



# Roadmap to Digital Transition

For Ireland's  
Construction Industry  
2018-2021

**Across the globe best practice use of digital tools combined with collaborative processes are already transforming the way we design, construct, commission and interact with the built environment. As William Ford Gibson put it, “The future is already here, it’s just not very evenly distributed”.**

## **Vision 2021**

Planning decisions are made in days not months with open 3D format models validated by machines for compliance and shared with stakeholders to virtually experience proposals. Design teams have moved from paper silos to digital tools and collaborative platforms and integrated ways of working. Through design, technology is driving productivity down to the manufacture of components and their assembly by robots. The way we select, compare and value construction products and systems continues to be disrupted at tremendous pace as global sourcing, mass customization and comparable, interoperable information liberates choices.

The programming of tasks and trades can be recorded, analysed and communicated at intricate levels of detail. Complemented on-site by complete and accurate information that resides in the hands of the right people when they need it. The result is that delivery programmes for new buildings have been reduced by months and in some cases years. Schedules for the procurement, delivery and location of required materials, products and components sit on a series of connected mobile devices.

Both public and private clients, from Ireland and overseas and across all sectors, are using information contained within the digital models of their built assets, not only to improve the performance of their buildings or infrastructure but to improve the performance of their businesses. On highways and railways, vehicles and passengers are experiencing fewer delays through the more precise programming of works and the intelligent incorporation of smart technologies into design models before deployment. Improved pupil performance is achieved through better teaching environments in schools where exemplary designs are captured, transferred and repeated.

In hospitals, better patient outcomes are achieved by integrating sensor data into buildings. There is less operational downtime on the shop floors of advanced manufacturers. Retail outlets are adapting floorplans and layouts to optimize €/m<sup>2</sup>. The performance of homes and offices are becoming more advanced to respond to user needs and climatic conditions.

The future of our built environment is “connected”, well planned and well-designed urban communities that leverage all of this smart data to enhance the human experience. The future “internet of buildings” starts with the way we produce and manage information today.

All aspects of the 2021 vision exist today and most of them already exist in Ireland. In many respects, the last twelve months has taught us that the identification and alignment of key stakeholders, simply “connecting the dots”, will be a key requirement for an effective transition.

The roadmap is a summary of consultation, discussion and review through collaborative process to better understand how Ireland’s construction sector can progress to digital. Expressed in terms Mr Gibson might use, “how we might more evenly distribute the future, today”.

(National BIM Council 2017)

<sup>1</sup> Mass customization is a manufacturing technique that combines the flexibility and personalisation of custom-made products with the low unit costs associated with mass production.

# Foreword

The construction industry continues to be a significant contributor to our national economy with one in ten jobs in Ireland employed by the sector. Many of our indigenous Irish construction businesses are increasingly competing for work internationally and have a reputation across the globe for delivering world class projects.

Like most sectors in today's working world these businesses are challenged to work in an increasingly digitised world with sophisticated demands from intelligent clients. This digital transition is particularly evident with the rapid development and adoption of Building Information Modelling (BIM) across the globe.

The Irish government recognises the importance of BIM and sees the benefit of how it brings together technology, process improvements and digital information to radically improve project outcomes and asset operations. We see BIM as a strategic enabler for improving decision making and delivery for both buildings and public infrastructure assets across the whole lifecycle.

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.

The production of this report is very timely. The Government has accepted the Government Contracts Committee for Construction's (GCCC) recommendation for the adoption of BIM across the public capital programme. A direct response to the growing challenges faced by government and public clients to stimulate economic growth and competitiveness while delivering value for public money.



The convergence of the EU BIM Task Group handbook release, the Government mandate and the NBC roadmap present Ireland with an opportunity to become leaders in industry adoption of BIM – implementing common standards and guidelines into common practice.

The Irish Government recognises the important work of Enterprise Ireland and the wide industry support they have received in promoting BIM in Ireland, delivering on their responsibilities as set out in the Construction 2020 Strategy and in the more recent Action Plan for Jobs 2017.

Furthermore, the work of the National BIM Council is evidence of how both the Government and industry can work together to create a more agile and innovation-rich sector, creating jobs and export potential for the industry now and into the future.

**Minister Heather Humphreys,**  
Department of Business,  
Enterprise and Innovation,  
December 2017

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# Executive Summary

Digitisation is impacting every aspect of our lives. The rapid advancement of the Internet of Things coupled with ever increasing developments in modelling and collaborative technologies brings with it a necessity for modern construction businesses in Ireland to embrace these developments to create a more productive and agile industry.

The National BIM Council has developed this roadmap to digital transition for Ireland's construction industry to increase adoption of Building Information Modelling in Ireland. The formation of the council is also a key measure in fulfilling Enterprise Ireland's obligations under the Construction 2020 strategy. In particular, to work with industry organisations to promote the use of BIM and develop the appropriate technical skills amongst Irish construction firms so that they can successfully compete in markets where BIM is widely adopted or is a requirement.

This roadmap is designed to secure funding for digital transition development in Ireland, to set performance goals and to support the Programme of Government. It is designed to be a living document that will drive development and guide the process of reaching long-term goals of a proficient digital sector.



**Caroline Spillane, Chair, NBC**

This report is well aligned to the Government's recent commitment to the progressive adoption of BIM across the public-sector capital programme and also seeks to support the key recommendations of the EU BIM Task Group Handbook for implementing BIM in the public sector.

The roadmap provides a long-term view of the support structures needed to underpin a successful digital transition programme for the Irish construction industry. It outlines a high-level plan of strategic initiatives to assist both the public and private sector collectively build their digital capability.

BIM is at the centre of a digital transformation of the construction sector and the built environment across the world. It is time for Ireland to stimulate economic growth and competitiveness while delivering value for public money through the wider and structured introduction of BIM that is built on international standards and best practice.

# Introduction

Beyond a small number of early adopters, the digital transition of the construction sector in Ireland began in earnest around 2010, with the innovative introduction of a Building Information Modelling requirement in the design of a major semi-conductor wafer fabrication facility for a major US company. Since then, the organic growth and adoption of digital tools has been quite remarkable. The use of digital tools is still fueled by client requirements on large technical FDI projects. But that has been accompanied by State investment through the National Development Finance Agency (NDFA) and a growing requirement for Building Information Modelling (BIM) in our closest trading neighbours. Simultaneously, the supply chain has been encouraging traditional clients of construction to realise the benefits of BIM. In Ireland today an estimated €2 Billion of projects have been delivered with a BIM requirement.

While the adoption of digital tools has been rapid, it is predominantly focused on the short-term capital delivery phase. There are many barriers to the adoption of the collaborative working processes required to deliver the true potential of digital, particularly the fragmented and adversarial nature of the supply chain. The barriers to collaborative working with digital tools are significant and are common across the globe. The barriers to collaboration whether cultural, legal, due to vested interests or procurement structures cannot be overcome in isolation.

To truly work collaboratively, we need a truly collaborative approach to tackling the obstacles preventing us from working together. Industry bodies must collaborate with other industry bodies for example and the supply chain will have to work through strategies that enable greater transparency and certainty of outcome. Further, if we are to succeed, the industry will have to better support the decision making of clients with better data and more accurate information if we are to break the downward spiral of “lowest price wins” as “lowest price” rarely represents best value or lowest cost

The importance of the support of Ireland’s largest client of construction, the Government, for digital transition was the single greatest priority for the council. The progression of the OGP’s consultation and positioning paper through to the announcement and further commitment by Government is arguably the most significant step forward in the sector’s transition so far. The support for phasing a mandate across a progressive time scale and across different project types reflects both client and industry needs to transition at a measured pace, while realising the benefits of lower cost and improved productivity as quickly as is practical.

A leadership model to support long-term structure and governance should be explored over the next 6 months with key stakeholders. Several options should be advanced and scrutinised before a final decision is made and the long-term structure put into place. This is to ensure that full consultation occurs, and the optimum structure and governance is put into place, to enable the model to work for and on behalf of Government and Industry as a whole.

# National BIM Council

The National BIM Council (NBC) of Ireland was convened in June 2016. The NBC is a committee of construction clients and representatives from the industry supply chain with a shared ambition to set out a National Roadmap for the successful implementation of the digital design, construction and operation of built assets in Ireland. The key deliverable for the NBC is the development of a National Roadmap.

Of all industries, construction has traditionally been one of the slowest to adopt new technologies. Historically low levels of investment in technology, training, research and career development have hindered the industry's ability to attract and retain the skills it needs to develop and grow. Symptoms endemic of an industry that rides the highs and lows of boom and bust are intensified by a procurement process that typically focuses on price as the key determinant of value.

Ever more quickly the world around the industry progresses, increasing the gap between client needs and the domestic industry's ability to meet them in a consistent or predictable manner.

The starting point for the National BIM Council was the review of digital strategies developed by other countries. The BIM Innovation Capability Programme (BICP) established in 2016 has collated important research to support the work of the Council, looking at other global strategies, researching Ireland's current capability in both industry and education, and providing evidence based performance indicators from project case studies across Ireland.

Consultation, expert input and research evidence indicates that strong leadership of Government and Industry, public and private sector support, standards, procurement, skills and training must be prioritised as key components of Ireland's Roadmap.



The importance of Government as the biggest client for construction, the largest estate manager, the trustee of our country's valuable resources, and leader for the adoption of digital tools and processes is a heavily weighted element of any digital strategy and the Government's implementation of a Building Information Modelling (BIM) adoption strategy for the Irish public sector is a significant enabler.

The ambition is to create an industry that is more closely integrated with the users and occupants of the built environment. We anticipate a structured interface and gateway that will enable the developers of software, digital tools and smart technologies to help drive new and yet to be seen ways of working and communicating. An industry that will attract a diverse range of people to new positions that don't currently exist.

The role of leadership across the industry to drive the incentives and to communicate the impacts across organisations small and large will be key to determining the speed of Ireland's transition to digital. Leadership must come from the demand side, from early adopters in the supply chain and from the enablers; the educators, professional institutions and industry associations.

It is a key recommendation of this report that the model to support the long-term structure and governance of the industry's digital transition should be explored over the next 6 months with the key stakeholders. In the interim, the NBC transition model can press ahead with identifying and putting into place the initial prioritised recommendations.



# Strategic Objectives

## PRINCIPLES UNDERPINNING THE ROADMAP

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The National BIM Council, through its consultancy processes, has identified a number of important principles upon which to base its key recommendations. These principles are summarised below.

1. Foster engagement from government, industry and academia by demonstrating the specific value propositions of BIM at an individual, organisation wide and collective level.
  2. Facilitate the development of guidelines, protocols, technical codes and standards to further enable and standardise the use of BIM.
  3. Specify training, educational and certification support initiatives to develop the core BIM capabilities.
  4. Create a culture of collaborative project delivery environments that facilitates the use of BIM.
  5. Measure, evaluate and assess the impact and maturity of BIM on a regular basis.
  6. Provide a platform to adapt and sustain the transition to BIM and collaborative project delivery practices.
  7. Support the development of BIM capability in a measured way that does not disadvantage SME's or create a divided sector (digital and non-digital).
  8. Recognise and profile the creation of long term digital assets that can be utilised to improve estate and facilities management practices.
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## STRATEGIC GOALS OF THE ROADMAP

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The specific objectives that supports this vision are set out below.

- To present a strategic paper that provides vision, leadership and a collective voice for the advancement of digital design, construction and the operation of built assets.
  - To develop a national road map to optimise the successful implementation of BIM. The roadmap is to be informed by BIM adoption in other countries and considered in the context of the domestic and overseas trading environment today and tomorrow.
  - Engage Government as a client of construction to support the adoption of BIM on public projects.
  - To align the construction industry's digital transition with EU, central and local government regulation and guidelines to bring wide ranging economic, environmental and societal benefits.
  - To recognise the role that technology and 'better information management' plays in achieving measured improvements in productivity, international competitiveness, collaboration and innovation.
  - Identify and prioritise the key enablers and key challenges of a successful digital transition to support a successful implementation.
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It is intended that these goals are measured and connected to metrics and Key Performance Indicators (KPIs). These goals in turn influence the initiatives that are set out in this Roadmap.

# Recommendations

The following are the four main recommendations of the NBC, with each recommendation demonstrating key characteristics/outcomes of a successful implementation.

## RECOMMENDATION 1:

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**Facilitate the formation of a resourced National BIM Centre of Excellence (NBCE) with a focus on driving the digital transformation of the sector.**

**If Recommendation 1 is successfully implemented, the following kinds of outcome can be expected:**

1. A national central resource has been established to support the roll out of digital tools and processes in Ireland. It will be a resource with both public and private commitment which will leverage from existing digital interest communities.

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2. A suitable individual/executive to lead the implementation programme has been appointed.

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3. A platform for leadership to drive a digital transformation programme representative of stakeholders in the Irish AEC & FM sector is in place.

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4. Collaboration occurs internationally on a regular basis to make the case for structured, validated, comparable data sets.

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5. A clear vision has been set, communicated and fostered through a regional cluster of BIM communities of practice throughout Ireland.

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## RECOMMENDATION 2:

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**Strengthen and support Ireland's commitment to adopt a common collaborative framework of Open BIM Standards and to seek to play a proactive role in ongoing development of international information management standards in construction.**

**If Recommendation 2 is successfully implemented, the following kinds of outcome can be expected:**

1. Regular consultation with key stakeholder groups to determine commitment, willingness, or resistance, or to identify roadblocks to adopting open, internationally recognised information standards (a common or consistent approach).

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2. Active involvement in the development of International and European Standards. Communicating what is happening with regards to adoption of International and European Standards. ISO-TC-59, CEN-TC-442, OGC, etc.

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3. Government and industry supporting the NSAI (National Standards Authority of Ireland), and other recognised Institutes, to develop industry training and certification programmes in relation to the standards.

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4. Appropriate cross-discipline and discipline specific national guidelines for use of BIM are being disseminated across all stakeholder groups.

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5. Support for the implementation of "National Tools" (like a digital toolkit and national BIM Library) that help drive general conformance with standards, avoid duplication of effort, and avoid exclusion of SME's (Small Medium Enterprises) are in place.

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6. Helping to ensure that public procedures, like mapping, planning, building control, public sector asset management, etc, comply with these standards, and require, or incentivise, submission of digital information in compliance with standards. The move from 'paper to data'

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### RECOMMENDATION 3:

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**Develop a consistent, seamless and coherent digital experience for students in Irish education and industry to help grow industry capacity and maturity in the use of BIM and other innovative technologies.**

**If Recommendation 3 is successfully implemented, the following kinds of outcome can be expected:**

1. A broad awareness and upskilling learning framework for both educators and industry is being delivered through a National BIM Education Taskforce based on core multi-disciplinary digital curriculum outlining the skills needed to deliver a 21st century workforce for the built environment sector in Ireland.

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2. An online BIM self-assessment tool for companies (that differentiates between the needs of design/contractors/products) to help companies define training needs is freely available.

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3. A base level of learning outcomes targeted at alternative NFQ (National Framework of Qualifications) levels has been developed.

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4. An “open BIM” education programme certified by the National Standards Authority of Ireland (NSAI) has been rolled out.

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5. The inclusion of Digital Design and Construction in second-level curriculum is being actively encouraged.

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6. The professional institutions and bodies are being consistent in specifying BIM competencies when accrediting built environment programmes.

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## RECOMMENDATION 4:

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**Support a public-sector BIM adoption mandate that will facilitate the implementation of Government policy objectives in the procurement of public works projects, in their construction and in their maintenance upon completion.**

**If Recommendation 4 is successfully implemented, the following kinds of outcome can be expected:**

1. The benefits and risks of adopting BIM are widely known and understood across the Public Sector.

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2. Experienced leadership and direction is in place to support the adoption of BIM on public sector projects.

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3. Role specific guidance has been prepared and published to better equip procuring authorities when adopting BIM.

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4. The recommendations from the medium-term strategy for the procurement of public works in relation to BIM are being considered for implementation.

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5. The national building stock will be efficiently and effectively managed and operated using digital information, tools, and processes, to bring significant benefits to the towns, cities and people of Ireland.

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# Roadmap

## Digital Roadmap 2021 Construction Sector

2021

- 20% reduction in project delivery programme
- 20% increase in construction exports
- 20% reduction in capital costs

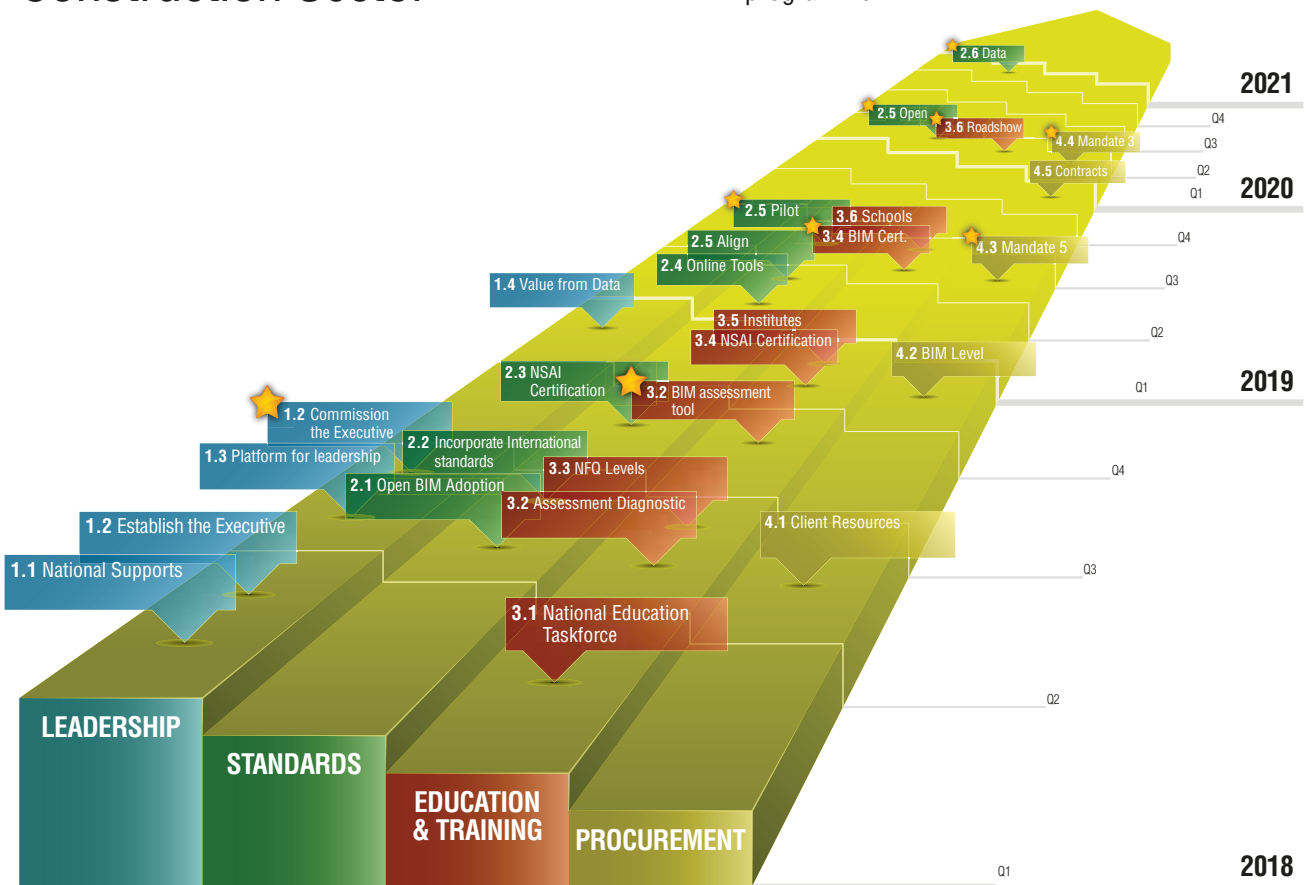


FIGURE 1. NBC ROADMAP TO 2021

**TABLE 1: NBC ROADMAP – KEY ACTIONS AND EVENTS**

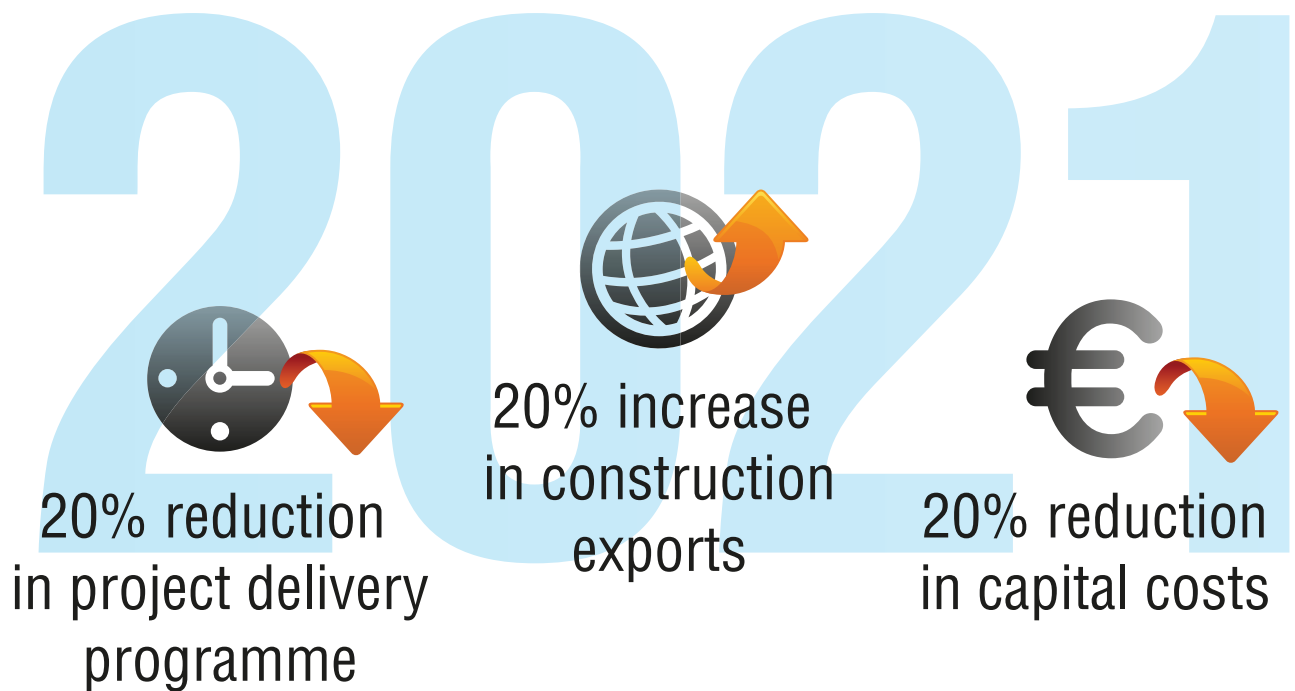
Item	Action/Event	Start Date	Item Title	Item Description
1				<b>Leadership:</b>
1.1	A	Q1-2018	National Supports	Set up a national central resource to support the roll out of digital tools and processes across client groups and the supply chain in Ireland. A resource with both public and private commitment
1.2	A	Q1-2018	Establish the Executive	Identify a suitable individual/executive to lead the implementation programme
1.3	A	Q2-2018	Platform for Leadership	Create a platform for leadership to drive a digital transformation programme in the Irish AEC & FM sector
1.2	E	Q2-2018	Commission the Executive	Commission the Implementation Taskgroup
1.2	E	Q4-2018	Value from Data	Collaborate internationally to enable the use of structured, validated, comparable data sets for improved analysis and decision making across the industry
2				<b>Standards</b>
2.1	A	Q2-2018	Open BIM Adoption	Consultation with key stakeholder groups to determine the commitment, willingness, or resistance, or to identify the roadblocks to adopting open, internationally recognized information standards (a common or consistent approach)
2.2	A	Q2-2018	Incorporate International Standards	Support Ireland's involvement in International and European Standards development. Communicate what is happening with regards to adoption of International and European Standards.
2.3	A	Q3-2018	NSAI Certification	Government & industry support of the NSAI (National Standards Authority of Ireland), and other recognized Institutes, to develop industry training and certification programmers in relation to standard
2.4	E	Q1-2019	Online Tools and Supports	Help implement "National Tools" that help drive general conformance with standards, avoid duplication of effort, and avoid exclusion of SME's (small medium enterprises)
2.5	A	Q1-2019	Align Planning, Building Control Public Asset Information	Ensure public procedures, like mapping, planning, building control, public sector asset management, etc, comply with these standards, and require, or incentivize, submission of information in compliance with standards
2.5	E	Q2-2019	Pilot Open Format Models for Applications	Pilot 3D open format applications for planning and building control submissions
2.5	E	Q2-2020	Open Format Incentives Established	Incentives in place to encourage 3D model applications in open format
2.6	E	Q4-2020	Harmonised Asset Data Standards	Common / Coordinated asset information requirements and refs across public sector

**TABLE 1: NBC ROADMAP – KEY ACTIONS AND EVENTS CONTINUED**

Item	Action/Event	Start Date	Item Title	Item description
<b>3</b>				<b>Education &amp; Training</b>
3.1	A	Q1-2018	National Education Taskforce	Deliver a broad awareness and upskilling learning framework for both educators and industry through a National Education Taskforce based on core multi-disciplinary digital curriculum outlining the skills needed to deliver a 21st century workforce for the built environment sector in Ireland.
3.2	A	Q2-2018	Assessment Diagnostic	Development of an online BIM L2 self-assessment tool for companies (that differentiates between the needs of design/contractors/products) to help companies define where the training needs are required.
3.2	E	Q3-2018	BIM Assessment Tool	Launch a BIM L2 self-assessment tool.
3.3	A	Q3-2018	NFQ Levels	Develop a base level of learning outcomes targeted at alternative NFQ levels.
3.4	A	Q4-2018	NSAI Certification	Develop a BIM certification programme to be managed by the National Standards Authority of Ireland (NSAI)
3.4	E	Q2-2019	Launch Certification Programme	Launch BIM certification programme.
3.5	A	Q4-2018	Professional Institutes	Need for the professional institutions to be consistent in specifying BIM competencies when accrediting built environment programmes.
3.6	A	Q2-2019	BIM in Schools	Encourage the inclusion of Digital Design and Construction in second-level curriculum.
3.6	E	Q1-2020	Deliver Curriculum Roadshow	2nd Level Digital Curriculum Roadshow.
<b>4</b>				<b>Procurement</b>
4.1	A	Q2-2018	Client Resources	Develop online supports for public clients to receive, review, manage and assess BIM on their projects. Including a common, independent body to assess performance across a common criteria.
4.2	A	Q4-2018	BIM Level Requirements	BIM contract requirements for public sector to be determined
4.3	E	Q2-2019	OGP Mandate B5	Government Mandate for BIM on Band 5 Projects
4.4	E	Q2-2020	OGP Mandate B3	Government Mandate for BIM on Band 3 Projects
4.5	A	Q4-2019	Procurement Contracts	Review suitability and make provision for developing Government construction contracts.



# 2021 - Key Roadmap Performance Targets



- Incentives are in place for the submission of open standards based 3D models as part of a planning or building control application.
- Wasteful practices in construction will have been reduced bringing construction costs down by at least 20%.
- 20% increase in construction exports – Through enhanced productivity and knowledge leadership, Ireland will drive and support the advancement of digital construction across overseas markets.
- Project delivery time schedules will be reduced by 20%.
- Every construction project will contribute valuable digital data to our smart communities, smart cities and smart economy, positioning Ireland to the forefront of digital transition across Europe and globally.

# Global Perspective

The BIM Innovation Capability Programme (BICP) Global BIM Study 2017<sup>2</sup> reported on the compelling case for BIM adoption across the globe. The study focused on 27 countries across the world designed to assist the National BIM Council in identifying recurring themes to assist in the development of this roadmap.

The recent World Economic Forum (WEF) report<sup>3</sup> outlined that most other industries have undergone tremendous changes over the last few decades, and have reaped the benefits of process and product innovations. Furthermore, the WEF reported that the construction sector has been hesitant about fully embracing the latest technological opportunities.

Governments across the globe are increasingly recognising the efficiencies that can be gained with this change. Learning from leading jurisdictions,

governments which are embarking on the transformational journey have been convinced that the strategic use of BIM can support a leaner more innovative construction sector thus addressing declining productivity prevalent in construction (Kelly et al, 2013<sup>4</sup> and Farmer, 2016<sup>5</sup>).

The Global BIM Study provided evidence of the increasing relevance of BIM to the international construction community. Over 50% of the 27 countries reviewed had a regulatory requirement for BIM or are planning on implementing one in the near future. The presence of key champions and drivers of BIM in each country was clearly evident with a significant number of countries being influenced by the work of buildingSMART chapters within their regions. Over 60% of the countries reviewed have produced a BIM guide or manual to assist in the promotion of BIM locally.



<sup>2</sup> CitA (2017), BIM Innovation Capability Programme (BICP) Global BIM Study: Lessons for Ireland's BIM Programme

<sup>3</sup> World Economic Forum (2016), Reshaping the Future of Construction – A Breakthrough in Mindset and Technology, World Economic Forum

<sup>4</sup> Kelly, G., Serginson, M., Lockley, S., Dawood, N. & Kassem M. (2013) BIM for facility management: a review and a case study investigating the value and challenges, Proceedings of the 13th International Conference on Construction Applications of Virtual Reality, 30-31 October, London, UK

<sup>5</sup> Farmer, M., (2016), The Farmer Review of the UK Labour Market - Modernise or Die, Time to Decide the Industry's Future, Published by the Construction Leadership Council (CIC)

## UK CONSTRUCTION DIGITAL PROGRAMME

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The UK Government has mandated BIM for all centrally-funded public-sector capital projects since April 2016. The UK has issued in tandem with their Level 2 BIM initiative a suite of connected frameworks and guidelines that are influencing BIM adoption in many other countries. This includes a number of Publicly Available Specifications (PAS) and British Standards (BS) which offer best practice in information management for the capital/delivery and operational phase of construction projects using BIM. The UK government has more recently embarked on an ambitious Level 3 BIM programme.

The UK Government's Construction Strategy published in May 2011<sup>6</sup> set out a goal to reduce the cost of public sector assets by up to 20%, and improve the building performance (or Carbon output) by 50%. Coupled with the mandate, the government established a dedicated BIM Task Group to support public-sector clients and the wider construction industry.

Following their ambitious BIM programme, the UK is now recognised as a global leader in the adoption of BIM with wide-scale uptake in recent years. Despite the challenges of the recent Brexit decision the UK is a very important trading partner with many Irish construction businesses routinely bidding and working in the UK. In response to the UK BIM digital construction programme, many Irish businesses have adapted their work processes to align with UK level 2 BIM protocols. Careful consideration will need to be given to how closely Ireland's digital construction programme will reflect current UK practice and protocols.

It is clear from this momentum that Ireland needs to embrace BIM and be seen to do so by its international trading partners to prepare Irish construction and engineering businesses to work in regions where BIM is a requirement and to prepare for the increased requirement for BIM at home by industry and government.

## BIM IN THE EU

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In 2014, the European Commission procurement directive permitted that Member States may require the use of specific electronic tools, such as building information electronic modeling tools or similar to be adopted for public works contracts and design contests.

Further, a connected Digital Single Market has been signaled as a top priority for the EU Commission. A fully functional Digital Single Market could contribute €415 billion per year to the EU economy and create hundreds of thousands of new jobs. 'Digital as a driver for growth'<sup>7</sup> is a key Juncker commission policy area ensuring that Europe's economy, industry and employment take full advantage of what digitalisation offers.

As a consequence, there is at present a rapidly evolving suite of national digital programmes across the EU. Table 1 provides an overview of the rapidly evolving BIM programmes across Europe presently and the key drivers in those countries.

<sup>6</sup> Cabinet Office (UK), (2011), Government Construction Strategy, UK Government Cabinet Office, London

<sup>7</sup> ([http://europa.eu/rapid/press-release\\_IP-17-1232\\_en.htm](http://europa.eu/rapid/press-release_IP-17-1232_en.htm))

**TABLE 2: RAPIDLY EVOLVING NATIONAL DIGITAL PROGRAMMES<sup>8</sup>**

<b>Germany</b>	Planen bauen 4.0 (Digital Plan, Efficient Building, Sustainable Operation Initiative)	<b>Norway</b>	STATSBYGG (Directorate of Public Construction and Property)
<b>France</b>	Plan Transition Numerique dans le Batiment (Plan Digital Transition in Building)	<b>Spain</b>	Comision para la implantacion de la metodologia BIM (Commission for the BIM methodology)
<b>Finland</b>	Sennatti (Senare Properties)	<b>UK</b>	UK BIM Task Group
<b>Netherlands</b>	Rijkswaterstaat (Ministry for Infrastructure and the Environment)	<b>Denmark</b>	Bygningsstyrelsen (Property Agency)

The Scandinavian countries of Finland, Norway, Denmark and the Netherlands have been enjoying the benefits of BIM for almost a decade. More recently highly influential programmes are evident in the UK, closely followed by rapidly evolving programmes in France, Germany and Spain.

In 2015, the European Commission awarded the EU BIM Task Group the role of delivering a common European Network approach to align the use of BIM by public procurers, policy makers and public estate owners. The Task Group's vision is to encourage the common use of BIM, with the aim of improving value for public money, quality of the public estate and for the sustainable competitiveness of the EU construction sector.

The EU BIM Task Group recently launched their BIM Handbook<sup>9</sup>. The BIM Handbook is a pan-European collaboration of public sector organisations across 21 countries which is responding to the growing challenges faced by governments and public clients to stimulate economic growth and competitiveness while delivering value for public money through the wider introduction of BIM across the EU.

It is emphasised on the EU BIM Task Group website that the group will not be creating new or competing standards to ISO, CEN or buildingSMART but simply developing common guidance and practice for public procurers when introducing BIM.

## INTERNATIONAL LEADERSHIP OF BIM PROGRAMMES 2017

To further understand how the different international Governments have supported their BIM programmes the BICP research team recently completed a comprehensive Global BIM Study to help inform the National BIM Council of Ireland in developing a Roadmap to Digital Transition for Ireland's Construction Sector. This paper details the findings of a more concentrated investigation on a selection of jurisdictions on how particular international BIM programmes are organised, managed and the level of governmental support that is evident in those jurisdictions.

The BICP research team chose eight countries of particular interest given the relative advancement in their BIM journey. The authors secured responses from principal contacts in the countries chosen using an online survey. Whilst the results showed variation in approach amongst respondents, the consistent ingredient evident was strong and decisive support from central government and representative groupings from industry.

Evidence collated suggest that this is best achieved through the establishment of a central resource funded by central government to drive digital transition.

<sup>8</sup> CitA, (2017), BICP Global BIM Study, pp. 11

<sup>9</sup> EU BIM Task Group (2017), Handbook for the introduction of Building Information Modelling by the European Public Sector Strategic action for construction sector performance: driving value, innovation and growth.

**TABLE 3: LIST OF CONTACT ORGANISATIONS<sup>10</sup>**

Countries	Contact Organisations
Australia	QSx Tech and Change Agents AEC
Canada	buildingSMART Canada
Finland	VTT Technical Research Centre of Finland
France	Plan Transition Numérique dans le Bâtiment (PTNB)
Germany	LocLab Consulting GmbH and planen-bauen 4.0 GmbH
United Kingdom	BIM Regions UK
Scotland	Scottish Futures Trust
South Korea	Myongji University

The average time reported to execute a mandate was between 3-5 years. However, in countries such as France which had a high maturity of BIM previously within the sector the mandate is 3 years. Finland, South Korea and Scotland also had short time frames due to the readiness of the sector to respond.

All of the countries with mandates in place had an appointed Government representative managing their BIM requirements. The UK BIM Task Group, Planen-bauen 4.0 GmbH, KIRAdigi, PTNB and Scottish BIM Delivery Group represent specialist teams that have been appointed by respective Governments with appropriate funding. These entities were tasked by Federal Governmental agencies to lead, manage, coordinate and deliver a BIM implementation plan to address their recommendations. Despite a top-level request for BIM to be mandated by respective Governments the operational strategy is primarily guided and executed by an external body.

While dedicated BIM Centres were not a common feature, there were a number of exemplars, such as Construction Scotland Innovation Centre, South Korea’s Korean Institute of Construction Technology and Finland’s Building Information Institute.

BuildingSMART have played an advisory role in the majority of the jurisdictions investigated, with the exception of the UK and Scotland. Their role varies from country to country depending on the requested level of involvement. Their guidance with regards to open standards has been instrumental to the success of the BIM programmes.

Most of the countries with a mandate in place have developed a number of guidance documents on standards and professional practice. To achieve this a number of specialised groups have been created with responsibility for drafting these guidelines.

The key ingredients for each country varies but some common themes can be established with regards to leadership. All of the mandates require high levels of engagement with Government, industry and academia to create a movement to BIM. This is usually the responsibility of a government appointed Task Group who will shepherd this consultation process. The development of guidelines, protocols and technical codes to standardise the use of BIM is paramount which has seen BuildingSMART play an increasingly important role. A number of specialised communities are usually established to help guide this process. The development of training and educational programmes through different training bodies has been an obvious area which has required significant attention.

<sup>10</sup> McAuley, B., Hore, A.V., West, P. and Kuang, S., (2017), Stewardship of International BIM Programmes: Lessons for Ireland, CITA BIM Gathering International Conference.

Each jurisdiction has or is investigating their contractual frameworks to ensure a collaborative project delivery environment is present. While not evident in all the reviewed countries there have been attempts to measure and assess the impact and maturity of BIM. In a number of countries such as the UK, Germany and Scotland, programmes have required specific pilot projects to serve as a key learning tool.

Any proposed international BIM roadmap whether driven from the private or public sector requires strong and decisive stewardship from the body responsible. As seen from the selection of jurisdictions reviewed it is crucial that a deep consultation with Industry is undertaken before the release of any roadmap. This in most cases is performed by an external body which has been tasked by the Government to meet their recommendations. These respective BIM delivery groups must set realistic benchmarks which are dependent on the maturity of the industry and usually vary between 3-5 years. These dates are based on a proposed support mechanism that will be in place to ensure targets are achieved. Most support mechanisms in place include guidelines, working groups, BIM portals, pilot projects, standards, etc. which are essential to any successful roadmap. Entities such as buildSMART have proven invaluable in helping to establish and deliver this process. While not essential many jurisdictions have either full or partial dedicated BIM centres, as well as established benchmarking tools. This has helped advance their roadmaps and is a strong indicator of a mature sector. The overarching lesson to be learnt from this study is that a dedicated body must be established and funded in Ireland by either the public or private sector institution (or by a partnership between the two), to assist in meeting their stated BIM targets. If adequate resources and remit are provided to this body, as seen in the countries explored above, then the most desired outcome for all can be achieved.

### BIM IN IRELAND

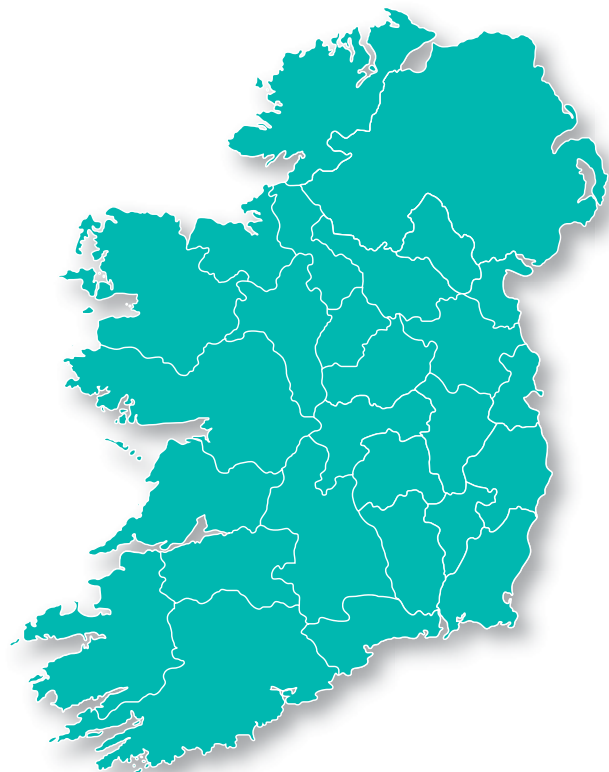
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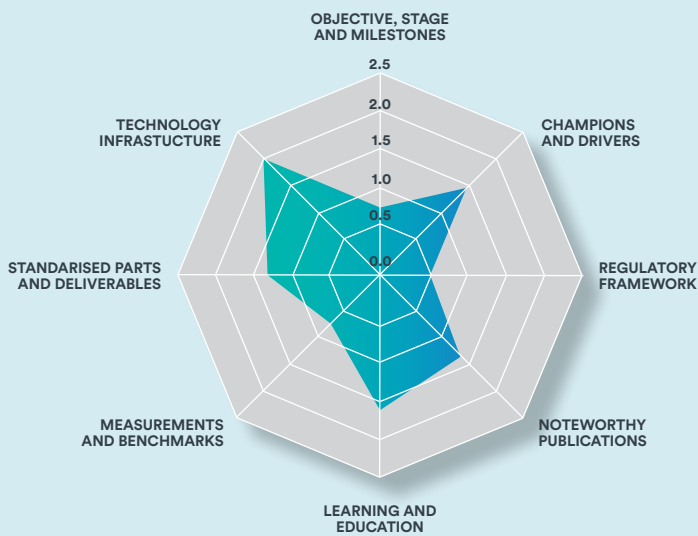
BIM adoption across Ireland has most recently been captured within “The Building Information Modelling in Ireland Study 2017”. Through a series of consultations, workshops, community engagement, events and surveys, CITA/BICP have captured the most in-depth picture of Ireland’s digital progress to date.

In April 2017, the BICP research team applied a number of conceptual models originally developed by Dr. Bilal Succar (AU) and Dr. Mohamad Kassem (UK) to measure macro BIM adoption . These models can be used for:

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

The level of 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.

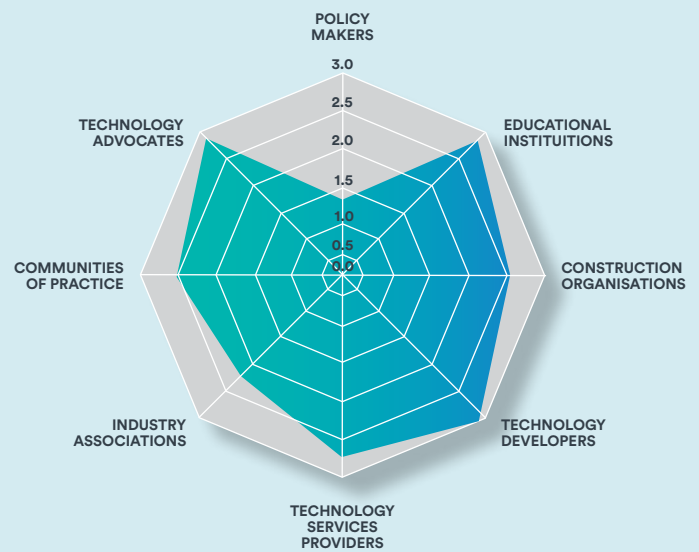




**FIGURE 2: MACRO MATURITY COMPONENTS - IRELAND**

The Macro Maturity Components model (Figure 2) 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.

Results indicate that Ireland ranked highly when it came to technology infrastructure, which would be expected in a developed country. Learning and education; champions and drivers and noteworthy publications also ranked relatively highly. However, Ireland ranked poorly when it came to regulatory frameworks; standardised parts and deliverables; measurement and benchmarks.



**FIGURE 3: MACRO DIFFUSION RESPONSIBILITIES - IRELAND**

The Macro Diffusion Responsibilities Model (Figure 3) 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: policy makers; educational institutions; construction organisations; individual practitioners; technology developers; technology service providers; industry associations; communities of practice; and technology advocates.

The results show the Technology Driver as an influential player, while the educational institutes had a much higher BIM diffusion compared to policy makers. Both construction organisations and communities of practice were identified as key process players.

# Implementing Digital Transition

## FROM ROAD MAP TO IMPLEMENTATION

### VISION – SKILLS – INCENTIVES – RESOURCES – PLAN

The foundation for any successful transition must contain Vision, Skills, Incentives, Resources and a Plan as outlined in Figure 4.(Knoster T, 1991).

**“Without Vision you will have confusion; without Skills you will foster anxiety; without Incentives you will meet resistance; without Resources you will breed frustration; without a Plan you’ll go on to make false starts.”**



FIGURE 4. A FRAMEWORK FOR THINKING ABOUT SYSTEMS CHANGE<sup>11</sup> (KNOSTER, 1991, PP.273)

<sup>11</sup> (Knoster, 1991, pp.273)



The BICP team were requested to test this theory by selecting a sample of stakeholders with the purpose of mapping these five key components necessary for a successful transition programme.

A total of 6 representatives from each of the 5 different stakeholder disciplines were targeted.

The sectors consisted of: Public Sector Clients; local authorities; designers; contractors and operators. Table 4 is a summary of the respondents' organisations:

Each sector representative was asked the following 5 questions pertaining to their organisation:

1. What is the vision of your organisation with regards to BIM deployment?

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2. To achieve this vision what upskilling, if any, has your organisation invested in?

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3. Where have you procured these skills i.e. in-house, external training body, etc.?

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4. What are the greatest incentives with regards to BIM as established by your organisation?

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5. What resources has your organisation used or plan to use in the future to ensure their BIM Vision is successfully executed?

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6. How can these resources be used to overcome existing barriers?

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7. What key actions has your organisation executed to ensure that their BIM vision has been successful?

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TABLE 4: SURVEY RESPONDENTS

Stakeholder Type	Respondent
Public sector Clients	<ul style="list-style-type: none"> <li>• National Development Agency</li> <li>• Office of Public Works</li> <li>• Department of Education and Skills</li> <li>• Transport Infrastructure Ireland</li> <li>• Grangegorman Development Agency</li> <li>• Irish Water</li> </ul>
Local Authorities	<ul style="list-style-type: none"> <li>• Dublin City Council</li> <li>• Irish Water</li> </ul>
Designers	<ul style="list-style-type: none"> <li>• Ryan+Lamb Architects</li> <li>• Henry J Lyons Architects</li> <li>• C+W O'Brien Architects</li> <li>• Coady Architects</li> </ul>
Contractors	<ul style="list-style-type: none"> <li>• BAM</li> <li>• Kirby Engineering</li> <li>• John Paul Construction</li> <li>• JJ Rhatigan &amp; Company</li> </ul>
Operator	<ul style="list-style-type: none"> <li>• IBM</li> </ul>

# SECTION TWO: IMPLEMENTING DIGITAL TRANSITION

TABLE 5: COMPONENTS FOR A SUCCESSFUL TRANSITION

	VISION	INCENTIVES	SKILLS	RESOURCES	ACTION PLAN	
Public Sector Clients	The partnership of technology and process enhancements to help build public infrastructure more efficiently by improving the quality, efficiency and sustainability of State assets.	Improved decision making, efficient data retrieval, reduced potential design flaws, optimal asset management, operational efficiency and better facility performance evaluation.	BIM training and support for staff to build BIM awareness and capability across the team. Ensure processes are adjusted or improved to support the BIM strategy for each department.	Set up a BIM task group with a defined strategy. Ensure hardware and software has been upgraded i.e. cloud based environment for project information exchange.	Mandate that the entire project is delivered in a BIM environment. Ensure the correct baseline both in terms of digital technology and processes using relevant guidelines.	=Change
Local Authorities	To manage all new construction projects through a BIM process so that intelligent data can be produced and utilised.	Better co-ordination of the design team, improved productivity in producing documentation and enhanced asset management for better maintenance.	Software training for all technical staff. Presentations to senior management on BIM across all departments. Establish working groups with external support where required.	Funding and adequate resources, as well as the allocation of admin staff. Change or improve the current data management systems to incorporate BIM data.	The execution of a top down strategy led by senior management. The training of staff and utilisation of a BIM manager to assist with implementation.	=Change
Designers	The implementation of BIM to assist with the the development and future growth of practices in what is becoming an increasingly digitised construction industry.	The delivery of high quality design outcomes which continuously meet the client's expectations. The greater visual interrogation of design and ability to analyse building performance.	The development of a training plan tailored to suit project workflows. The training of all members of staff appropriate to their role in the BIM process.	Development of in-house training and upskilling with regards to the preferred design tools and processes. Aligning office protocols with the requirements of existing standards.	Develop a CPD programme for staff members. Actively implement a post project review policy which enables continuous improvement. The investment in BIM Hardware and Software.	=Change
Contractors	To integrate BIM process into daily construction management processes where possible. The application of digital construction will ensure relevance in current markets.	Effective detailed coordination of services, increased level of offsite fabrication, programme and cost savings, a better standard of project management and overall product for the Client.	The review and evaluation of all departments to identify specific benefits that the implementation of BIM would bring. The training of both software and BIM related processes.	Development of a long-term BIM execution strategy and continuous improvement through adding new resources, new technology and ongoing training of existing resources.	Building capability through a BIM awareness programme. The training of all key staff and continuous assessment of the BIM process. The procurement of certification and business agreements.	=Change

The results from this study are shown in Figure 5. The operators' section has not been included due to low response numbers, however, public sector and local authority objectives are synonymous with operator requirements.

Creating a vision and timeline for each of these elements has been an intrinsic aspect of the roadmap and further consideration of these elements is covered separately in this document.

Within the report's recommendations, the resources required to support the transition have been clearly defined. Through wider consultation and research, the dedication of appropriate resources has been a reoccurring problem for many other implementations. At the core and across different jurisdictions, the allocation of costs is not always borne where the benefits lie. Eventually the benefits will be shared but not always in a timeline that encourages investment.

A common conclusion would suggest that the central provision of resources will foster efficiency through less duplication and support a more standardised industry approach for both public and private projects.

As with the allocation of costs and the receipt of proportional benefits, incentives to transition for firms and individuals across the industry stakeholder groups differ greatly – Direct benefits to one stakeholder group, may be secondary or indirect benefits to another stakeholder group. Providing clarity on the benefits of digital data and better information across the short, medium and long term will be a key factor in developing incentives for industry.

Some of the key 'direct' benefits and incentives for the adoption of digital processes and better information must still be developed and prioritised to provide more tangible value. More indirect benefits, or benefits that are harder to quantify for individual groups generally, become compounded to make statements relating to improvements in cost, programme, quality, health & safety, and sustainability.

TABLE 6: INCENTIVES BY STAKEHOLDER GROUP

Stakeholder Group	Key Benefits	Benefit Enablers
<b>Client of Design and Construction:</b>	<b>Enables broader consultation, scenario modelling and buy-in from a wider group of Stakeholders.</b>	<p><b>Direct benefit enabled by:</b></p> <ul style="list-style-type: none"> <li>• Visualisation of information at design stage assists client consultation and more likely to get an optimum outcome.</li> <li>• Data-driven capture of best practice to support decision making.</li> <li>• Improved cost and programme certainty – maximised when key decisions are taken early on.</li> <li>• Improved understanding of the predicted performance and quality of the asset and associated long-term life cycle costs (not just capital cost.)</li> </ul>
<b>Building Owners / Managers</b>	<b>Reduced costs from improved operational efficiency and optimised resource allocation.</b>	<p><b>Direct benefit enabled by:</b></p> <ul style="list-style-type: none"> <li>• Remote/mobile access to asset information from any device at any time.</li> <li>• Data on product performance – Design vs Actual.</li> <li>• Data to benchmark, compare and improve building management efficiency.</li> <li>• Increased clarity around defects and liabilities.</li> </ul>
<b>Design Companies:</b>	<b>Increased productivity, accuracy and international reach.</b>	<p><b>Direct benefit enabled by:</b></p> <ul style="list-style-type: none"> <li>• Automation to coordinate and schedule tasks.</li> <li>• Optimised decision making through easier evaluation of design alternatives.</li> <li>• Re-use of digital palette of design solutions across different building types.</li> <li>• Opportunity for better coordination with other designers.</li> <li>• Less likelihood of delays on site due to incomplete or missing information</li> <li>• Greater visual interrogation of the design by stakeholders.</li> <li>• Improve predictability of system design and ‘as built’ performance.</li> </ul>

Stakeholder Group	Key Benefits	Benefit Enablers
<b>Contractors</b>	<b>Supported by data, communicated visually, the opportunity to develop a branded offer that reliably differentiates value from lowest price.</b>	<b>Direct benefit enabled by:</b> <ul style="list-style-type: none"> <li>• Better processes will lead to more accurate definitions, identification and understanding of a project’s risks.</li> <li>• More complete, and greater accuracy of project information will reduce uncertainty of decision making during the construction process.</li> <li>• Better cost/asset information will assist with future commercial decision making.</li> <li>• Effective detailed coordination of information.</li> <li>• Waste reduction through improved accuracy of Bills of Materials and procurement timing through supply chain integration.</li> <li>• Reduced on-site labour and improved efficiency through coordination and offsite manufacturing.</li> <li>• Training and education of new employees as information supports experience</li> <li>• Increased opportunity for off-site construction solutions.</li> </ul>
<b>Product Manufacturers</b>	<b>Increased global reach, lower cost base and a higher proportion of repeat business.</b>	<ul style="list-style-type: none"> <li>• Open, digital formats present an opportunity for products to be specified and selected by designers across the globe.</li> <li>• Increased internal efficiency through the adoption of digital information processes into manufacturing processes.</li> <li>• Comparative measures of product performance and feedback that can become a substantive part of a future product selection/procurement process.</li> <li>• Increased potential to incorporate products into offsite system solutions through methods such as Design for Manufacture and Assembly (DfMA)</li> <li>• Providing the client/end user with accessible, accurate information at handover that will ultimately provide increased opportunity for customer loyalty and repeat business.</li> </ul>

# Leadership (1.0)

## DESIRED STATE:

**Create an industry that possesses digital skills and work processes that will place the Irish AEC & FM sectors on a trajectory of greater competitiveness. The vision is for a new destination that will inspire, stimulate innovation and motivate people to change and adapt to working more collaboratively to achieve improved project outcomes and optimization of the whole-life performance of assets.**

Strong, consistent leadership is at the very centre – it is most important that a platform is created and supported with the resources to sustain the change process. A lot has been achieved to-date, but there is still a lot to do. There is an inevitability around the digitisation of the construction industry and adoption of technologies like BIM. The question of Why? is already answered for most people. It is now a discussion on how and when. There are some major challenges for industry, such as developing or finding the skills, capacity and capability to work in these new ways. We need strong leadership, clear policy, adoption of international standards, and education that is more relevant to a digital future.

Since 2015, the top 100 industry leaders across the architecture, engineering and contracting (AEC) community in Ireland have been invited to participate in the production of a national digital construction transition survey. The surveys have sought to report on the extent to which the digital transition of Ireland's construction sector is underway. A sample size of the most influential leaders was selected with the co-operation of the Association of Consulting Engineers of Ireland (ACEI), Construction Industry Federation (CIF), Society of Chartered Surveyors in Ireland (SCSI),

Engineers Ireland and the Royal Institute of Architects in Ireland (RIAI). This sample represents a broad cross-section of industry stakeholders representing both larger and SME business across all regions of the country.

The first survey provided a benchmark of the level of Building Information Modelling (BIM) adoption in Ireland in November 2015.

- 67% of the industry sample possessed confidence in their skills and knowledge to deliver BIM.
- 27% reported some knowledge of BIM and a gradual improvement of their BIM skills.
- 75% of the research sample reported seeing an increased demand for BIM.

Respondents were largely split on the matter of a BIM mandate in Ireland, which at the time was very topical given the imminent BIM mandate that was due to become active in the UK in April 2016.

The 2016 survey results reported an increase in the level of confidence to 76% in their knowledge and skills in using BIM. The sample also reported a slight increase in tender requirements for BIM.

In 2015 the majority of respondents were acutely aware of the imminent UK mandate. However, surprisingly only 47% of respondents stated that it has had an influence on their business. A total of 66% of the sample believe that Ireland should follow in the UK's footsteps and mandate BIM.

A new question was introduced in 2016 to address how the Irish Government could better encourage and support the transformational change to BIM for public sector projects.

**Suggestions from the sample included:**

1. Funding from the Irish Government to implement the road map and ensure a sustainable approach is achieved.

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2. Review current contract and procurement routes to ensure that they are BIM ready.

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3. The development and dissemination of national guidelines to create and implement a collaborative environment that will foster the use of BIM.

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4. Review international standards and establish if they can be adopted within the Irish AEC.

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5. Develop and roll out a national training programme for both the public and private sector.

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6. Select and monitor pathfinder projects that will enable the transition to BIM and collaborative project delivery practices through pilot projects.

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In the 2017 survey, 64% of the sample reported that their awareness has improved significantly over the past 12 months and are now using BIM on a number of projects. This represents an increase from last year which demonstrates the further growth of organisations in their BIM development. 76% of respondents indicated that they possessed confidence in respect to BIM knowledge and skills which is similar to the levels recorded in 2016.

Beyond 2017, there needs to be a broader discussion on BIM that goes beyond architects, engineers and constructors, to a recognition of how Digital Data for the Built Infrastructure of Ireland, can support more innovation and competitiveness in the industry, and support the future Smart communities, towns and cities in Ireland. We know the benefits of a digital process can result in better quality, better delivered, buildings and infrastructure (transport, housing, healthcare, education, tourism & leisure etc) and more effective use of our limited resources (people, time, money, materials, energy, water, etc) for a growing population. Advanced analytics of digital data will begin to provide key information to support decision making for a Smart Economy. The future of BIM in Ireland is inspiring and exciting.

**KEY STAKEHOLDERS**

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Department of Housing Planning and Local Government (DHPLG), Construction Industry Council, Office of Government Procurement, Enterprise Ireland, Industry representatives (RIAI, SCSl, Engineers Ireland, CIF, BMF, ACEI, CIOB, CIBSE, IGBC, LCI, IDA), Private Clients, Public Clients, Public Buyers.

### NEXT STEPS

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1. To further understand what existing mechanisms or initiatives are in place currently in Ireland to facilitate leaders in construction and to leverage this to efficiently utilize this resource in the design of a leadership initiative.

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2. Identify list of potential leaders to partake in structured forum: Include knowledge sharing speaker from abroad.

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3. Establish a leadership structure including Terms of Reference.

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4. Consult on and agree key components in the leadership phase, management and implementation of same.

---
5. Support the Office for Government Procurement's (OGP) BIM champion and align standards and guidelines across the private sector.

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6. Progress initial discussions with the DHPLG to coordinate the adoption of digital technologies across regulatory functions including planning, planning appeals and building control.

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7. Secure funding to support components of BIM Roadmap

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## THE LEADERSHIP EXECUTIVE

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It will be important that attention is focused on and directed toward the activities necessary to help bring the Roadmap to fruition. A possible framework for this includes the following components:

Selection of an appropriate leadership and governance structure. Key attributes should include:

- Leadership may not necessarily come from a single person, but may require a group.
  - The leadership must have the gravitas and credibility to influence other industry leaders,
  - They will have to convincingly be able to “inspire” and communicate the “Why” to promote and instigate change.
  - They need to have enough knowledge of the industry to discuss in depth the key issues and to be able to have meetings/conversations with many different types of key stakeholders.
  - They will have to have enough technical knowledge of “How” digital is going to be implemented in the sector.
  - There may be an individual that has all of the above qualities, but it is more than likely going to be a leadership group or board.
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## RECOMMENDATIONS FOR ACTION

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### Leadership:

#### 1.1 National Supports

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Set up a national central resource to support the roll out of digital tools and processes in Ireland. A resource with both public and private commitment to develop the industry’s capability.

#### 1.2 Establish the Executive

---

Identify a suitable individual/executive and support team to lead the implementation programme.

#### 1.3 Platform for leadership

---

Create a platform for leadership to drive a digital transformation programme in the Irish AEC & FM sector.

#### 1.4 Value from Data

---

Collaborate internationally to make the case for structured, validated, comparable data sets for improved analysis and decision making across the industry.

# Standards (2.0)

## DESIRED STATE:

“A highly efficient digitised planning, design, construction and built asset or property real estate sector, will depend on highly standardized “machine readable” data. There will be a common agreement between all of the various built environment stakeholders, on how to describe all elements of buildings or infrastructure, from the macro level, down to individual building products, in a common data language (schema). This will be open, vendor-neutral, and in line with best-practice international and European standards.”

## CURRENT SITUATION

The “exchange of data” is not current common practice within the built environment. Information is traditionally exchanged in paper-based documents, or multiple independent proprietary file formats, that may, or may not adhere to standards. Without any agreements on the standards to be used, it is difficult for “buyers” of information to specify exactly what they want, and it is equally difficult for “suppliers” of information to deliver what is required. The volume of information related to buildings or infrastructure, ideally requires “machines” to automate most of the checking. Without consistent “rules” or standards for “machine readable data”, it is almost impossible to check if the information that has been provided, complies with the requirements, or follows industry norms.

The following standards for building information have now been adopted by the European Standards Committee (CEN) which effectively precludes any member state from developing or maintaining a separate or conflicting standard. However, these are not “mandatory” and are generally not being used in practice in Ireland.

- \* I.S. EN ISO 16739:2016 Industry Foundation Classes (IFC) for data sharing in the construction and facility management industries (ISO 16739:2013)
- \* I.S. EN ISO 12006-3:2016 Building construction - Organization of information about construction works - Part 3: Framework for object-oriented information (ISO 12006-3:2007)
- \* I.S. EN ISO 29481-2:2016 Building information models - Information delivery manual - Part 2: Interaction framework (ISO 29481-2:2012)

The International Standards Organization is currently developing standards for “Information management” for both the capital deliver and operations phase of built assets (ISO 19650 part 1 & 2, under ISO-TC-59). These are currently in draft and under consideration/ballot. These are jointly being considered by CEN-TC-442 at European level under the “Vienna Agreement” (where ISO and CEN agree to develop these together, or rely on the other).

## KEY STAKEHOLDERS

The stakeholders involved in the built environment are diverse and varied, from geographical and mapping professionals, to planning, building control, design professionals, contractors, specialist fabricators, product suppliers and manufacturers, to building operators and users. All these stakeholders need to be engaged. The information pertaining to the built environment has a “lifecycle” that passes from one party to the next, through these various parties and professions. Achieving a highly efficient “digital” economy, transacting “machine readable” information between these stakeholders will depend on reaching agreements on the standards of information to be used. This should NOT be a uniquely Irish solution, but should follow, or take into account, emerging international and European standards.

## KEY GAPS TO REACHING THE VISION

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The fragmented, adversarial nature of the sector along with the disjointed nature of “Information Systems” across the built environment is the “Big Problem”. Since the various stakeholders mentioned above have traditionally not “collaborated” around common “machine readable” data, but rather paper-based information, each stakeholder group has approached the “digital transition” over the past decade in their own way, with only their own requirements in mind, and without consideration on how information would be used “downstream” (since it wasn’t shared as data). Software development in these various sectors has been very bespoke to that sector, and most commonly based on proprietary or vendor formats, or lock in static or paper-based formats.

A key challenge, that needs to be addressed, is that these various stakeholder groups may now have a serious investment in their own systems and processes, and may not be eager or willing to change, or adopt more common open, or non-proprietary, formats or standards.

## RECOMMENDATIONS

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### Standards

#### 2.1 Open BIM Adoption

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Consultation with key stakeholder groups to determine the commitment, willingness, or resistance, or to identify the roadblocks to adopting open, internationally recognized information standards (a common or consistent approach):

#### 2.2 Incorporate International standards

---

Support Ireland’s involvement in International and European Standards development. Communicate what is happening with regards to adoption of International and European Standards. ISO-TC-59, CEN-TC-442, OGC, etc. (It will be important to avoid a national approach to the development of standards.)

#### 2.3 NSAI Certification

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Government and industry support of the NSAI (National Standards Authority of Ireland), and other recognized Institutes, to develop industry training and certification programmers in relation to standards.

#### 2.4 Online Tools and Supports

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Help implement “National Tools” (like a digital toolkit and national BIM Library) that help drive general conformance with standards, avoid wasteful duplication of effort, and avoid exclusion of SME’s.

#### 2.5 Align planning, building control and public asset information with standards

---

Ensure public procedures, like mapping, planning, building control, public sector asset management, etc, comply with these standards, and require, or incentivise, submission of digital information in compliance with standards. (The move from ‘paper to data’.)

# Education & Training (3.0)

## DESIRED STATE

“Deliver a broad awareness and upskilling learning framework for both educators and industry through a National BIM Education Taskforce based on core multi-disciplinary BIM curriculum outlining the skills needed to deliver a 21st century workforce for the built environment sector in Ireland.”

## BIM IN IRELAND’S HIGHER EDUCATION INSTITUTES (HEIS)

Ireland’s HEIs have responded rapidly to a demand by industry for BIM related training despite the absence of a national BIM mandate, such as is evident in the UK. A sample of programme titles, modes of delivery and levels reported by Irish HEIs are listed in Table 1.

TABLE 7: BIM PROGRAMMES WITHIN IRELAND’S HEIS

HEI	Title of Programmes	Mode of Delivery
Athlone Institute of Technology (AIT)	Revit Building Information Modelling (BIM) Project Management and Collaboration Advanced Revit Building Information Modelling (BIM) Project Management and Collaboration Beginners	CPD Part-time
Cork Institute of Technology (CIT)	Higher Certificate in BIM	Part-time
Dublin Institute of Technology (DIT)	MSc in Applied BIM & Management MSc in Construction Informatics	Part-time Part-time (online)
Dundalk Institute of Technology	Certificate in Building Information Modeling	Part-time
Galway Mayo Institute of Technology (GMIT)	Higher Diploma in Engineering in Building Information Modeling	Part-time and Full-time
Institute of Technology Carlow	BIM Management module on the MSc in Management in the Built Environment	Full-time
Institute of Technology Sligo	module on the 4th year of the BSc BIM and 3D surveying module on the BEng (Hons) in Civil Engineering and the BEng in Environmental Engineering	Full-time
Institute of Technology Tralee (ITT)	Certificate in Building Information Management	Part-time
Letterkenny Institute of Technology (LKIT)	Higher Certificate in Science in Construction Technology with BIM Bachelor of Science in Digital Construction	Full-time
Limerick Institute of Technology (LIT)	Construction Management and BIM module in year 2 on the BSc (Honours) Construction Management and BSc (Honours) Civil Engineering Management Degrees	Part-time (Special Purpose Award)
Ulster University	Postgraduate BIM module as part of the MSc in Commercial Management	Ulster University
University College Cork (UCC)	MEngSc in Information Technology in Architecture, Engineering and Construction	Full-time
University College Dublin	BIM components within the Design & Materials on the MSc module for the BEng Honours in Mechanical Engineering	Full-time
Trinity College Dublin	BIM modules in Façade Engineering and third year on the Bachelor Programme in Civil Engineering	Full-time
Waterford Institute of Technology (WIT)	Higher Diploma in Science in BIM BSc Honours in Architectural and Building Information Modelling Technology	Full-time Part-time

Ireland's National Skills Strategy specifically referred to the shortage of BIM skills in Ireland. Traditionally, the construction sector has not been regarded as 'technologically advanced and is not attracting sufficient talent or diversity in its workforce.

The results of the 2017 BICP study Assessing the Current Position and Associated Challenges of BIM Education in Irish HEIs confirmed a healthy confidence among Irish HEIs that were responding to the demand for BIM education in Ireland. The key challenges identified included:

- Incorporating BIM in an already concentrated programme.
- Cost of purchasing software and upgrading hardware.
- Cultural change by academic staff.

This survey was modelled on the UK 2016 BIM Academic Forum (BAF) survey. The work of the UK BAF groups has been closely monitored with members of the BICP team attending their 2016 conference. As a direct consequence, a BIM Academic Forum in Ireland (BAFI) has been set up and its first meeting was held in recent months. More complete details on the current situation can be located on [www.bicp.ie](http://www.bicp.ie).

Appropriate skills for those leaving education to participate in our industry and appropriate training for those already engaged in the construction sector. The awareness and training path, from client through to the designer, contractor and product manufacturer vary greatly. Distinguishing "What Digital will mean to me (or my organisation)" will be at the heart of this approach – Understanding where the skills gaps lie and how, using blended learning via web, blogs, chatrooms and classrooms, free and bespoke we can meet the priority needs.

## KEY STAKEHOLDERS

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Secondary schools, HEIs, ETBs, NSAI, Solas, Skillnets, Skillnet networks (CitA and CIF), Professional Institutions Industry Representatives (Training Managers/Human Resources), HEA, Dept. of Education & Skills.

## RECOMMENDATIONS

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### Education and Training

#### 3.1 National Education Taskforce

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Deliver a broad awareness and upskilling learning framework for both educators and industry through a National Education Taskforce based on core multi-disciplinary digital curriculum outlining the skills needed to deliver a 21st century workforce for the built environment sector in Ireland.

#### 3.2 Assessment Diagnostic

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Development of an online BIM self-assessment tool for companies (that differentiates between the needs of design/contractors/products) to help companies define where the training needs are required.

#### 3.3 Develop a base level of learning outcomes targeted at alternative National Framework of Qualifications (NFQ) levels.

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#### 3.4 NSAI Certification

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Develop a BIM certification programme to be managed by the National Standards Authority of Ireland (NSAI).

#### 3.5 BIM in Schools

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Encourage the inclusion of Digital Design and Construction in second-level curriculum e.g. National competition, Young Scientists Competition etc. Present the broad and diverse range of 'career choice opportunities' in the construction sector.

#### 3.6 Professional Institutes and Industry Bodies

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Need for the professional institutions and bodies to be consistent in specifying BIM competencies when accrediting built environment programmes.

# Procurement (4.0)

## DESIRED STATE

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A better quality built environment, safely and efficiently delivered and operated through informed decision making at key stages of each individual project's development and operation with a clear appreciation of how each project fits into the "digital whole" of our long-term 'smart' communities, towns and cities.

## THE CONSTRUCTION SECTOR

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Several reports<sup>12</sup> have identified systemic issues in the construction process relating to its levels of collaboration, under-investment in technology and R&D; and poor information management.

These issues result in unacceptably high levels of waste, poor value for public money (where public works projects are concerned) and higher financial risk due to unpredictable cost overruns, late delivery and avoidable project changes. Across Europe the construction sector's output represents 10% of the region's GDP and it employs over 18 million people mostly in the SME sector<sup>13</sup>.

Closer to home, the report on the Review of the Public Works Contracts carried out in 2014 also highlighted information deficiencies at tender stage, noting that the standard of information required was not being met in many cases leaving the State exposed to increased risk of claims from contractors who could not adequately price the project<sup>14</sup>.

<sup>12</sup> BCG, "Digital in Engineering and Construction", 2017; Economist Intelligence Unit, "Rethinking productivity across the construction industry", 2016; UK NAO, "Modernising Construction", 2001

<sup>13</sup> Handbook for the introduction of Building Information Modelling by the European Public Sector, EU BIM Task Group.

<sup>14</sup> <http://constructionprocurement.gov.ie/wp-content/uploads/Report-on-the-Review-of-the-Performance-of-the-Public-Works-Contract.pdf>

Digital technologies are playing an increasing role in the construction sector, not simply in project delivery but in planning and regulatory compliance. As noted, the construction sector has been slow to reap the benefits that digital technology has brought to other sectors. A significant barrier to digital penetration in the construction sector has been the absence of a platform through which the diverse contributors to a construction project can embrace digital technology. BIM has emerged in recent years as a serious contender to address this shortcoming.

Unlike other manufacturing sectors the construction industry exists to service diverse clients' requirements rather than a definable consumer demand. If the construction client does not understand the value proposition for BIM there is little scope for digital advancement throughout the property sector.

For almost all clients, the construction stage is merely a means to an end. The successful delivery of a project is, to a large extent, dependent on the level of understanding of the construction process and the capacity to manage it well. What defines a successful project will vary depending on a client's point of view.

Upon completion of a project there are clients who will have to live with the consequences of the decisions taken in the design and construction stage and there are those who will pass them on. The former, having a long-term interest, tend to be more interested in a quality outcome, however the latter may need persuading. The means of persuasion will vary depending on the circumstances.

Whilst clients are the key decision makers there are also many influencers that shape a project's direction.

Risk, or more properly, awareness of risk shapes a project's outcome. A failure to identify risk in the first place limits the steps that can be taken to avoid, reduce or manage it and can prove extremely costly - to the point where the project's viability is questionable.

Construction projects also require significant financial investment, investors have a significant stake in the success of the project, they may also be the client but frequently they are not. The more certainty that can be brought to the process the more attractive it becomes to investors.

Risk and finance are but two of the significant influences on a project's development to which design, safety, environmental impact, construction technologies, planning and building regulations (to name but a few) might also be added. Uncertainty in any of these influential areas impacts decision making.

BIM has the capacity to bring greater certainty to the design, construction and operation phases thus aiding the decision-making process. For clients across the public and private sectors this has to be the single biggest benefit to adopting BIM.

### PROCURING BIM

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From a client's perspective defining what BIM is and how to procure it are key challenges. BIM is a process that flows through different project stages, it is not a standalone product or a service that can necessarily be procured independently. At the outset of a project's development, the requirements for the optimum management of a project should be considered so they may be procured at the appropriate stage. The following are key considerations for the inclusion of digital technologies in construction projects from the procurement perspective:

- Rationale - Clients should have the information at their disposal to determine whether the adoption of digital tools and processes on a project will provide superior outcomes.

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- Procedures - Having 'opted to adopt', the process should be clearly mapped out so that clients can procure the expertise and skills necessary at the appropriate points of input.

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- Market - Construction professionals, contractors, subcontractors and suppliers must understand the requirements and have the capacity to enable the digital development of building projects and provide the necessary data for their efficient and safe operation upon completion.

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- Support - To assist clients in clearly describing what they require and the market in obtaining the necessary skills and technology to meet those requirements.

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BIM harnesses digital technology to generate models from information that is routinely produced on construction projects. That information is not always available when it might benefit the decision making process and it is rarely in a structured manner that has a use beyond the purpose for which it was prepared. In order to avail of the digital modelling capability of BIM, that information must now be structured so it is digitally accessible and must be available at specified stages of the project's development. A successful BIM implementation therefore requires:

- Information and its format to be specified,

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- The entities who are to produce the appropriate elements of the specified information to be identified, and appropriately tasked to deliver the information.

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- The level and extent of that information to be defined relative to the project's stage of development.

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BIM thus imposes discipline on the design development, the construction process and the operation stage because the various modelling, measuring and scheduling tools cannot function without data. Information gaps become immediately apparent and collaboration is better enabled since everyone is aware of their and other team members' obligations.

Construction projects stall and falter without information. The discipline imposed on the project, construction and operation teams in 'feeding' the BIM model ensures decisions are taken, to the greatest extent possible, on the basis of up to date and accurate information. BIM also allows the impact of those decisions to be tested virtually prior to incurring the capital cost.



Procurement is best undertaken at the point where requirements are certain. The solution to those requirements does not need to be fully defined at the point of procurement, but the extent of definition influences the method of procurement and the contracting strategy.

The other significant procurement challenge associated with BIM adoption is to ensure that the necessary data is available at appropriate stages to a project's development. It may result in a requirement for certain specialist input earlier than would be available in a traditional procurement model and, as a result, has the potential to turn such models on their head and therefore create significant disruption in the months and years to come.

## **PUBLIC SECTOR PROCUREMENT IN IRELAND**

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The Capital Works Management Framework (CWMF) was developed to deliver the Government's objectives in relation to public sector construction procurement reform. It consists of a suite of best practice guidance, standard contracts and generic template documents that support the framework. The Office of Government Procurement (OGP) is responsible for maintaining the CWMF in line with EU procurement rules, legislation governing the sector and Government policy.

The Government Contracts Committee for Construction (GCCC) is a forum to discuss public sector construction related issues and to provide expert advice and technical input into the development of public sector national construction procurement policy. The OGP chairs and provides the secretariat to the GCCC and manages the CWMF.

In March 2017 the GCCC commenced a consultation process with industry on the basis of a position paper titled "A Public Sector BIM Adoption Strategy"

The first objective of the strategy as set out in the position paper was 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, contractors and suppliers that are engaged in public works projects. The second objective was to drive the wider adoption of BIM across the sector generally. This could be advanced by the State, as the construction sector's single largest client, setting the agenda for adoption across its sizeable capital programme.

The position paper acknowledged the benefits that BIM can bring to the delivery of public works projects but also identified the challenges that its adoption will bring. To mitigate the challenges, it proposed a phased adoption in recognition of the differing states of readiness within the industry (and public service). The programme identified the early adopters as being the large scale, more technically complex projects where those engaged already have the capacity to deliver projects through BIM to the standard required.

The proposed adoption programme recognised 5 project bands in order of descending scale and complexity and established an outside period of 4 years after which BIM would be a requirement on most public-sector projects. The phased approach permits smaller businesses operating in the industry the time to invest in the technology and human resources necessary to deliver projects through BIM.

### GOVERNMENT MANDATE

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Various sanctioning authorities and contracting authorities across the public capital programme have already set out BIM requirements on a range of projects. Whilst the public capital programme funds a variety of public works projects across many sectors of the construction industry, taken together the programme represents the largest investment by a single client, the State, in construction services. Whilst public works are not procured by a single entity, the requirement to comply with the requirements of the CWMF means that a reasonably consistent approach is taken to works procurement.

In recommending the adoption of BIM across the public capital programme to Government to meet the objectives set out in the position paper, the GCCC also recommended that Government should mandate this requirement to ensure consistent standards for delivery are imposed across the public sector and that public bodies invest the necessary resources to adopt BIM in line with the strategy.

Those in the industry who invest in meeting the requirements for the public sector will also be able to offer those same services to private clients both in Ireland and further afield. Indeed, those contractors and construction professionals who have already adopted BIM are successfully competing for projects in other EU member states, particularly in the UK.

The public-sector strategy has considered the risks as well as the benefits that BIM offers, the threats to successful deployment and the necessary measures to mitigate same in arriving at the implementation plan.

The implementation plan will also take into account the impact that the adoption of BIM will have on public sector bodies, on construction-related service providers, main contractors and their supply chain and facilities management.

Once finalised, the implementation plan will encompass procurement [both consultancy and construction], contract administration and performance, project handover and operation and maintenance.

It will also include recommendations around standards to be adopted. Key to its success will be the establishment of an oversight body who will develop template documents and guidance for public works projects under the oversight of the GCCC.

Government has accepted the recommendations and is a keen advocate of the adoption of BIM across the public capital programme.

### IMPLEMENTATION

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The procurement challenges associated with the adoption of BIM highlighted earlier would suggest that it is simply not possible to change traditional procurement practices overnight, to do otherwise risks uncertainty and upheaval for construction clients and industry alike. In formulating a public-sector approach to the procurement of construction projects through BIM this must be carefully managed so that the construction of necessary infrastructure is not impacted.

The experience that has been gained through the introduction of direct tendering to specialist subcontractors in the public works contracts will inform the approach to be taken to ensure that appropriate expertise and input is procured at a point where it is needed to provide a complete picture for decision making purposes.

In addition to the phased and scaled approach for public sector BIM adoption the requirements will initially be framed within familiar procurement models. Clear requirements will be imposed on each member of the project and construction teams as separate and discrete procurements. The level of detail that each team member is required to provide for key milestones in the project's development, where that team member's information delivery obligations end and, where applicable, who is to further develop that stream of information.

Without a support structure to industry the adoption of BIM is likely, at best, to be patchy as some clients and sections of the industry itself cherry pick elements of the process to avail of the easy pickings rather than looking at the total delivery. That support should take the form of a resource and reference point but also an active proponent of BIM who will champion its use and co-ordinate the necessary policies, templates and training programmes.

As noted earlier in the document, many other countries are much further along in the adoption of BIM. This presents an opportunity to learn the optimum means of implementing the measures necessary to successfully manage this significant change in the industry.

International standards exist in many areas governing BIM, particularly the standards around data and these should be the starting point to ensure interoperability and open data platforms that are robust and capable of exploitation for purposes that may only become apparent many years from now.

The handbook published by the EU BIM Task Group concludes that there is a window of opportunity for harmonising a European wide common strategic approach for the introduction of BIM. Government policy and public procurement

methods are recommended as powerful tools to support this step-change in the sector. Without this top-down leadership, the sector's low and uneven adoption of information technology is likely to continue which would limit its opportunity to significantly improve productivity and value for money.

EU BIM Task Group / Public Sector adoption of BIM will begin to establish the framework for procurement that we anticipate will 'conduct' across to the private sector. Longer term, a defined road to value based decision making, supported by data and technology, has the potential to disrupt the traditional approach of competitive tendering and contract award across all clients and all projects.

Technological advances in how and when financial transactions are made also have great potential to positively impact procurement in construction. Alignment of technologies like block chain for example could revolutionise how the supply chain is valued and compensated. Greater transparency and traceability of payments in our industry also has the potential to signal and provide a measured understanding of where supplier value lies from sector to sector and from project to project.

## RECOMMENDATIONS

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### Public Sector Procurement

- 4.1 Determine a clear framework for procurement of BIM on public sector construction projects.
  - 4.2 Identify a champion for BIM. A body who will act as a focal point to support its adoption and provide a central resource with expert advice. This advice should take into account clients, both public and private sector, construction professionals, contractors, subcontractors and suppliers.
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# Conclusion

The progression of the GCCC's industry consultation for BIM adoption and the acceptance of its recommendations by Government for the progressive mandating of BIM for the public capital programme is a significant step forward in the industry's digital transition. The development of a strategic roadmap and the recommendations of this paper, by the industry for the industry is another positive development. Further, the third successive industry leadership survey by Enterprise Ireland and CitA in 2017 has again concluded that the industry's organic adoption of digital tools continues to increase.

Nonetheless, the challenge that lies ahead is still formidable and while the NBC acknowledges the digital transition in Ireland is well progressed, the likelihood of transition stalling is still significant. We anticipate that the benefits from the adoption of digital tools will plateau unless we find more collaborative ways for the industry to work together. In presenting a strategic approach to overcoming some of the obstacles to adopting more collaborative, digital processes we recognise the speed of transition relative to our closest trading partners, as well as the final destination is key.

Strong, consistent leadership has been prioritised as a key element of the roadmap if we are to enjoy early adopter benefits and obviate the high cost of failure.

Leadership will come from Government as a client of construction, but must also come from the industry based upon a vision for a sector that attracts a forward thinking and diverse workforce. An industry that invests in the future through research and development and training. An industry that ultimately improves the outcomes and reduces the risks of construction for all incumbents and stakeholders. A more international industry, an industry, that ultimately, we are all proud to be a part of. Only then, as a healthy, more investable sector, will we be able to contribute more directly to wider organisational and societal benefits.

In putting forward the case for greater adoption and a roadmap for industry implementation, we conclude this report with the consequences of Ireland adequately failing to support the implementation of digital tools and processes.

1. The status quo will come at a cost.  
There is tremendous opportunity to generate value for Ireland that is being currently squandered due to inefficient work practices. (20% savings could generate an additional 50,000 homes for example.)

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2. We will fall short of our sustainability targets.  
Limited consideration during design and poor use of resources during construction will continue to impact on our environment.

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3. Ireland risks losing its position in terms of innovation and competitiveness on a national and international scale. While other countries are investing in their AEC & FM community to support research and development and promote innovation and best practices, Ireland shows very limited support for this sector.

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Mr Eugene Forde – Department of Business, Enterprise & Innovation

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**The National BIM Council are:**

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Ms Caroline Spillane (Chair) – Engineers Ireland

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Mr Damian Duffy – National Development Finance  
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Mr David O'Brien – Government Construction  
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Mr David O'Connell – CIC BIM Working Group

---

Mr Gerard Bourke – Office for Public Works  
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Mr John Hunt – Enterprise Ireland

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Mr Noel Kennedy - Intel

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Mr Ralph Montague – CITA / Arcdox

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Mr Sean Downey – Construction Industry  
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Mr Shane Brodie - Intel / MacArdle McSweeney  
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Mr Stephen Hughes – Enterprise Ireland

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Ms Suzanne Purcell – CITA (Secretariat)

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