Legal aspects of Building Information Modelling: a world view (Part I)

Building Information Modelling (BIM) is increasingly in the spotlight as its use starts to increase around the world. This article analyses legal aspects of BIM in six different jurisdictions: Brazil, Canada, Denmark, Ireland, UK and the US.

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There is no universally accepted single definition of what Building Information Modelling (BIM) is. However, there are certain common features that we have identified across the six jurisdictions analysed for the purpose of this article.

From a technical perspective, the common elements are that BIM involves:

- accurate virtual models of a building being constructed digitally;
- computer-generated models which contain precise geometry and data needed to support the construction, fabrication and procurement activities;
- shared knowledge resource for information about a facility throughout its lifecycle, that
is from earliest conception to demolition; and
• collaboration by different stakeholders at different phases of the lifecycle of a facility to insert, extract, update or modify information.

BIM is not simply a new way to design or something which affects only the design and construction of a building, but ‘a process focused on the development, use and transfer of a digital information model of a building project to improve the design, construction and operations of a project or portfolio of facilities’.1

In the UK, the government described BIM as follows:
‘BIM uses advanced computer systems to build 3D models of infrastructure and hold large amounts of information about its design, operation and current condition. At the planning stage it enables designers, owners and users to work together to produce the best possible designs and to test them in the computer before they are built. In construction it enables engineers, contractors and suppliers to integrate complex components cutting out waste and reducing the risk of errors. In operation it provides customers with real time information about available services and maintainers with accurate assessments of the condition of assets’.2

BIM comes in numerous shapes and sizes. The industry in the US has loosely adopted different terms to refer to the various forms of BIM but the descriptions of these broadly hold true elsewhere.

Under the most rudimentary form of BIM, the design professional uses software to develop a 3D model. The 3D model is then used to generate a traditional set of construction drawings, which are provided to the general contractor for construction. This is loosely referred to as ‘Limited Lonely BIM’.

Another level expands upon Limited Lonely BIM by providing all project participants with access to the 3D model. This is loosely referred to as ‘Limited Social BIM’. One variant of Limited Social BIM allows select project participants with authority to modify select versions of the BIM model, and this facilitates construction planning and the documentation of as-built conditions.

Yet another level expands BIM beyond 3D modelling and incorporates the use of various BIM elements such as cost estimation, time evaluation, energy efficiency analysis, usage optimisation, and the like. This approach is loosely referred to as ‘Expanded BIM’ and it is seen in both ‘lonely’ and ‘social’ forms: ‘Expanded Lonely BIM’ and ‘Expanded Social BIM’.

BIM is a process which applies throughout the whole lifecycle of a building.

Each of these variants holds strengths and weaknesses depending upon the type of project and the form of the procurement. For example, Expanded Social BIM is well suited and an arguable necessity for projects employing Integrated Project Delivery (IPD) as the delivery method. On the other hand, Expanded Social BIM has no applicability to most competitively bid public works projects. Limited Lonely BIM or perhaps Expanded Lonely BIM would be best suited in such instances.

In the full ‘social BIM’ context, BIM is a process which applies throughout the whole lifecycle of a building. Use of BIM is, though, varied. It is often not used in this sense but as ‘lonely BIM’, where the technology is used to assist in the design and construction phases, possibly only by the designer and contractor but without the rest of the aspects identified above.

Aside from the technological aspects of the BIM process, BIM raises a number of legal issues to be considered and accommodated within the contractual framework of the project. We have identified some key aspects and what follows is a comparison of the treatment of these across the jurisdictions considered.

Why is BIM relevant? Adoption of BIM

Across the six jurisdictions here analysed, the level of adoption of BIM and the approach taken by governments and industry has varied. However, it would be fair to say that in each case, use of BIM is increasing.

Brazil

In Brazil, there is no federal statute establishing the mandatory use of BIM. However, a legislative bill to include the obligation to use BIM in public projects is currently under discussion at the Brazilian Senate. Some Brazilian state governments, such as Paraná and Santa Catarina, are imposing the use of BIM in some specific projects.
Information about the Brazilian construction market is very limited. However, in 2015, a survey was carried out regarding the use of BIM. This identified that out of 282 Brazilian construction associations and architects, acting in the public and private sectors, who were interviewed, 60 per cent had worked with BIM. More than 50 per cent of those started to work with BIM after 2013. The development of BIM in Brazil is therefore very new and still not well developed.

It also appears that BIM is more widely used in the private sector rather than in the public sector. However, use in the public sector is increasing. Some major Brazilian contractors, such as Metodo Engenharia, Construtora Norberto Odebrecht, JHSE, Hochtief Brasil, SINCO, MATEC and GAFISA have been using BIM in several projects.

Many public projects, such as the FIFA World Cup stadiums and facilities for the Rio 2016 Olympics at least in part used BIM, but this was initiated by the contractors and not the public authorities.

The Brazilian army began to develop the use of BIM back in 2006. In 2014, other public bids demanded the use of BIM processes including the project for circa 270 regional airports for ANAC, the National Civil Aviation Agency of Brazil, and two hospitals by the state of Santa Catarina. Furthermore, the state-owned company Petrobras has used BIM in the construction of its headquarters in the city of Santos. Santa Catarina was the first state to set out a BIM deployment programme requiring that from 2015 projects should be presented on this platform.

A significant number of architectural firms are using BIM applications. In São Paulo, 40 per cent of architecture firms and structural engineering work is already integrated into BIM. In the area of facilities, this percentage drops to 20 per cent. In other Brazilian cities, the use of BIM in construction projects is not so significant.

Regarding the use of BIM by suppliers, according to a survey made by ABRAMAT, the Brazilian Association of Construction Material Suppliers, most of the use is focused on cement, walls and roof suppliers.

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Canada

In Canada, there are no formal policies mandating the use of BIM on public projects, although many commentators are optimistic that Canada will embrace BIM.

Many public sector institutions, such as Defence Construction Canada and the Department of National Defence, have recognised the potential for use of BIM technologies in construction and are taking steps to consider its use. A number of public sector pilot projects incorporating BIM have been undertaken in recent years, for example, the Moose Jaw Hospital and Royal Alberta Museum. BIM has also been increasingly adopted by the private sector even though its adoption across Canada is inconsistent.

The institutions formed to advance the use of BIM include the Canada BIM Council (CanBIM) and the Institute for BIM in Canada. These institutions have developed BIM protocols, toolkits, manuals and contract language documents to facilitate the adoption of BIM.

CanBIM, for example, was established to provide ‘professional, educational, construction, fabrication and supply chain members a collective voice dedicated to BIM’ aiming to ‘produce tangible working methodologies that allow BIM to develop as a standard.’

In Canada, CanBIM developed a parallel BIM protocol based on the UK model named AEC, which was first published in 2009. The first CanBIM Protocol, based on the AEC model, was published in 2012, and was updated in 2014.

The Institute for BIM in Canada aims to ‘lead and facilitate the use of Building Information Modelling (BIM) in the design, construction and management of the Canadian built environment’ and to ‘endorse, develop and maintain Open BIM Standards for the Canadian market’. In order to carry out this goal, the Institute for BIM in Canada established buildingSMART Canada (bSC) to foster collaboration towards open BIM standards among members of the Canadian Architecture, Engineering, Construction, Owners and Operations (AECOO) community.

To date, there has not yet been an endorsement by federal, provincial or municipal authorities of the documents prepared by CanBIM or the Institute for BIM in Canada.
Denmark

In Denmark, the adoption of BIM is both public and private sector driven. The first BIM legislation was passed in 2007. It is referred to as the ‘ICT’ regulation, that is, the regulation concerning information and communication technology. The ICT regulation forms the basis of the requirements of public developers to their suppliers as to the use of ICT in the context of public construction projects. It specifies the requirement for the use of digital, object-oriented building models in connection with project competitions, project planning and execution. Its aim is to encourage the use of ICT in the Danish construction industry in general through high and uniform demands on behalf of the public authorities to the construction suppliers so that productivity in public construction and any subsequent operation can be increased.

The adoption of BIM is also private sector driven. Large construction companies in Denmark are making substantial investments in BIM at the moment while large architectural firms are starting to focus more and more on BIM. The Danish Association of Architectural Firms, named ‘DANSKE ARK’, has, for example, just released a supplement to its defined description of digital design, which defines the digital services that architects must provide as documentation when working with BIM. This reflects the new demand for BIM.

BIM has also grown to be a considerable part of the education of engineering and architect students, which in time will contribute to implementing BIM in the lower tiers. However, there is still a practice in Denmark where architects and engineers reserve their position as to their BIM-models, and instead they contract from their paper material.

Ireland

In the construction industry of Ireland, BIM is being driven by both the public and the private sector in an unplanned and ad hoc basis.

There is no government mandate or legislation to implement BIM in Ireland at this stage, besides some minor references in the Construction 2020 Strategy Ireland that was published in May 2014 by the government. This strategy sets out a package of measures defined by the government and is aimed at stimulating activity in the building industry. It consists of 75 action points to ensure that necessary and sensible development can take place.
In the public/state sector, the requirement for BIM is being driven by public agencies like the National Development Finance Agency (NDFA), which is the statutory financial advisor to state authorities in respect of all public investments. The New Children’s Hospital of Ireland, which is the largest public infrastructure project in the history of Ireland, and all key NAMA projects are requiring the use of BIM and are taking the lead in employing BIM.

The private sector and, in particular, foreign direct investors from the UK, US and Canada are driving Irish developers towards incorporating BIM in construction projects. Recent projects include those procured by Facebook, Intel, Union Investment and Kennedy Wilson.

Additionally, Irish construction and consultancy companies have successfully provided BIM services for overseas projects for some considerable time and are now providing similar BIM services in Ireland. Enterprise Ireland (Ireland’s leading business procurement organisation) is campaigning that the early adoption of BIM will help businesses win more business. As noted by the chair of Enterprise Ireland: ‘If our closest neighbours are going to mandate BIM, it looks like it’s going to be an option for other European members to mandate it in the EU. There’s an inevitability that Ireland will have to follow’.

The ‘lonely BIM’ approach tends to focus mainly on the construction phase and the savings which can be achieved during that process.

Overall, client and contracting organisations are progressing towards reaching BIM Level 2, which is the UK standard. However, there is no express target implementation date and it is very much being adopted on a ‘lonely BIM’ ad hoc project basis.

The ‘lonely BIM’ approach does not have the same benefits in terms of the whole lifecycle of the project but tends to focus mainly on the construction phase and the savings which can be achieved during that process.

The reasoning is that clients in particular do not have the expertise, experience and resources to use BIM in a lifecycle facility management role. The Construction IT Alliance (CITA) Enterprise Innovation network has done much to shape, promote and develop BIM in Ireland.

To date, in the absence of legislation or government mandate, there is a relatively slow uptake of BIM in the Irish construction industry, particularly in the facilities management field.

United Kingdom

The UK government produced its construction strategy in 2011. This was a wide ranging document aiming to deal with studies which had indicated that the UK was not obtaining full value from public sector construction. It included a programme of measures the government wished to take in order to reduce costs by up to 20 per cent. Among other measures, this provided that the government would require fully collaborative 3D BIM (with all project and asset information, documentation and data being electronic) as a minimum by 2016.

In parallel with this was the Government Soft Landings (GSL) policy of September 2012. This recognised that the ongoing maintenance and operational cost of a building during its lifecycle far outweighed the original capital cost of construction. GSL identified the need for this to be recognised through early engagement in the design process. A recommendation was put forward that the GSL policy should apply to all new central government projects and major refurbishments and should be implemented by central government departments during 2013 working towards a mandate in alignment with BIM in 2016. The aim of this was to align the interests of those who design and construct an asset with those who subsequently use it.

From October 2012 onwards, responsibility for GSL moved to the government’s BIM task group in order to ensure that BIM and GSL were in alignment and to allow work towards the combined mandate in 2016.

The UK government’s ‘Digital Build Britain’ sets out a vision for reform of the construction sector by taking advantage of the opportunities offered by the Digital Economy. The UK government’s vision is to continue the BIM journey from the implementation of Level 2 and to build on this in Level 3.

In Scotland, the Scottish government issued its BIM implementation plan in September 2015. This sets out the strategy
for public sector projects in Scotland to adopt BIM Level 2 by April 2017.

In some respects though, the private sector has been leading the way although in the context of a ‘lonely BIM’ model. Many of the larger main contractors within the UK have been using BIM for a considerable period of time. However, this is not BIM in the sense of the government mandated model whereby the employer works with an integrated team to generate benefits in terms of savings for the project as a whole. Further, the ‘lonely BIM’ approach does not necessarily have the same benefits the government is seeking in terms of the whole lifecycle of the project but tends to focus mainly on the construction phase and the savings which can be achieved during that process. Private sector contractors and some parties lower down the supply chain have identified the benefits of BIM in terms of improvements in their ability to value engineer through the design process. They have been using it to make bid projects more competitive and improve margins, having identified areas where savings can be made at tender or during the construction process onsite.

To date, the industry appears to have been relatively slow in dealing with BIM in the facilities management stage of the project. This is perhaps because many of the private sector developers are not necessarily involved in buildings which they wish to occupy and use, but instead buildings which they wish to either sell or rent commercially on full repair and insure leases. This means that the private sector landlord is less likely to be interested in the lifecycle costs of maintenance and operation of the building. However, interest within this sector is increasing.

United States

In the US, the adoption of BIM continues to grow in both the private and public sector. A 2014 study published by McGraw Hill Construction indicated that 40 per cent of building owners anticipated using BIM on more than 75 per cent of their projects by the end of 2016. Although this projection may not prove accurate, it exemplifies the fact that BIM is becoming mainstream technology and widely adopted in the United States. It would appear that this is particularly true for facilities projects such as office buildings, hospitals and schools. It is also seen with increasing prevalence in industrial projects such as power plants and refineries. It is less prevalent on publicly-financed road and paving projects and on mass excavations, although even these types of projects routinely use BIM-friendly technology for the development of site topographies, construction documents and project estimates.

In addition to the Federal Government of the United States, the legislatures of each of the individual 50 states have the authority to enact laws relevant to the use and implementation of BIM, as do the multitude of political subdivisions within the Federal Government and each of the 50 states. As a general proposition but not necessarily as a rule, when public entities in the US seek the implementation of BIM related technologies it is done by way of administrative regulation, as opposed to vetted legislation.

BIM is becoming mainstream technology and widely adopted in the United States.

An example of this can be seen in the administrative mandates issued by the General Services Administration (GSA) of the Federal Government. In 2003, the GSA, through its Public Buildings Service, established the National 3D-4D-BIM Program. Since that time, the GSA has issued numerous guidelines and mandates to promote and require the use of BIM in its projects. The current state of the GSA’s BIM mandate is most concisely described in the following language published by the GSA:

‘GSA requires model-based design, including native and IFC BIM deliverables at all project milestones, with any required supplementary 2D deliverables to be derived from the model. GSA also requires open-standard facility management data as a project deliverable at all project milestones. At the same time, all GSA projects are encouraged to deploy mature 3D, 4D, and BIM technologies to the maximum extent practicable to support specific project challenges and to continue to lead industry in the development and adoption of BIM as a building lifecycle tool.’

Reflections of the mandates of the GSA can be seen in numerous state and local government mandates. BIM has been implemented on select public university projects and related hospital facilities.
Many private owners have also embraced BIM technologies. More frequently the use of BIM is an element of a more elaborate IPD programme. The use of BIM and IPD has been adopted by the technology sector, private hospital owners and large corporate end users.

**What contract structures are being adopted?**

Of primary interest to lawyers is the question of how we contract for BIM. The starting point is to question what has in fact changed as a result of BIM. The focus should be to analyse any change, if relevant, rather than to seek change for the sake of change. Further, the contractual requirements will differ depending on whether what is sought is full ‘social BIM’ or the more restricted ‘lonely BIM’. The experience of what is happening in the market from the jurisdictions represented in this article has varied.

**Brazil**

The Brazilian construction market does not use national or international standard forms such as AIA and FIDIC. Usually, in Brazil, each contracting party imposes the use of its own contracts and most of such contracts do not rule the integration between such instruments and others related to the same project, except subcontracts.

In cases where the owner, who is usually the model manager, decides to have BIM applying to its projects, the adoption of BIM is imposed on the main contractors. Specific clauses would thus be included in the contracts in this respect, such as liability and rights for contribution and indemnities in the most relevant contractual relationships related to the project. The owner would also provide for a ‘BIM Protocol’ that shall apply to all such contracts.

**Canada**

The Institute for BIM in Canada has developed contract appendices for the use of BIM. These appendices may incorporate by reference the use of ‘models’ as contract documents. These draft agreements provide a guide for the use of BIM in infrastructure delivery.

**Denmark**

In Denmark, contract structures most often involve two-way contracting in the traditional way, but combined with an attached ICT performance specification, which, in most cases, will be identical in all contracts for the project.

In public construction, the public developers are obliged to make sure that an ICT coordination takes place, which, in most cases, involves the use of the standard ‘ICT performance specification’ made by BIPS – a member-driven, non-profit association working for construction companies. This standard ICT performance specification states that all parties are obliged to include the same ‘performance specification’ in their contracts. BIPS has, however, just released a new ‘ICT performance specification’ which instead suggests that the parties may make individual ICT specifications.

At the moment, one large construction company in Denmark is drafting a multiparty contract, which may indicate that in future these types of contracts will be used instead of two-party contracts. However, the new ICT performance specification indicates the opposite.

**Ireland**

The Public Works Contract Forms published by the Department of Public Expenditure and Reform (the ‘PW-CF Forms’) and which are to be used on all public sector works projects do not technically allow any BIM amendments. Nevertheless, a number of government agencies have gone ahead and incorporated BIM requirements into construction documents.

There are other bespoke building contract forms used in Ireland in the private sector including: RIAI, FIDIC, JCT and NEC forms of building contracts and specific bespoke building contract forms which have been customised to incorporate BIM.

The preferred way of adopting BIM in Irish projects is through either a Construction Industry Council (CIC) BIM protocol (as noted for the UK below) or a bespoke project protocol incorporated into all consultant appointments, building contracts and sub-contracts setting out the rights and responsibilities of all parties in relation to BIM. In terms of prioritisation, this would generally sit under the contract terms and conditions.

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**United Kingdom**

In the UK, so far, contract structures being adopted involve simple two-way contracting in the traditional way as opposed to multiparty contracts. The most commonly used standard forms, which have provided for BIM, have provided for BIM on the basis of the two-party contract model. In essence, their approach has been to incorporate the BIM protocol as a contract document.

The most commonly used protocol is the CIC Building Information Model Protocol commissioned by the BIM Task Group but this is not mandated for use and other protocols can be used. The BIM protocol is a key part of the BIM contractual structure, which is intended to be incorporated into appointments between the employer and the project team and, in turn, the supply chain.

The professional body for architects, the RIBA, has included BIM related tasks into the Plan of Work.

A number of technical documents have been produced with a view to there being consistency of approaches throughout the industry. These include PAS 1192-2:2013, PAS 1192-3:2014 (Information management processes), PAS 1192-5 (Security), BS 8536:2015 (Facilities management briefing for design & construction) and COBie – BS 1192-4:2014 (Information exchange).

**Conclusion**

BIM is certainly here to stay and the use of BIM will likely increase across the world. Those advising the industry will need to be familiar with how it works and the legal issues that may arise out of it in order to best advise their clients.

In Part 2 of this article, which will be published in the next edition of *Construction Law International* (March 2017), we will look at some lessons learned in projects to date, what contractual structures are best for BIM adoption, how the insurance market is responding to BIM, and some issues related to data.

**Notes**

1. PSU Computer Integrated Construction Program 2010
3. Mohamad Kassem, PhD, MSc, MEng, Professor of the University of Tennessee, and Sergio R Leusin de Amorim, Arqt, DSc Eng Produção, Professor of the Universidade Federal Fluminense.