A Public Sector BIM Adoption Strategy

Statement of Intent

"Properly implemented, a public sector Building Information Modelling (BIM) adoption strategy will support the implementation of Government policy objectives[1] in the procurement of public works projects, in their construction and in their maintenance upon completion."

Executive summary

We are all aware of the impact that digital technologies are having on our lives; they are driving huge change across industry, healthcare, education, entertainment and almost any other facet of life one can imagine. Whilst its benefits largely outweigh its costs, its adoption is usually accompanied with a degree of disruption as traditional practice, businesses and even industries are forced to adapt or be consigned to history.

Digital technology has been making a positive contribution to the construction industry for well over 30 years. The applications for digital technology have increased in the last decade with spectacular advances in land and building surveying in particular. Digital drawing packages have been in universal use across the industry for the past 25 years. Digital analytical modelling systems utilising 3D drawing software packages have developed in recent years to such an extent that they are challenging conventional project delivery methods.

The use of digital technology has, until recently, largely been confined to the pre-construction stage. The construction and operational phases are still reliant on paper outputs from the digital platforms used at the design stage. This is because, until relatively recently, the technology had not developed sufficiently to facilitate the complex supply chain that contributes to a construction project. Building Information Modelling (BIM) has evolved to provide a means of extending the digital reach into the construction and operation stages. The legal and liability aspects associated with its adoption should not be ignored but the manner in which it is adopted will mitigate these risks.

The case for adoption will be set out in greater detail later in this document. Notwithstanding the case for and against, were Government to decide to do nothing the technology and processes would be used in any case such is its traction at this stage. The strategy will be primarily concerned with managing its adoption rather than case making.

BIM programmes are essentially change management initiatives that require goals, resources, projects, momentum, successes and time. Its widespread adoption will have a disruptive impact akin to that experienced across the various sectors that have embraced digital technology over the past 20 years. The lessons learned from these experiences would suggest that Government should take a lead in setting out measures to manage its adoption. In this way businesses can plan for the change rather than realise too late that they no longer have the capacity to contribute to the industry and to earn a living.

[1] Government policy objectives:
- Cost certainty at tender award stage
- Better value for money (VFM), and
- More efficient delivery of public works projects

It is recommended that a strategy for the adoption of BIM on public sector construction projects be mandated by Government to ensure a consistent and coherent approach to procuring BIM on public sector building projects.

1.0 Context

1.1 Building Information Modelling (BIM)

A digital representation of physical and functional characteristics of a facility… and a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition[2]

This is but one of many definitions, all suggest that BIM combines technology with a set of work processes with differing emphasis on either one or the other.

It describes the process of designing a building or piece of infrastructure collaboratively using one coherent system of computer models rather than as separate sets of drawings. Collaboration within disciplines isn't enough. BIM is by its nature multidisciplinary and it is not enough to simply adopt it within traditional structures as it challenges the conventional means of project procurement.

1.2 The rationale for the adoption of BIM

BIM is not a merely a 3D graphic representation but in fact a virtual model that can be used to evaluate the construction and performance of the built reality. Properly implemented, it delivers projects more efficiently, to a higher quality and more safely. It also provides an information asset that can optimise the management (and performance) of the completed facility and, upon wider adoption, has the potential to revolutionise the way public infrastructure is planned and public services delivered.

In the context of the digital world, a BIM model represents a data rich environment, data which can be utilised to deliver real efficiencies and for purposes that haven't yet been conceived.

1.3 The Policy Framework

The European construction sector's output of €1,400bn is approximately 10% of the region's GDP and it employs over 18 million; most of which are employed by small and medium sized enterprises. However, it is one of the least digitalised sectors with flat or falling productivity rates over the past twenty years. Several reports across the EU identify 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 poor value for public money and higher financial risk due to unpredictable cost overruns, late delivery of public infrastructure and avoidable project changes.

At a European level the 2014 Procurement Directive recognises the role of BIM in project delivery and the EU Commission has established the EU BIM task Group to deliver a common European network aimed at aligning the use of Building Information Modelling in public works. A *Handbook for the Introduction of BIM by Europe's Public Sector Community* is to be published in Q3 of 2017.

[2] As defined by the National Institute of Building Sciences in the United States

Nationally the adoption of BIM has been identified in the context of supporting international expansion and technology advancements in the construction sector and in this regard **Construction 2020** includes:

> Action 68
> *Continue promotion of the Enterprise Ireland Lean Start Programme and advance construction companies onto the following stages, Plus and Transform. Implement a BIM staged development programme to support companies advancing to Level 2 BIM capability.*
>
> Action 69
> *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 a requirement.*

Recognising the increased activity in the construction sector the **Action Plan for Jobs 2017** includes a BIM related action in the context of supporting greater efficiencies in the construction sector.

> Action 162
> *Prepare a strategy for the adoption of Building Information Modelling across the public capital programme and to mandate the manner in which it is to be adopted across the public sector.*

Whilst the context for both Construction 2020 and APJ 2017 is entirely relevant, the strategy will address the value for money perspective through channelling the efficiencies that the use of BIM can achieve and the benefits to the public capital programme whilst setting out the risks and threats.

1.4 The International Context

The use of BIM is widespread on large projects across northern Europe - Scandinavia, the Netherlands, Germany and Finland were early adopters. The UK government mandated the use of BIM to Level 2 on all central government projects by 2016. Its use in the US is widespread and Singapore is seen as an innovator in this area requiring planning applications to be submitted in BIM format – the city of New York has also set this requirement in recent times.

BIM is fast becoming an essential requirement for informed consumers of construction services across the globe. It has already been used on a number of high profile building projects in Ireland including the refurbishment of the fabrication plants in the Intel facility in Leixlip, Co. Kildare which accounted for $5bn investment between 2011 and 2014. It is being used on the National Children's Hospital at the St James's Hospital campus, on the Grangegorman Development and across the PPP programme.

A BIM enabled construction sector features high on the wish list of foreign and indigenous investors particularly in the high tech and pharmaceutical sectors. Large to medium-sized Irish main contractors and specialist construction companies and some of the specialist manufacturers have already invested in the technology and have won significant contracts in the UK capitalising on the UK government's BIM mandate.

1.5 Consultation

Preliminary consultation has been undertaken with the main capital spending bodies represented on the Government Contracts Committee for Construction (GCCC). The views of these bodies have been taken on board in the preparation of this paper.

The next step will see the publication of this paper for industry wide consultation.

2.0 The Implications of BIM

2.1 The Benefits

There are many but they may be summarised concisely as waste reduction.

- A powerful design tool with which clients can interact reducing wasteful design revision.
- Better design and information co-ordination for the construction stage – reducing time spent in redoing work. BIM requires the detailed project information to be produced and co-ordinated in a manner that is consistent with the approach sought upon the introduction of the public works contracts.
- Potential programme and cost savings to the client[3].
- Delivers greater certainty to the client, design team, contractor and facility manager.
- Significant time savings at the tender stage in evaluating contractors' offers where a BIM model is used as a tender document.
- In public procurement it offers the potential to tie down products and materials pre-award.
- In moving to full BIM adoption (beyond Level 2[4]) it offers scope for a more collaborative approach where risk (and waste) is better managed through the model.
- A valuable information asset to manage the performance and maintenance of the completed facility.

2.2 The Risks in its adoption

There are many, primarily associated with an ill-informed implementation. Instead of the intended benefits it may, if not considered properly, lead to increased waste and reduced competition.

- Improperly implemented, it can result in the production of a model that is of little long term use at a significant cost.
- Significant disruption in organisations during its early adoption.
- Greater potential for claims particularly should a poorly prepared model be provided for tender purposes.
- Liability issues where BIM Level 3[5] is implemented without a proper risk allocation template.
- A reduced level of competition as suppliers fail to adopt the new technology and procedures necessary to qualify for tender competitions.

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[3] Return on Investment analysis of building information modelling in construction. B Giel, RRA Issa & S Olbina

[4] Under BIM Level 2, each design team member creates and develops its own digital model; together these comprise a *federated model* of the overall project. BIM Level 1 envisages each design team member operating in 2D or 3D but imposes standards for information management such as BS 1192: 2007.

[5] BIM Level 3 signifies full collaboration by the project team members and anticipates the use of a single BIM model held by all project team members to access, use and modify at any time within a centrally held *Common Data Environment*.

- The use of BIM in the construction of facilities with sensitive security requirements must be carefully managed.

2.3 The Risks in failing to manage its adoption

- It opens the opportunity for early adopters of BIM to dominate the tender and contract management phases.
- Information requirements to feed into contractor's project management phase will increasingly be BIM focussed.
- A piecemeal approach to adoption across the public sector will result in different approaches – a lack of consistency from a procurement and contract perspective that the Capital Works Management Framework (CWMF) was intended to counter.
- Wasted financial and technical resources in each public body developing their own approach.
- Greater investment will be required to undo the non-standard practices that may be adopted without proper leadership.
- If a consistent or standardised approach is not taken by public bodies, with each contracting authority doing their own thing, then we can expect a piecemeal response from the market in responding to local requirements meaning some suppliers will not develop their capacity until it is too late.

2.4 The key challenges

In order to assist in its adoption, standards must be mandated to ensure that the public sector sets clear and consistent scope of service requirements to tendering consultants and contractors. Much of the 'heavy lifting' has been undertaken in the UK in response to their Government mandate and is readily transferrable to the Irish construction industry.

- A draft International Standard ISO 19650 *Organization of information about construction works — Information management using building information modelling* Part 1 - *Concepts and principles* & Part 2 - *Delivery phase of assets* are currently out for comment by CENTC442.
- The **UK Construction Industry Council's BIM Protocol**[6] is a useful reference to establish the scope of service requirements. The following are just some of the concepts that are unique to BIM but must be defined as part of any scope of service/works requirement:

  Model Production and Delivery Table[7]
  Levels of Definition/Levels of Information[8]
  Employer's Information Requirements[9]
  Common Data Environment[10]
  BIM Execution Plan[11]

- Ensuring that the **data** contained in the model remains in the **ownership** of the contracting authority and not the design team or the contractor, nor indeed the software manufacturer.

[6] http://cic.org.uk/publications/
[7] Construction Industry Council Building Information Model (BIM) Protocol (2013) CICBIM/Pro. Glossary at Appendix D and also Chapters 5.1 and 6.2
[8] Dealt with as Levels of Detail in CIC BIM Protocol Glossary at Appendix D and also Chapters 5.1 and 6.2
[9] CIC BIM Protocol Glossary at Appendix D and also Chapter 6.2
[10] CIC BIM Protocol Glossary at Appendix D and also Chapter 6.2
[11] CIC BIM Protocol Glossary at Appendix D and also Chapter 6.3

With regards to the latter, the project team will be required to prepare a model in an **Industry Foundation Classes (IFC) data model**[12]. This addresses data ownership but also software interoperability and the accessibility of file formats.

- Intellectual property associated with data.
- A new role is required under PAS 1192-2 - a **Project Information Manager**. Best practice suggests that this important role requires full attention and should not be performed alongside other roles except on smaller projects. The role should be separately identified and resourced for the design, construction and operational stages.
- New **roles, procedures and technology requirements** in client organisations, consultancy firms, contractors and sub-contractors. Key challenges include:

  Raising the capital for new technology and training
  Recruitment of key personnel – BIM Manager
  Adapting IT systems to cloud based environments
  Adopting new procedures
  Insurance requirements

- **Training and upskilling** required in both the public sector and construction sector may prove challenging if sufficient lead-in time is not provided.
- A requirement for BIM to **Level 2 does not require significant changes to the procurement or contract regime** and is one of the key reasons why it was chosen by the UK government – in reality it is not really BIM because collaboration is limited.
- **Early contractor involvement is necessary for Level 3** and beyond – it is here that even greater efficiencies in the construction phase are to be realised. It also requires a different approach to risk and insurance provisions.
- Is the **culture change** that is necessary for the successful implementation beyond Level 2 possible – can the industry trust itself?

3.0 Public sector BIM adoption strategy

3.1 Government mandate

Government is to be asked to note the benefits that BIM can bring to the public capital programme and the challenges associated with it. Government will be asked to decide to mandate the adoption of BIM across the public service on the basis of a high level strategy that is summarised in this section 3.0. It is envisaged that the mandate will have a twofold purpose 1) to ensure that public bodies invest the necessary resources to adopt BIM in line with the strategy and 2) to impose standards for delivery across the public sector.

In the absence of EN or Irish Standards, Government support for the strategy is necessary to implement a consistent approach in procuring BIM across the public service.

[12] This is a platform neutral, open file format specification that is not controlled by a single software developer or group of developers. The Danish government and many governmental organisations in Norway and Finland require IFC models. It is also an ISO standard: ISO 16739:2013

There may also be wider benefits to the industry in such an approach. If clear and consistent BIM requirements can be established by public sector bodies through the proposed strategy there is no reason why those requirements should not be adopted by private sector clients who may be looking for the same outcome. This consultation process affords the opportunity to explore the extent to which this level of alignment may be possible.

3.2 Considerations for inclusion in the strategy

The strategy will consider the risks as well as the benefits that BIM offers, the threats to successful deployment and the necessary measures to mitigate same. These are summarised in section 2.0 of this paper and more will, no doubt, be raised during the consultation phase.

It will consider 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.

It will encompass procurement [both consultancy and construction], contract administration and performance, project handover and operation and maintenance.

It will conclude with high level recommendations around standards to be adopted and a timeline for implementation. Key to its success will be the establishment of an oversight body who will report to the GCCC.

3.3 Application of the strategy

It is proposed that the strategy will apply to all projects procured under the public capital programme to the extent set out in Table 1. The PPP programme already has a BIM requirement. The CWMF has been developed to ensure a consistent approach to the procurement of all projects sanctioned under the public capital programme. The CWMF will be augmented to incorporate the necessary documentation, protocols and template scope of service requirements for public sector bodies to procure the consultants and contractors necessary to design and construct the project.

The strategy will not extend to private sector projects. Nonetheless the manner in which BIM is adopted by the public sector will be persuasive because of the scale of the public capital programme. Through liaison with industry representative bodies such as the Construction Industry Council a consistent approach may be developed across the public and private sector when procuring BIM on construction projects. An aligned set of requirements across both public and private sectors will reduce the burden on consultants and contractors in responding to client requirements.

3.4 The development and implementation of the strategy

An oversight body will be established which will comprise officials with expert knowledge of the technology but also those with extensive project management, cost management and procurement experience. The body will be chaired by the OGP and will make recommendations to the GCCC on the manner in which BIM should be procured and the standards to which the BIM model should adhere (until an EN/ISO Standard covering BIM is adopted).

Officials on the group will also report on the extent of uptake across the public sector and the challenges being encountered.

3.5 Indicative timeline for adoption

The strategy will set target dates for projects to adopt BIM – the timeline set out at Table 1 is for the purposes of consultation and is subject to change. The early adopters will be those projects where the long term benefits are deemed to be the greatest and where those involved in the delivery have already made significant strides in the adoption of BIM. The strategy recognises 5 different project types as defined below encompassing the very different project types procured across the public service. Project values typically increase as you move towards Band 5, however this may not always apply. For example certain categories of civil engineering projects pose a particular challenge in terms of definition since they can often have a high capital cost but be reasonably straightforward from an operation and maintenance perspective. An indicative timeline is included at Table 1 for discussion purposes.

Two factors are taken into account in setting the categories 1) the project's construction complexity and 2) the operation and maintenance regime.

The timeline will allow those bodies who do not have experience of BIM to undertake their own pilots for projects in Bands 1, 2 & 3 in line with the standards set out in the strategy and to feed back into the BIM oversight group set out at 3.4.

Band 1 – low complexity projects with straightforward operation and maintenance requirements;[13]

Band 2 – medium complexity projects with straightforward operation and maintenance requirements;[14]

Band 3 – medium complexity projects with particular operation and maintenance requirements;[15]

Band 4 – complex projects with particular operation and maintenance requirements;[16]

Band 5 – complex projects with a specialist operation and maintenance regime.[17]

[13] Small schools, low density housing projects and simple civil engineering projects. They should have simple operation and maintenance requirements.
[14] School buildings, low rise apartment schemes, civil engineering projects involving simple structures. They should have simple operation and maintenance requirements.
[15] Third level educational facilities, high density apartment schemes, primary care centres. They should have particular operation and maintenance requirements, e.g. regular service requirements for mechanical or electrical equipment.
[16] Specialist third level facilities, hospitals, complex civil engineering structures e.g. large span bridges. They should have particular operation and maintenance requirements, e.g. regular service requirements for mechanical or electrical equipment.
[17] Acute hospitals, laboratories, specialist civil engineering structures e.g. light rail. They would typically have specialised operational requirements and/or planned maintenance.

Table 1 – Indicative BIM implementation timeline – Period (months) from Government mandate to the introduction of BIM requirements in contract notices

Department/ Public Body	Sub-sector	Band 5	Band 4	Band 3	Band 2	Band 1
D. Ag & Marine		-	-	-	+ 36	+ 18
D. Defence		-	+ 18	+ 24	+ 36	+ 48
D. Education	Primary	-	+ 18	+ 24	+ 36	+ 48
	Secondary	-	+ 18	+ 24	+ 36	+ 48
	Third Level	+ 12	+ 18	+ 24	+ 36	+ 48
D. Health	HSE	+ 12	+ 18	+ 24	+ 36	+ 48
	Vol. Hospitals	+ 12	+ 18	+ 24	+ 36	+ 48
D. Housing	Housing	-	+ 18	+ 24	+ 36	+ 48
	Non-housing	+ 12	+ 18	+ 24	+ 36	+ 48
Office of Public Works	Heritage	+ 24	+ 30	+ 36	+ 48	-
	Flood Risk Management	-	-	-	+ 36	+ 18
	New Build	+ 12	+ 18	+ 24	+ 36	+ 48
Transport Infrastructure Ireland	Rail	+ 12	+ 18	+ 24	+ 36	+ 18
	Road	+ 12	+ 18	+ 24	+ 36	+ 18

Legend

BIM Level 1		
BIM Level 2		

Note 1: The scope of services for the engagement of design team consultancy services must make provision for the production of a BIM model to the level defined (Level 1 and 2 will be defined in the Strategy) where the Contract Notice for the design team occurs after the periods listed above. The public works contract awarded for the construction stage will also include BIM requirements in line with the Strategy.

Note 2: Contracting authorities should adopt BIM Level 1 requirements before the adoption strategy requires Level 2 to be applied to their projects. BIM Level 1 imposes many of the information production standards without having to make the transition to a digital environment and so 'prepares the ground' for the move to the digital requirements of BIM Level 2.

Note 3: In the devolved sectors of education, health and housing (AHBs) consideration may be given to extending the applicable deadlines by up to 12 months to prioritise the internal organisational changes in the first instance.

Note 4: Where refurbishment or conservation works are concerned (excluding minor repair and maintenance works) and the contracting authority has a long term interest in the property, contracting authorities should undertake an evaluation with regards to cost and programme to establish whether a BIM model should be produced for the works tender stage. Should the heritage strategy[18] apply to

[18] See section 7 of guidance note GN1.4

the project significant investigation works are to be carried out under a separate contract which may provide scope for the preparation of a BIM model. Where it is decided, on the basis of the evaluation, not to provide a BIM model then the design team and contractor's scope of service shall include the production of a BIM model to level 2 upon the date of substantial completion of the works.

Note 5: Note 4 above does not apply to minor repair and maintenance works. Where such works are concerned a BIM model is not required at tender stage and should not be a requirement for the design team and the contractor to produce a BIM model during the works phase unless the contracting authority has a planned programme of such works to the same structure and the contracting authority sees long term benefit in preparing a BIM model.

Note 6: Where extensions to existing buildings are concerned, the new build element should be undertaken as per Figure 1 above. However the evaluation set out at Note 4 should be undertaken to establish the extent of the existing structure that should be included in the BIM model for the works tender stage.

Note 7: Where external design team services are not necessary, a period of 9 months may be added to these dates to identify the period after which a works contract in the specified bands will require a BIM model to the specified levels to be provided for the works tender stage.

Note 8: With regards to Bands 1, 2 & 3 contracting authorities should not include BIM Level 2 requirements across their programme in advance of the time periods set out with the exception of pilot projects. This is to allow service providers and contractors time to adopt the technology and processes required.