Rethinking the Contractual Context for Building Information Modelling (BIM) in the Australian Built Environment Industry

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Abstract
Building Information Modelling (BIM) can be defined as a process of generating and managing information of a building or infrastructure during its life cycle. Whilst the 3D visualisation or dimensional functions of BIM are not necessarily new, it is the usage and integration of this information related to project delivery, management and performance analysis that are challenging current construction industry practices. Industry has called for the development of more collaborative and integrated contractual arrangements to facilitate the use of BIM. Such recommendations appeal to the ideal use of BIM, but also provide a potential opportunity to seek improvement within the construction industry. This paper proposes a procurement approach to BIM to establish the applicable contractual context to address the potential legal risks and commercial considerations, relative to current practices in Australia. It also outlines why BIM, with other enabling technologies, will drive the evolution of contract delivery methodologies.

Keywords: BIM, Contract delivery methodology, Procurement

Introduction
Whilst a building information model is defined as an object based 'digital representation of physical and functional characteristics of a facility' (NIBS buildingSMART alliance, 2012), Building Information Modelling or BIM encompasses the processes associated with a model that can create a shared knowledge resource for information about a building or facility and forms a reliable basis for decisions during its life cycle, from earliest conception to demolition (RIBA, 2013). Perhaps illustrative of the potential BIM presents is the phrase 'Building Information Modelling and Management' (BIM(M)) (RIBA, 2012). Relevantly for construction related applications, BIM can be used to create, use and share an integrated source of information provided or contributed by project participants of various disciplines. It is this multidisciplinary information source capability that represents opportunities and challenges to the construction industry, well recognised as fragmented, adversarial and possibly primed for or in the process of cultural change.

Locally and internationally, the legal issues associated with BIM have repeatedly been identified as one such challenge to overcome, including the need to develop contractual arrangements that complement BIM objectives and outcomes. Arguably, BIM is just another potential risk factor to be considered for construction projects. Understanding how BIM can be used and how BIM is intended to be used on a project will provide the necessary foundation to establish the potential contractual context. Accordingly any associated and resultant risks may, like any other project risk, be managed and addressed administratively or contractually with the inclusion of specific provisions and requirements.

Critically, what BIM may provide is the impetus, as an enabling tool and process, to test and potentially transform the construction industry's approach to the existing contract delivery methodologies. Whilst the object and intent of certain existing contract delivery methods will align better with the optimal use of BIM, other forms of contract delivery may require review to varying extents. Ultimately, as construction industry perceptions and practices change towards more developed integration across the life cycle of the built environment, a new approach to contract delivery may necessarily need to evolve.

Distinguishing the Difference, Features facilitated by BIM

In practice, the adoption of BIM has advanced from being a tool predominantly applied by consultants, particularly designers and architects, to support their own planning process. However, it is also becoming a tool associated with the integrated delivery and management of project information across the entire building life cycle and across collaborating professions (Holzer, 2011) (US AIA, 2007).

On a construction project (including renovations) and depending how BIM is used, BIM enables project participants (including contracting parties) to plan, design, review, program, cost or manage projects. Whilst BIM can represent an interactive process, it can also lead to an ‘enhanced design product’ (Hurtado & O'Connor, 2008). In this context, there are two distinguishing features that underpin the potential key differences to traditional construction practices, namely that:

(1) BIM can represent an information source for a project (whether as a single dataset or comprised of integrated or linked datasets); and
(2) multidisciplinary parties can contribute to an integrated or federated virtual model as part of the BIM process.

These are detailed further in the following paragraphs.

As an Information Source

As information comprising the model can be used for multiple purposes or functions, BIM requires the sourcing of that corresponding information (including the relevant content, structure and format). If initially set up to address BIM deliverables or outcome requirements of downstream stakeholders in the supply chain and across the life cycle, a model and the associated data can be reused or extracted (to avoid rework or the need to duplicate work). By way of example, the industry is increasingly coming to terms with the distinction between ‘Design Intent BIM’ or ‘Design BIM’ that includes the information traditionally produced by designers or consultants, and ‘Construction BIM’ that refers to the resolution of models (and associated data) as required by trade contractors for detailed assembly and installation. Depending on the contract delivery method adopted, additional requirements may be necessary to ensure data comprising the Construction Model is ‘imported from a Design Model or, if none, from a designer’s Construction Documents’ and ensuring the Construction Model ‘contains the equivalent of shop drawings and other information useful for construction’ (ConsensusDOCS, 2008b).

In practice, there exist opportunities to facilitate (or even partially automate) the transition from Design Intent to Construction BIM. An industry example supporting this is the BIM-MEP^{AUS} initiative developed by the Air Conditioning and Mechanical Contractors’ Association (AMCA). An objective of the initiative is to develop a dataset of digital mechanical, electrical and plumbing components that can be readily incorporated into design and for modelling. One of the benefits is to facilitate the creation of models that contain sufficient details and refinement for supply or manufacturing purposes, which traditionally would have developed through a shop drawing process or on the job clarifications.

In addition, as BIM can incorporate many components and features of a building or facility these in turn can be coded with attributes or into further categories. This coding or assigning of attributes to building components (including relative relationships) can create a dataset of intelligent information which is not restricted to the physical attributes of a building. It can also facilitate data access or linkages, whether as part of a designed application (for example using unique identification coding) or middleware solutions.

There are emerging dimension classifications loosely recognised in industry that are indicative of the types of attribute or intelligent information that can be used in a BIM context. Whilst 3D (graphic/spatial dimensions), 4D (time) and 5D (cost) are readily recognised, there is some uncertainty regarding subsequent dimensions. For example 6D has been identified for Facility Management (FM) or Environmental Sustainable Development (ESD), although these subsequent dimensions have no recognised formal application in industry or academically (Holzer, 2011).

Multidisciplinary Application

Information or requirements pertaining to the built environment are not typically available from or standardised by single source providers. For BIM, input or contributions may be required from many. If applied across the building/facility life cycle, the list could be extensive and may include planners, project managers, architects, designers, specialist technical consultants/contractors, quantity surveyors, programmers, engineers, contractors, suppliers, manufacturers, and facility and asset managers.

The multi authoring function of BIM is supported by a digital platform or forum that can be established to form or host federated models which are generally created by bringing together independent modelled building components. An example definition of a federated model is ‘a Model consisting of linked but distinct component Models, drawings derived from the Models, texts, and other data sources that do not lose their identity or integrity by being so linked, so that a change to one component Model in a Federated Model does not create a change in another component Model in the Federated Model’ (ConsensusDOCS, 2008b).

Whilst a single integrated model where all BIM contributors work collectively can also be created, this is rare in practice (McAdam, 2010). One such ‘single model work environment’ was applied in a building context (to a degree) at Swire’s One Island East project in Hong Kong (US AIA, 2013). Regardless of model format, the opportunity to integrate the contribution of project participants for intelligent use is not generally encountered in traditional practices.

Legally BIM

A potential challenge to the construction industry is the development of a framework that facilitates or manages built environment information across all participating professions. Critically on a project this impacts the management processes, how project participants interact and the legal implications that can arise from such circumstances. The net effect is that it can also result in risks that are different, but not necessarily always new.

Legal issues identified generally by industry (BIM Industry Working Group, 2011) (Allen Consulting Group, 2010) have common themes that specifically relate to these multidisciplinary, integrated party interactions. Examples include:

- Liability

  Liability in the context of BIM could be potentially complex, given the potential multidisciplinary forum where information is contributed by an author or BIM contributor (as a recognised professional) and adopted (or relied upon) by other BIM contributors or another party, as part of a process related risk (Azhar, Khalfan, & Maqsood, 2012). Whether liability arises in contract or negligence (either as a duty to a client, contractor/consultant or to a third party), will necessarily be determined in context of collaborative and integrated approaches or contracting methodologies, and the factual matrix.

Any unintended assumption of responsibility for design by the contractors and for means-and-methods or constructability by the designers may be avoided by ensuring roles are appropriately defined and control over collaborative processes is maintained (and notwithstanding those processes, such as shop drawings, that already blur these lines) (Larson & Golden, 2007). In addition, disclaimers (including 'for information only'/non-reliance type of provisions) and warranties may be required to be drafted to avoid impractical scenarios that could eventuate in an integrated forum. For example, this may eventuate where a designer's warranties are impacted by the interaction of a subcontractor's contribution to the model (Regner, 2008).

Although provisions or modelling protocols setting out details concerning or tracking BIM contributions, review, authorisation and notification for example can assist, arguably the risk will not be completely erased (Larson & Golden, 2007). There may be circumstances where a position or decision is made and agreed to by all, the source of information or error cannot be reasonably clearly attributed to a specific person or entity, or where parties are not contractually bound. Whether collective liability is considered will be dependent on the project and the participants.

Relevantly, insurance is another key issue that has been repeatedly raised by commentators, including consideration of integrated insurance models (AIA/CA BIM/IPD Working Group, 2012). It is proposed that integrated project insurance products may be suitable for use on projects incorporating BIM but on the basis that such products would 'need to be tested on a wider range of pilot project' (BIM Industry Working Group, 2011).

- Intellectual Property (IP)

  Whilst parties will need to ensure IP rights are clearly identified and defined in any event, further consideration may be required to determine ownership of IP (and any licensing arrangements, whether actual or implied) in a BIM context. This may include distinguishing or identifying IP in terms of the model (including as element parts, embedded data or databases) and file formats in an integrated or federated system. Proposed efforts have necessitated the need to define IP vested in shared BIM models, collaborative working environments and virtual teams (BIM Industry Working Group, 2011).

  The need for more clarity relating to IP associated with BIM is particularly evident given the uncertainty that may arise (for example whether copyright of a model as a whole exists) and whether cross vesting or collective licencing may be required to fit BIM. Downstream implications may arise particularly if BIM use is applied across the life cycle of the built environment.

There are, however, a number of potentially new requirements concerning the management of BIM. It is anticipated that these requirements will not challenge existing legal concepts, but may require legal and management consideration. For example, if BIM is being used on a project, the following issues may need to be addressed contractually:

- BIM Management Plan or BIM Execution Plan, including provisions for the preparation of the plan and the details to be included or addressed. Such plans generally aim to set out a framework to coordinate and manage BIM related information between the project participants and over the course of the project (NATSPEC, 2011). Example details may set out specific BIM related roles and responsibilities (such as the BIM Coordinator or BIM Manager), BIM processes or procedures (including for collaborative practices whether co-locating relevant project contributors or using software/cloud and information/document management based practises and tools), uses, outcomes or standards (for example a standardised classification of model resolution into distinct levels of development or LOD (US AIA, 2008) or data exchange standard, such as Construction Operations Building Information Exchange (COBie) to facilitate data capture during a project (BIM Industry Working Group, 2011)), and BIM technological requirements;

- technology related provisions to address risks concerning interoperability (including the need to ensure that software can communicate with each other or import/export of data) (McAdam, 2010), software version compatibility, cyber and model security (for example to preserve rights, confidentiality), or software/hardware liability/insurance requirements (for example for the loss of data); and

- contractual status of the model. Whether the model forms part of the 'contract' (including being subject to a precedent hierarchy) or is a project tool and end deliverable required by the contract, may depend on the contractual context (McAdam, 2010) (US AIA, 2007). The notion of BIM representing a 'single source of truth' (Saxon, 2013) on a project may also warrant contractual standing to avoid uncertainty.

Perhaps one example where BIM may challenge existing legal concepts pertains to ownership and property law. This has included questioning whether the completed model is a product and hence subject to the laws that govern goods, including the doctrines of implied warranty and strict liability (Hurtado & O'Connor, 2008). Conversely, BIM raises the question of whether the data/model should be afforded proprietary recognition or clarity whether being personal or real. The quandary lies in the fact that a model is a virtual representation of a building or facility (and arguably also of significant value), which in the built, physical form is real property. Generally it would be expected that a model would be created for the benefit of the owner or ultimate user, including subsequent owners, occupiers or facility managers (McAdam, 2010), as a right to enjoy and the exclusion of others.

Opportunity to rethink the Construction Legal Framework with BIM?

What is not clear is whether legal implications will arise from new project requirements when BIM and BIM related data is used for or linked to project management related functions and/or with other project management related systems.

Of particular interest will be the development of a construction model that represents the 'design' in the context of both time (4D) and cost (5D) (which is generally facilitated in conjunction with or linked to other construction related software systems/programs). Whether this may provide an opportunity to depict live, real time status or more accurately and comparatively track performance, progress, costs, resources and other project management related functions will be predicated on construction practises and the demand by those managing the project. How and to what extent this will impact construction law may potentially be the subject of further research and debate.

Furthermore, it is anticipated that the coding/linking function of BIM will not inhibit proposals to assign specific classifications that could have direct legal implications. For example it is suggested that 'the relevant laws, regulations and other instructions provided by authorities available in electronic form and linking them into BIM would substantially benefit the review of the design solutions' (notwithstanding the acknowledged current limitations and need for extensive development for such a proposal) (COBIM, 2012).

The ability to simulate and examine the interactions of each modelled component in a particular context, whether it be technical, spatial, temporal or financial for example, illustrates the potential clarity and efficiency that BIM can present. However, such functions also highlight the critical and complex interplay of interface and relationship issues (whether administrative or contractual) within the model and BIM related processes. Arguably, the drive for efficiency and the resulting cost saving will result in traditional, more fragmented construction industry practices evolving into more structured, integrated approaches and methodologies.

How BIM can be used – the spectrum of BIM use by project participants

From a project procurement perspective and determining the resultant legal context, answering how BIM will be used on the construction project is critical (Hurtado & O'Connor, 2008). Some commentators suggest the approach to BIM is to ’begin with the end in mind’ (Computer Integrated Construction Research Program, 2011), or to ask ‘what are the purposes for which model(s) will be used’ to determine ’the end use of BIM to assess project risk, as well as assigning contractual rights and responsibilities’ (Hurtado & O'Connor, 2008). Users of BIM or those contemplating the use of BIM are faced with a range or spectrum of applications, not only for construction related purposes throughout the supply chain but across the building life cycle. Importantly for contract delivery, it is those applications that concern the interface between project participants (including those as contracting parties) that will require particular attention. ‘Lonely BIM’ and ‘social BIM’ are two such classifications (RIBA, 2012) that describe the BIM use spectrum.

At one end of the spectrum is lonely BIM, where BIM is used in isolation or for discrete or single use for the benefit of a single or limited numbered party or contributor. Arguably if deliverables have not changed from traditional formats (for example if 2D drawings are required and can be extracted from the BIM model), it is generally anticipated that such a scenario will neither impact the contractual risk allocation between the parties, nor does it reflect any dramatic change to non BIM or traditional practices (Larson & Golden, 2007) or party responsibilities (Sebastian, 2011). The independent party will still need to consider any commercial risks associated with the use of BIM and any potential impacts on its practice or services. This may include reviewing professional indemnity insurance policies.

However, at the other end of the spectrum is social BIM where key project participants (such as designers, contractors/subcontractors, quantity surveyors, programmers, project and facility managers, and potentially key manufacturers and suppliers) collectively and collaboratively work together to develop a model and supporting information that draws from the expertise of each participant, including elements and information concerning project delivery and facility management requirements. Also referred to as ‘integrated BIM’, this may include contributions from and involvement by all key project participants in a single digital forum. It is at this end of the spectrum in which social BIM sits awkwardly with the current construction market, often perceived as fragmented due to its historical roots (Hinchey, 1999) and adversarial (Cleves & DalGallo, 2012) (O’Connor & Bomba, 2009) (Rahman & Kumaraswamy, 2004).

As the industry evolves, it is anticipated that lonely BIM will be used by those who still need to overcome initial implementation hurdles (including developing or sourcing the relevant expertise), and may represent the necessary stepping stone for industry to achieve social BIM. Whereas the demand for social BIM will be driven by the opportunity for efficiency and is likely to become the standard method for delivering projects for all medium to large scale projects of a certain complexity.

The response to that critical first question will contextualise the potential types of processes, relationships, interfaces (both physical and virtual) that will need to align to promote contractual efficacy, and ideally, to reflect integrated practices, and administrative and project management realities. Whilst any contract can be drafted to incorporate any scenario in which BIM is to be used, adopting a contract delivery method (either existing or new) that compliments these objectives may assist to avoid unnecessary contractual complexity.

Applying Contractual Context to BIM

A commercial review of BIM implementation and use (including reasons not to apply BIM) will, necessarily, highlight the potential associated risks, and any subsequent legal implications, to ensure the relevant risks are appropriately considered, managed and monitored during a project. Again, it is likely (depending on how BIM is used) there will be contractual considerations that are not necessarily new, but may need to be examined differently.

The suggestion that BIM is generally not contractually addressed (Larson & Golden, 2007) may be attributed to how BIM is used or possibly the emerging awareness of BIM in industry. However, contracting for BIM, according to some, is not expected to be extensive for some applications (BIM Industry Working Group 2011). Whilst there is continual support to suggest that traditional or adversarial contract delivery methods are at odds with the objectives of BIM (O'Connor & Bomba, 2009), the proposed solution is a new approach to project delivery, and also contract delivery. What is not so obvious, is whether recognised contract delivery methods used in Australia, particularly for the immediate future, will provide the necessary basis to address BIM and more integrated practices as the built environment industry evolves.

Arguably there is a correlation between the aligned use of BIM and the contractual risk framework of existing contractual delivery methods. To illustrate, Figure 1 below sets out a sample of contracting delivery methods that have been adopted by the construction market (including the potential point risk scenario for owners responsible for building/infrastructure assets associated with relationship and traditional contracting delivery methods) and that apply across particular stages of the built environment life cycle. This is contrasted with how lonely BIM and social BIM better align with various contract delivery approaches presented.

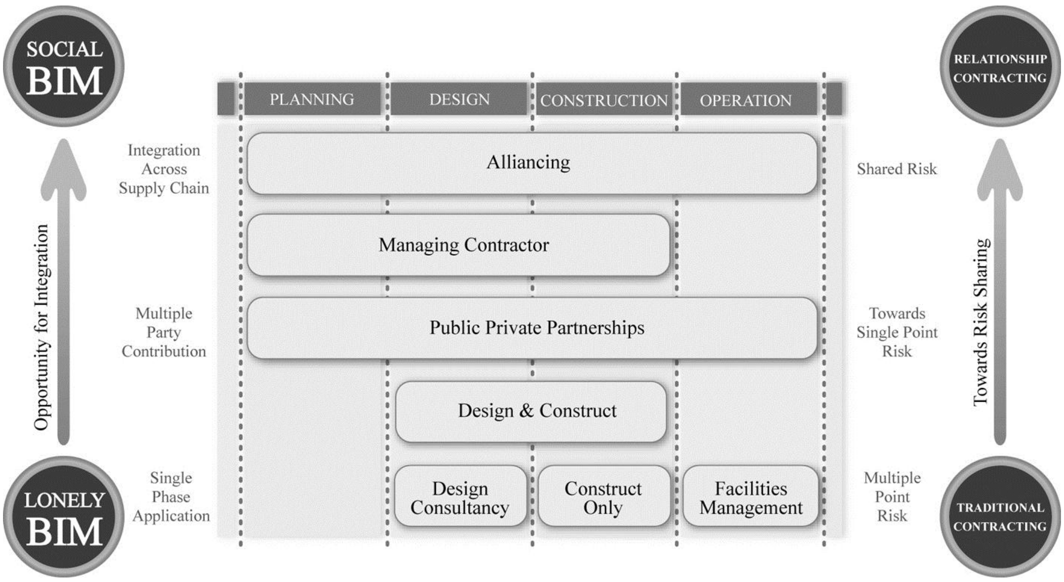

Figure 1 Alignment between BIM and selected contract delivery methodologies

This is not to dismiss alternate scenarios. For example it is still plausible to apply social BIM to a construct only context, although it may give rise to certain complexities. In order to address this further contractual drafting and administration may be required to be addressed between the contracting parties if BIM is to be used as a single source of information.

Conversely applying lonely BIM to an alliancing context, for example, may limit or negate opportunities that BIM may present.

As indicated in Figure 1, the longer term contracts that incorporate or that can potentially include more life cycle phases (that include and go beyond construction, such as operation) will potentially provide an opportunity to create an integrated BIM environment. Public Private Partnerships (PPPs) and similar contract delivery methods,[1] typically not regarded as relationship contracting,[2] can provide a forum that can connect parties (whether through a single management entity or via various interface relationships or arrangements) to incorporate contributions or expertise beyond the construction phases of the project, including facilities management (FM) or for the provision of service, if specifically a PPP (Infrastructure Australia, 2012). However, this single feature will not necessarily negate the adversarial nature that can still prevail with the arrangements, such as design and construct, within these types of contract delivery.

Alliancing too can enable preferred BIM environments (depending on the project requirements and circumstances) by involving all key BIM contributors throughout the project to develop, finance, design, engineer, procure materials, construct and operate, for example. Conceptually at least, the added benefit is the shared risk, no blame-no dispute approach (Infrastructure Australia, 2012) which can enable an integrated, collaborative BIM environment for administrative and contractual purposes. Whether alliancing is deemed commercially viable or acceptable is arguably uncertain or still evolving, particularly given the recognised procurement and delivery framework required to enhance value for money with alliancing (MacDonald, Walker, & Moussa, 2013) (Evans & Peck; Melbourne University, 2009).

The Managing Contractor (MC) contract delivery method, incorporating characteristics of design and construct and agency relationships of construction and project management, can also afford opportunities that will align with BIM. Typically reserved for complex projects, under the MC the contractor is responsible for the delivery of the project from feasibility, design through to construction and commissioning. Importantly for BIM, the role of the contactor is to provide general project management advice services and subcontract, in close consultation with the owner, the design and construction work to accommodate issues of buildability in construction and maintainability in design (Defence Support and Reform Group, 2011). Generally identified as a collaborative form of contracting, the MC methodology can facilitate the early introduction of key BIM contributors and integrate target deliverables (in terms of time and cost) particularly for the planning/design stages.

With the exception of relationship contracting, there is a stark contrast between the objectives of social BIM and traditional construction contract methods, such as ‘Design and Construct’ (D&C) and ‘Construct Only’ and including those related forms used for particular applications, such as Engineer, Procure and Construct (EPC) and Engineer, Procurement, Construct and Management (EPCM) delivery methodologies used in the resources and process engineering sectors, for example. Although it is feasible that a social BIM scenario

[1] Examples include Public Private Partnerships (PPP) models and the various adaptations (depending on financing arrangements and scoping requirements) such as Privately Financed Projects (PFP), Design, Build, Finance and Maintain (DBFM), Building Own Operate and Transfer (BOOT), Build Own Operate (BOO), Design Build Operate and those contract delivery methods that extend beyond D&C including Design, Construct and Maintain (DCM) and Design, Construct, Maintain and Operate (DCMO).

[2] Relationship contracting, such as alliancing, managing contractor and partnering, are methodologies that provide an approach to managing the owner-contractor relationship and facilitating collaborative outcomes and solutions. ‘Relationship contracting is based on achieving successful project outcomes, which include: completion within cost; completion on time; strong people relationships….; optimum project life cycle cost; and achieving optimum standards, during execution and in service for safety, quality, industrial relations, environment, and community relations’ (ACA, 1999).

could be incorporated into traditional construct only or D&C contracts, there would be particular emphasis on the owner or its representative to clearly establish the requirements concerning the use of BIM (Computer Integrated Construction Research Program, 2011) (Sebastian, 2011). Arguably, by not having the construction or facility management contractor parties/representatives involved as the model is established or developed during the preliminary stages, opportunities may be missed or rework will be required to use BIM for specific construction and FM functions.

A New Approach or Contract Evolution?

BIM with other practical, technical and industry developments are changing the way projects are delivered. Disruptive technologies generally (Manyika, Chui, Bughin, Dobbs, Bisson, & Marrs, 2013), coupled with construction related approaches such as lean construction (a production management and control based approach to project delivery which aims to optimise the project (or system) as a whole rather than just focusing on individual stages for the reduction of waste and value assurance or improvement (Dave, Koskela, Kiviniemi, Tzortzopoulos, & Owen, 2013)) and project focussed innovation research (Taylor & Levitt, 2009) or as part of broader drives for improvement and cultural change in construction (Cabinet Office, 2011) (Engineers Australia, 2005)) are indicative examples.

As a consequence for contracting, commentators note that ‘new technology has opened the door to eliminate inefficiency in design through the use of BIM, and lean principles have taught project teams how to eliminate waste in the process of construction. Proper use of these tools demands a change in the way owner's contract with project teams’ (Cleves & DalGallo, 2012). Conceivably, this has also presented an opportunity to re-examine the construction procurement and contracting methodologies. If the Australian market is to follow the US and potentially the UK, there may be renewed calls for more integrated, collaborative focussed framework and contracts (buildingSMART Australasia, 2012) (AIA/CA BIM/IPD Working Group, 2012).

An example approach to project delivery from the US is Integrated Project Delivery (IPD). IPD is described as ‘a project delivery approach that integrates people, systems, business structures and practices into a process that collaboratively harnesses the talents and insights of all participants to optimize project results, increase value to the owner, reduce waste, and maximize efficiency through all phases of design, fabrication, and construction’ (US AIA, 2007). It has been observed that IPD is ‘essentially the United States version of Project Alliancing’ with a notable difference that IPD is often used with BIM and lean construction/principles (Hinchey, 2012) (Raisbeck, Millie, & Maher, 2010). Despite the limited projects using this approach and the fact there is ‘little in the way of empirical information on successes and shortcomings’ (Hinchey, 2012), there may come a time where alliancing is revisited, albeit potentially in the form of IPD. Whilst IPD is arguably an emerging concept, IPD based contracts have also been developed (US AIA) (ConsensusDOCS, 2008a).

By way of contrast, the UK Government has mandated that, by 2016, all central construction projects over £50M are to be delivered using ‘collaborative 3D BIM’ (Cabinet Office, 2011). There has been some debate about whether collaborative 3D BIM, also known as Level 2 BIM (where 3D information models are used by all key team members in an integrated way but that separate models may be used), is not fundamentally different to current practices but with a reinforced focus on collaboration (BIM Industry Working Group, 2011). However, it is acknowledged that the development of new contract forms are required to address requirements for Level 3 BIM or integrated BIM which employs a fully open process and data integration enabled by web services compliant with open standards managed by a collaborative model server (BIM Industry Working Group, 2011). Collaborative focussed contracts (as distinct from the US IPD contracts) have also been identified as another possible framework for using BIM. McAdam (2010) suggests existing UK standard contract forms, such as the NEC3 and JCT Constructing Excellence (with PPCC2000 being akin to an IPD approach), conceivably align with the collaborative intent of BIM (despite not being specifically drafted with BIM in mind). Recent examples drafted in consideration of BIM include the UK CIOB 'Contract for use with Complex Projects' (Chartered Institute of Building, 2013) which also focusses on collaboration and time management.

Regardless of the contracting methodology adopted, if social BIM is the adopted approach, contract provisions setting out the framework, roles and processes for information usage, sharing and exchanging would need to be detailed to reflect strategic BIM objectives and deliverables.

Contracting for BIM

As there are currently no published standard form construction contracts or arrangements that specifically address BIM in Australia, bespoke provisions and requirements are likely to be developed from scratch or drawn from international examples. Further, challenging industry is the emerging nature of industry standards relevant to BIM, including those concerning information management for construction and across the life cycle. However in Australia, industry based guidelines, technical specifications and template forms addressing BIM may provide an initial step for project delivery and contractual consideration.

Addressing the strategic and technical considerations and requirements concerning BIM will inevitably benefit from standard form contracts that reflect adequate, acceptable commercial dealings and accommodate industry practice (Bailey & Bell, 2011), including BIM (Sebastian, 2011). For example in an integrated BIM context, standard form contracts or arrangements may assist to formulate the appropriate relationship between the consultants, the contractor and the subcontractor in order to avoid the gap of power where intelligent flow of information gets severed due to a misalignment in the design to construction workflow.

From a contracting perspective, capturing BIM requirements between and across distinct contracting arrangements requires particular attention. Whether incorporated directly into or required indirectly in a bespoke contract or as an addendum, exhibit or amendment form to a head/lead contract, reflected as back-to-back provisions in separate project contractual arrangements or via alterative means, such as a multi-party project arrangement, will be dependent on the project and participant needs. At a minimum, provisions ensuring the technical foundation for the use of BIM and integration will be critical particularly as industry standards and practices continue to evolve.

International examples include standard form 'addendum' documents that aim to fit within a contract arrangement by incorporating amendments or provisions to make them suitable for BIM. Some of the earlier published examples emerged from the US (ConsensusDOCS, 2008b) (US AIA, 2008) with more recent examples published in the UK (Construction Industry Council/BIM Pro, 2013) (Joint Contracts Tribunal, 2011)). Perhaps indicative of the emerging nature of BIM, internationally used standard form construction contracts (such as the International Federation of Consulting Engineers (FIDIC) suite of contracts) are yet to be published (if at all) to address BIM and BIM based integrated practices.

How these international examples will impact the Australian construction market remains to be seen, particularly how they compare with existing collaborative or relationship contracting or other contract delivery methodologies that have evolved incorporating consideration of BIM, or if they will be considered as part of existing contracting and procurement related initiatives and reviews (Infrastructure Australia, 2012) (Department of Infrastructure and Transport, 2012) (Attorney-General's Department, 2012).

Relevantly, determining the contractual framework may also incorporate consideration of supporting industry based material, whether using standards as the basis for quality or scope, template project documentation or industry guidance. In terms of BIM or supporting

BIM based practices, there are relatively recent international industry standards examples (NIBS buildingSMART alliance, 2012) (British Standards Institution, 2013) (International Organization for Standardization, 2013). Various Australian construction related industry agencies and groups have also issued or published guidance material and project related documents pertaining to BIM that are publically available (AIA/CA BIM/IPD Working Group, 2012) (NATSPEC, 2011). Undoubtedly BIM specifications are being developed in-house by owners, contractors or consultants and at the same time there are stand out industry groups (such as the AMCA) who are making progress to adopt standard BIM/integrated practices for their specialist fields (although these types of developments appear to be far from established across all key project disciplines).

Perhaps the real challenge for industry is to consider whether the suite of existing standard form construction contracts can or should be modified to cover the breadth of applications and use of BIM, and the limited (arguably untested) standards, to address risks that may arise, particularly given the relative and current use of BIM in the Australian built environment market. An interim or phased approach may present a plausible option.

The State of Play - BIM in the Australian Construction Market

Over the past years, various Australian industry reports and studies (buildingSMART Australasia, 2012) (Allen Consulting Group, 2010) (CRC for Construction Innovation, 2007) have highlighted the potential for BIM to deliver economic value and improve the way construction projects are delivered. This position is consistent with the observed growth of BIM use throughout the world (buildingSMART Australasia, 2012) (Davis Langdon; AECOM, 2009) and the mandating of BIM by international governments and agencies (buildingSMART Australasia, 2012) or encouraged use of BIM for public procurement (as proposed for application in the European Union (European Parliament, 2013)). The number of projects integrating BIM continues to grow in the global market and how BIM can be used is expected to diversify, particularly on infrastructure and resource projects (McGraw Hill Construction, 2012) (Davis Langdon; AECOM, 2009). For example, BIM is recommended practice for the application of lean construction methods to build new Australian LNG capacity (Engineers Australia (WA Division), 2012).

Despite early to more recent projects employing BIM (arguably lonely BIM), it appears the challenges encountered by construction practitioners, including the perceived value and effort related to BIM, continue to thwart the use of BIM in Australia (Holzer, 2013) (CRC for Construction Innovation, 2007). However, a Green Building Council Australia (GBCA) industry survey[3] highlighted whilst not currently adequately prepared, surveyed participants have planned to invest in BIM over the coming years (GBCA, 2012). In addition, the survey found that the more complex, integrated use of BIM is, relatively, not common in the current market.

Another Australian industry initiative culminated in the National Building Information Modelling Initiative (NBIMI) Report (buildingSMART Australasia, 2012). Prepared on behalf of the BEIIC, the NBIMI Report included key recommendations, including to require full 3D collaborative BIM based on open standards for information exchange for all Australian Government building procurements by 1 July 2016 and to encourage the same for Australian States and Territories. In addition, there are a number of proposed project work programs, including Procurement; BIM Guidelines; Education; Project Data and BIM Libraries; Process and Data Exchange; Regulatory Framework and Pilot Projects which are required to be implemented as part of the National BIM Initiative Implementation Plan in recognition of the emerging nature of BIM implementation and its applications.

[3] Prepared by the GBCA for the Built Environment Industry Innovation Council (BEIIC), an initiative supported and funded by the then Commonwealth Department of Industry, Innovation, Science, Technology, Research and Education (DIISTRE) but which was subsequently concluded December 2012.

To date, consideration of or interest in BIM by Australian governments has been initiated independently (including by departments or agencies such as the Department of Defence, Tasmanian Department of Health and Human Services, NSW Health Infrastructure and Transport for NSW, South Australian Department of Planning, Transport and Infrastructure and the Northern Territory Department of Infrastructure) rather than with the release of any new, definitive policy concerning BIM or information management for application across the built environment life cycle. The lack of uniform government position on BIM reflects the perception that very few owners, like governments, specifically require BIM on construction projects and that BIM is often used by larger organisation project participants (rather than specifically for the benefit of owners) (GBCA, 2012).

However, to effect and benefit from BIM implementation, any approach could traverse the entire built environment industry, including FM and asset management (AM).

Understanding BIM for FM/AM…..and beyond

Facilities management is recognised as one particular industry and function which has the most value to gain through more enhanced information management, whether using BIM or BIM derived information with other enabling technologies (IFMA; IFMA Foundation, 2013) (Gallaher, O'Connor, Dettbarn, & Gilday, 2004). Whilst BIM may present an opportunity for longer term operational efficiencies, it could equally apply to other related property or built environment functions, such as AM. In this context, the UK government objective to be more energy and cost efficient from capital and operation cost perspective recognises that with BIM maturity Level 3 it will be possible for 'asset management, KPI, and other feedback information to be aligned with intelligent briefing' (RIBA, 2012). Energy performance and sustainability, through the use of technology, has also driven BIM related projects and research in Europe and the US (Ploennigs, Dibowski, Röder, Kabitzsch, & Hensel, 2011) (US GSA, 2012).

Although FM/AM related information can already be captured during design and constructions phases or as part of a renovation, the challenge is ensuring the data (which can potentially include the model or relevant information and data content, but also the data structure and format) can be used or incorporated for operations and asset management related purposes. Without such, longer term benefits may be limited. Critically FM and/or AM input, particularly as part of the procurement process, will be necessary to ensure the appropriate data is sought and delivered. In the short term particularly as standards and practices evolve, project participants may be asked to deliver projects that incorporate longer term, life cycle applications. Those contract delivery methods not contemplating post construction requirements will require owners to ensure any internal expertise, services or subsequent contracts for operations and maintenance, or asset management related work or services are also tailored to accommodate BIM applications and information.

For owners, this is a future that potentially requires assessing internal legacy FM and AM frameworks, systems, procurement and education. It is recognised that it 'is also likely that property owners developing multiple sites will begin to explore portfolio operation and management of their buildings through joining of multiple completed project models' (Hurtado & O'Connor, 2008). Even for most estate or asset owners and managers, and the current FM industry, the depth of BIM knowhow is still emerging and BIM for FM applications and use of the data are considered rare (Jordani, 2010) but evident, particularly in the US (US GSA, 2011). Current projects in Australia, such as the Sydney Opera House BIM for FM project (Sydney Opera House, 2013), are stand out examples.

Given the potential to assign or link BIM related information, it further exemplifies the myriad of opportunities (and challenges) of those future, and as yet unknown uses and applications of BIM and other tools. Not only does it have the capacity to shape how parties create, manage and interact on a project but could apply across the built environment, including how land/property and property related functions are administered and regulated. Future applications may include using BIM for planning approvals and certification, work health and safety and environmental/green/sustainability simulations/assessment (buildingSMART Australasia, 2012), or BIM related information for asset accounting or performance related purposes. Further research relating to the integration of value for money data and BIM for procurement related applications has also been suggested (MacDonald, Walker, & Moussa, 2013). An endeavour to move from BIM with Geographical Information Systems (GIS) (Rich & Davis, 2010) and to develop a virtual built environment information/data bank (buildingSMART Australasia, 2012) will require investment, not only by individual entities and agencies, public and private, but right across the respective industries.

It is likely the full extent of applications relating to property is yet to be fully explored in a BIM context. Consequently, the potential legal implications of such applications and uses go beyond just construction law.

Concluding Comments

Depending how BIM is used on a project, the legal risks associated with creating, using and managing BIM related information will need to be addressed. Inevitably, if BIM is to be used between the project participants or contracting parties, specific contracts or contractual provisions addressing any contractual interfaces and BIM related requirements will also need to be developed to overcome the perceived lack of or limited contractual documentation in the current Australian market.

Although BIM can be used under any type of contract delivery method, it is arguable that current market projects that are delivered with relationship contracting will align better with the optimal use of BIM (including social BIM). Non relationship contracting, including traditional contract delivery methods, such as construct only or design and construct, will require careful consideration of the virtual BIM context by an owner, potentially not only for the construction phases, but across the life cycle of the building or facility. Whether BIM is the sole reason for the evolution of new, modified or rebadged contractual delivery approach, such as IPD, is debatable.

Even though BIM is not necessarily a new tool to the global construction industry, where some countries have developed depth of expertise and practices in BIM and integrated delivery more extensively than others, it is arguable the use of BIM and BIM related information is potentially only scratching the tip of the iceberg. BIM married with other evolving technological systems that support and facilitate the creation, recording, exchange and management of information between project participants have the capacity to change how projects are to be delivered. Whether for contractual or administrative purposes, it is this integrated approach which, according to some commentators, represents a viable, necessary alternative to overcome the perceived fragmented, isolated approach that exists in current construction practices and may represent a new frontier for innovation in construction.

Regardless, contracting for BIM in the Australian construction industry and across the built environment represents a step into a different world and perhaps a raft of opportunities yet to be discovered.

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