information related to a BIM model.

Organisations such as Malachy Walsh and Partners, Arcdox, McCauley Daye O'Connell stated that they use BIM despite it not being requested on projects due to its associated benefits. Quinn Architects and C+W Architects also stated that they are using BIM for a number of projects despite no requirements.

Further BIM activity within Ireland was highlighted at the Irish Construction Excellence Awards with 6 projects competing for best BIM project.

These included John Paul Construction for their Sir John Rogerson's Quay project where the Client chose to use the BIM processes.

The BAM managed Waterford Courthouse BIM Level 2 Project and Mace's Clonee Data Centre, which won the Best Large BIM Project in the world at the Autodesk excellence awards.

Other projects included the Glan Agua managed Kerry Central Water Treatment Plant which was one of the first major projects in the Irish water industry to implement BIM fully, integrating it into all aspects of the project, from design, through construction and into operations.

Midland Steel Reinforcement Supplies Ltd were involved with Wembley Pink Car Park, where they provided a fully BIM Level 2 compliant reinforcing steel deliverable during this project.

The final project was Sisk and Son (Holdings) Ltd Curragh redevelopment, which introduced a '4D Virtual Reality' environment, enabling them to plan and sequence their works in an immersive space[65].

> "The importance of BIM has increased first and foremost as it has become a deliverable on large scale projects. This has added increased incentive to our business by making "BIM as usual" in Ardmac . This allows us to add value to the client's deliverable if the project is not a BIM project."
>
> Tom Noctor,
> BIM Manager
> Ardmac

> "Educational institutions are key to the future development of BIM diffusion."
>
> John Bennett,
> Autodesk

[65] http://iceawards.ie/finalists-2019/#14

CitA
Construction IT Alliance

Ireland's BIM Macro Adoption Study

BIM Maturity in Ireland

Beckett Locke Aparthotel
C+W O'Briens Architects

Cookstown Crescent
C+W O'Briens Architects

Ireland's BIM Macro Adoption Study

This section details research recently undertaken by the BIM in Ireland research team in applying BIM Macro Adoption models developed by Dr. Bilal Succar (AU) and Dr. Mohamad Kassem (UK). These conceptual models have been utilised to measure macro BIM adoption across the world in recent years.

Given that the NBC Roadmap is industry-led and the government's digital strategy for the construction sector had not provided any clear guidance to-date, it was intended that the Macro BIM maturity model would assist in understanding any limitations that a lack of funding has had on the adoption of BIM.

These models can be used for:

- Assessing a country's current BIM adoption policy;
- Comparing the BIM maturity of different countries; and
- Developing a national BIM adoption policy.

The same 19 persons from a similar 2017 study were targeted to complete the Macro Adoption Study, which formed part of a BIMe [66] Initiative along with 7 new respondents who are actively involved in BIM. A total of 12 persons completed the study. This section will explore the results and compare them with the findings from 2017.

Model A: BIM Diffusion Model

The macro-adoption model clarifies how BIM field types (technology, process, and policy) interact with BIM capability stages (modelling, collaboration, and integration) to generate nine areas for targeted BIM diffusion analysis and planning. The 2017 results showed that Ireland was mature in modelling processes and model workflows, but it was weak with regards to collaboration processes and policies. Table 7 details the results from 2017 in comparison to 2018.

The BIM diffusion model for 2019 (Figure 12 and Table 7) signifies that Ireland has experienced a steady increase in both collaboration and integration for process and policies.

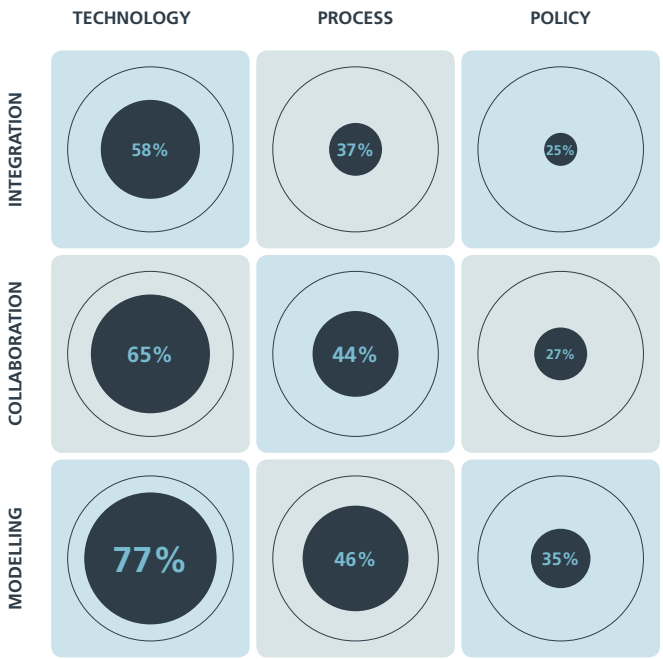
The maturity studied in this research focused on markets and not projects, teams, organisations, or individuals. Specifically, the study looked at the levels of "adoption and diffusion" of BIM in Ireland.

[66] http://bimexcellence.org/

Study Participants

John Bennett, Autodesk
Claire Crowley ,SCSI
Paul Brennan, BAM Ireland
Michael Murphy, BAM Ireland
EmmaHayes, Digital Built Consultants
Calogero Marino, C+W O'Brien Architects
Mary Flynn, Dublin City Council
Barry McAuley, TU Dublin
Alan Hore, TU Dublin
Robert Moore, Grangegorman Development Agency
Barry Kirwan, Ryan+Lamb Architects
Roger West, Trinity College Dublin
John Hunt, Enterprise Ireland

Figure 12: Model A: BIM diffusion areas model for Ireland in 2019



Ireland's BIM Macro Adoption Study continued

> "BIM diffusion within many organisations is being driven by individuals or small groups who are tasked with establishing the necessary operational functions to allow provisions of BIM services. Change management within organisations needs to be carefully planned. It is important to understand how BIM and digital technologies will impact on existing well established work practices before deploying or mandating them across all project teams."
>
> Barry Kirwan,
> Ryan+Lamb Architects

The improvement in policy and processes in regards to the BIM collaboration fields can be partially assigned to the roadmap and government's digital strategy. However, a more significant initiative which has helped in this context is the introduction of ISO 19650. The Irish BIM community previously reported it was comfortable working with the requirements of BS 1192 and the PAS 1192 standards . As these documents have influenced the new suite of ISO 19650 standards, it has resulted in a smooth transition for the Irish BIM community, which has contributed to the increase of this diffusion model.

Model B - Macro Maturity Components Model

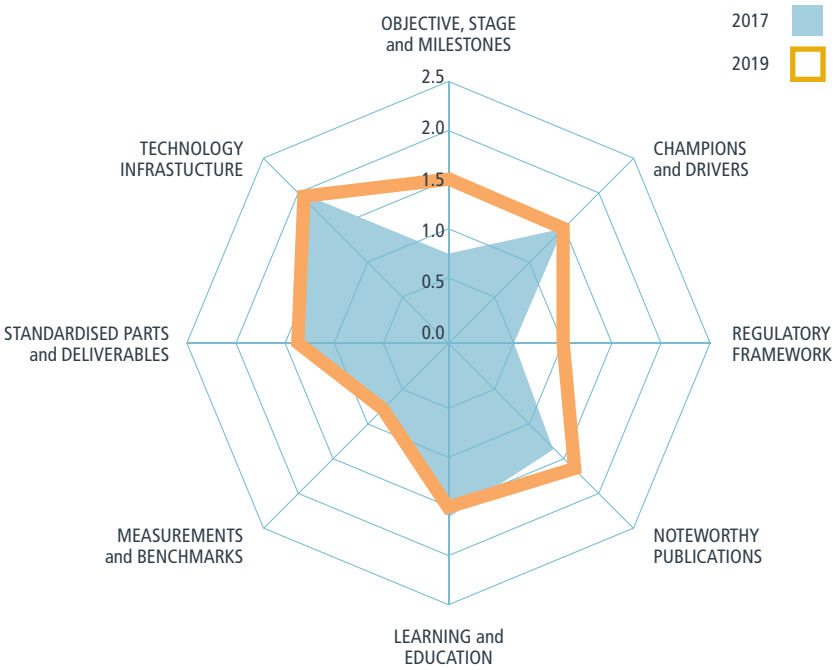
This model assesses the BIM maturity of countries using a comparative matrix or granularity using component-specific metrics. The model includes eight macro components: Objectives, Stages, and Milestones; Champions and Drivers; Regulatory Framework; Noteworthy Publications; Learning and Education; Measurements and Benchmarks; Standardised Parts and Deliverables and Technology Infrastructure. Figure 13 illustrates Ireland's estimated current maturity within each area.

Compared to 2017, Ireland has seen moderate growth in the majority of components. The most significant increase has come within the objectives and milestones, regulatory framework, and noteworthy publications. In 2017 concerns were raised that unless a statutory requirement for BIM is promoted from within the government, then these critical areas would stagnate or regress. The roadmap, government's digital strategy and ISO publications have all played a part in elevating these figures. While other statistics have not significantly grown, they remain stable. Ireland's technology and infrastructure continue to attract foreign investment with Project Ireland 2040 firmly placed to support businesses and communities across all of Ireland in realising their potential. Learning and education remain active with ongoing strong commitments to digital construction evident within leading third level educational bodies. This commitment is fundamental as the Irish construction industry now faces an unprecedented skills shortage that could potentially impact on the proposed Project Ireland 2040 targets.

Table 7 BIM diffusion 2017 vs. 2019

	Techno -logy (%)		Process (%)		Policy (%)	
	17	19	17	19	17	19
Integration	42	58	21	37	13	25
Collaboration	58	65	35	44	23	27
Modelling	76	77	45	46	27	35

Figure 13: Model B macro maturity components model for Ireland for 2017 and 2019



"Large organisations are the main driving stakeholder group in Ireland currently. Government are concerned with specifying the use of BIM due to perceived competitiveness issues."

Michael Murphy,
BAM Ireland.

Ireland's BIM Macro Adoption Study continued

Model C - Macro Diffusion Dynamics Model

This model assesses and compares the directional pressures and mechanisms affecting how diffusion unfolds within a population. The model includes three diffusion dynamics: top-down; middle-out, and bottom-up. The model also is augmented by three pressure mechanisms: downwards, upwards, and horizontal. Results are similar to those of 2017, which suggest again that Ireland's diffusion dynamic is middle-out, meaning that larger organisations or industry associations are pushing the BIM agenda within the industry and not the government (Figure 14). As the government has not provided strategic funding to-date or guidance documents to assist with BIM implementation, coupled with the roadmap being an industry-led initiative, has resulted in this model remaining static. This is concerning considering that unless adequate funding is provided to back up the government's digital strategy, it may risk further alienating SMEs within an already demanding and extremely competitive sector.

Model D - Policy Actions Model

This model identifies, assesses and compares the actions policymakers take (or can take) to facilitate market-wide adoption. The model includes three policy approaches, namely Passive, Active and Assertive. These approaches are, in turn, mapped against three policy activities: Make Aware; Encourage and Observe. Table 8 details the results from 2017 in comparison to 2019. Figure 15 illustrates Ireland's current maturity within each area.

In 2017 the policymakers in Ireland were mostly passive, with some evidence of active approaches and with little or no assertive activities. While results are similar in 2019, it is encouraging to observe that the Irish government is now seen as taking a more active approach when it comes to communication. This is evident by recent initiatives such as the establishment of the CSG which ensures that regular and open dialogue between government and industry takes place on how best to achieve and maintain a sustainable and innovative construction sector positioned to deliver on the commitments in Project Ireland 2040. The Public BIM Sector Group have also played a valuable role in educating members of the public sector through workshops and Hackathons.

	Passive (%)		Active (%)		Asserti -ve (%)	
	17	19	17	19	17	19
Communicate	68	55	32	45	0	0
Engage	74	73	21	18	5	9
Monitor	95	82	5	18	0	0

Table 8 BIM policy actions 2017 vs. 2019

Figure 14: Mode C: Macro Maturity Components

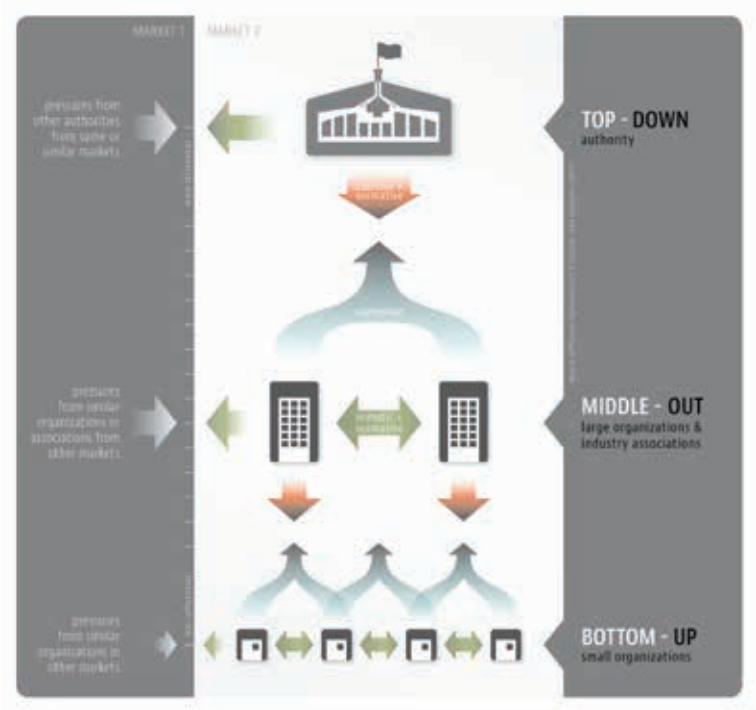
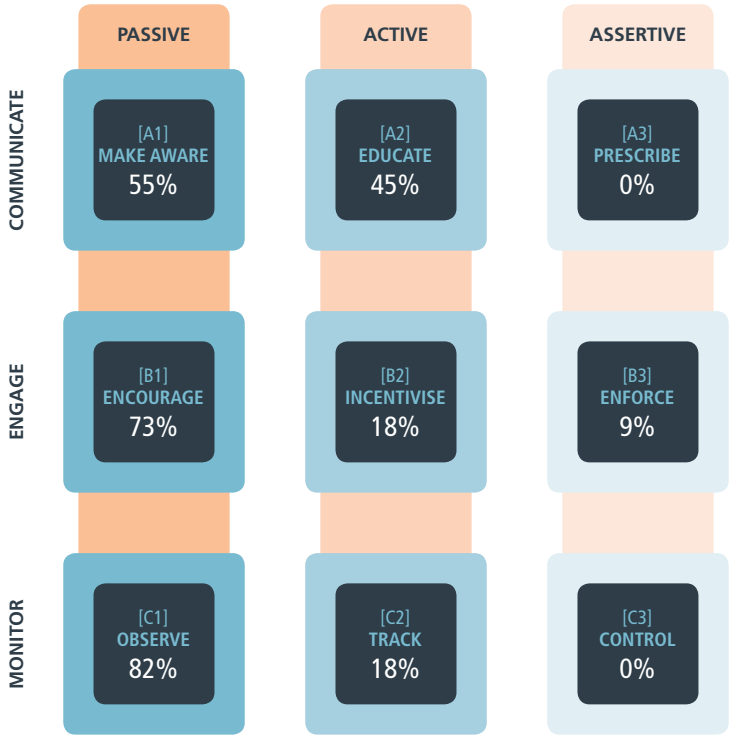


Figure15: Model D: Policy Actions Model

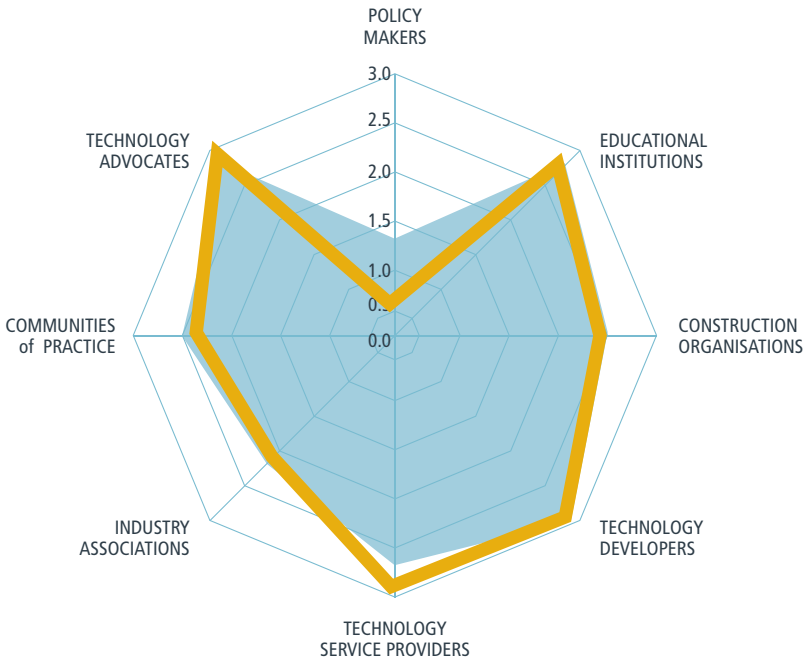


Ireland's BIM Macro Adoption Study continued

Model E - Macro Diffusion Responsibilities Model
This model assesses and compares the roles played by different stakeholder groups in facilitating diffusion within and across markets. The model uses BIM fields to identify nine-player groups, namely: policymakers; educational institutions; construction organisations; individual practitioners; technology developers; technology service providers; industry associations; communities of practice; and technology advocates (see Figure 16).

In 2017 the technology developers were seen as the most influential technology players. However, the developers, service providers and advocates are now seen as co-leaders in this space (within the accuracy of the data). For the policymakers, the educational institutes continue to have much higher BIM diffusion compared to policymakers.
On a concerning note, the survey shows a significant drop for policymakers within this area, which indicates that despite an increase in objectives and milestones, regulatory framework and a move toward an active communication strategy, the industry is looking towards educational institutes for leadership, research and training more than ever. The educational institutes have responded in kind to this, as seen through the growing number of undergraduate and postgraduate BIM courses. There has also been a marked improvement in BIM-related research projects in these institutes. The construction organisations are seen as critical process players. Industry associations and communities of practice are also ranked highly.

Figure16: Model E Macro Diffusion Responsibilities Model



2017
2019

"The National BIM Council Roadmap recommends a strong leadership to drive BIM adoption in Ireland but this has yet to be demonstrated in industry. In my experience BIM adoption is being driven by individual disciplines or stakeholders rather than an industry wide diffusion where there are different levels of maturity."

Emma Hayes,
Digital Built Consultants
BAM Ireland.

Overall Findings

Block F, DCU St. Patrick's Campus, Dublin 9
Taylor McCarney Architects

Overall Findings

The sector continues to show growth and there is an undeniable momentum in respect to the use of BIM in the Irish construction industry.The digital economy is expected to become one of the key growth sectors in the next number of years and the construction industry is primed for the exploitation of digital technologies. Ireland is perfectly positioned as a result of innovative and progressive organisations, technology developers, professional institutes of practice and educational entities to push BIM into this expansive digital agenda. The Roadmap for Digital Transition for the Irish Construction Sector has provided a clear path for this movement and outlines milestones modelled on successful jurisdictions.

This report has documented and celebrated an array of BIM initiatives, activities by BIM champions and acknowledges the vital work which is on-going in the industry in trying to progress the Roadmap.

While a Digital Strategy for Public Works has been announced, there is still a lack of clarification on how it should be executed, coupled with a lack of funding to implement it fully. The Roadmap has set the path for how this digital strategy could be implemented and funding is now essential if significant milestones are to be achieved, such as, the Digital Centre of Excellence, online self-assessment and guidance tools, the National BIM Taskforce, contractual guidance, etc.

There is no doubt that the Irish AEC Sector will continue its drive in pushing BIM, as it is seen as a process that results in not just financial gains but also productivity growth while offering a platform for professionals to collaborate in a less adversarial manner.

Digital technologies are disrupting the way industry works, and if it is to attract the next generation of professionals and seek out better value-for-money for our tax payer it is crucial that government and the industry stakeholders continue to embrace change.

The AEC sector now finds itself at a crossroads, with a push from government required to further advance BIM maturity within the industry. Without this incentive, the industry's digital transition may stagnate. The industry cannot afford to stay static and must advance in line with other jurisdictions with which it must compete globally.

It is encouraging to see that the work of the CSG is well underway and that there is broad agreement that there is a need for a Centre of Excellence for the construction industry that will include a core remit of implementing digital construction throughout all sectors in the construction industry and beyond.

> "The role of each of the stakeholders should not be underestimated, and it will take a coordinated effort to put in place a robust implementation plan for an order to be brought to the formal introduction of BIM in Ireland. It is also crucial that any such implementation plan should be compatible with the vision and objectives set out in the 2017 National BIM Council of Ireland Digital Transition Roadmap (2018-2021)."
>
> Dr. Alan Hore,
> TU Dublin and CitA.

Grangegorman Academic Hub
O'Donnell & Tuomey

The future is BIM, the future is here.

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Capturing the Construction Industry and Academia's response to the increased requirement for **BIM on Irish Construction projects**

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