BIM for procurement - procuring for BIM

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Abstract: Contractual frameworks currently applied in Australia predate the use of life-cycle Building Information Modelling (BIM) for the delivery of construction projects. To date, little has been done to align the various contractual procurement methods in Australia with the novel opportunities offered via BIM. It is the objective of this paper to position BIM under various contract procurement methods and to hint at the possibilities for adjustment of these procurement methods in the light of collaborative work-practices. The author does not claim to have extensive expertise in construction law and this paper does therefore not directly outline new forms of contractual arrangements. Instead, the author brings into perspective the opportunities and challenges of BIM under the contract procurement methods one by one.

Keywords: BIM; procurement; contract; collaboration.

1. Introduction

The adoption of Building Information Modelling (BIM) in parallel with the introduction of policies and national standards that govern its use progresses steadily in an ever growing number of developed countries (McGraw Hill, 2014). As much as BIM adoption is often market driven, regulatory frameworks and in particular contract procurement methods have a major impact on the success of BIM-use on medium-to-large construction projects. Contractual frameworks applied to govern design, construction and commissioning of projects typically predate the use of life-cycle BIM for the delivery of projects (Kuiper and Holzer, 2013). These frameworks may at times rather obstruct than support BIM use. Stakeholders from both project delivery as well as construction law (McAdam 2010, Chew 2010) have started to review the contract methods in the light of BIM. This paper adds to these efforts by scrutinising BIM-use under various contract procurement methods based on the common lines of reporting applied under these contracts. In particular the structure and sequence of reporting and sharing design and construction data will be analysed in the light of opportunities and challenges inherent to different BIM workflows.

The method applied for the research presented in this paper is as follows: After a brief problem definition, the author draws from literature to examine current international and Australian policies and
guidelines that relate to the adoption and procurement of BIM. Literature both relating to legal aspects of project procurement as well as practical aspects of project delivery has been reviewed in the light of BIM. The aim was to understand its impacts on the way stakeholders (can) engage under various Australian contract types. The author then compares the afforances of BIM to support collaboration among project stakeholders under these construction contracts. This overview is complemented by a reflection about the opportunities and constraints associated to BIM under these contract procurement methods. The author further discusses how considerations about contract procurement methods can be woven into BIM execution planning (as currently applied in practice). The paper will thereby consider the particular information requirements of each of the key parties who partake in the design, engineering, construction and operation of built assets along the way.

2. The BIM dilemma

As much as the focus of BIM development in its early days was put on technological advance, the legal and procurement aspect soon followed as an area of interest. By the mid-2000s, BIM proponents observed that the potential of information sharing and data interoperability offered via new technology can get constraint in practice by contractual frameworks or other legal considerations. Some key topics are listed here: Holzer (2007) describes how the use of BIM affects the distribution of roles and responsibilities of individual stakeholders and he hints at possible implications for planners who need to work towards specific BIM requirements by authorities. The US Associated General Contractors of America released a ConsensusDOCS 301 BIM Addendum (2008) for construction contracts with standardised BIM terminology for stakeholder and model type definition. Klimt (2011) highlights the need to resolve copyright and liability issues related to BIM models and Olatunji & Sher (2010) discuss model ownership and sharing of model data. Chew (2010) points out the limitations of BIM-use due to stakeholder focus on their individual part of the project with little consideration about process as a whole. In order to identify legal problems posed by the adoption of BIM, McAdam (2010) scrutinises UK contract procurement solutions. Further, Professional Indemnity Insurance in the context using BIM gets addressed by the UK Construction Industry Council CIC (2013). The above summary is a mere snapshot of a range of publications and industry papers on the legal aspect of BIM.

Considering a number of the topics listed here, the American AIA (California Council) published a document in 2007 where they promote a ‘radical’ new contract procurement method with the goal to maximise the potential BIM technology can offer with a more fitting legal framework: Integrated Project Delivery (IPD). IPD is based on the Australian ‘Alliancing’ contract model, complemented by an information management strategy that supports BIM collaboration. The AIA defines IPD as follows (2007):

Integrated Project Delivery (IPD) is 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.

Whereas Integrated Project Delivery (IPD) was initially hailed as the ideal procurement method to allow teams to achieve ‘full BIM collaboration’ the industry is now viewing the idea of ‘full BIM’ more cautiously (Cleves & Dal Gallo, 2012). IPD as a delivery method is developing (mainly in the US); it is still the closest fit (contractually speaking) one could aspire to a contract method in the context of BIM. At the same time IPD in its pure form may well be too idealistic for common adoption throughout
construction projects globally. IPD currently gets applied under Integrated Forms of Agreement (IFOA) on a number of infrastructure projects, or by selected clients who have learned to fine-tune its use in order to manage the supply chain associated to procuring their projects (Alarcon et. al., 2011). It will require markets to mature in terms of BIM knowledge, and stakeholders to become more comfortable with novel ways of procurement. Sive and Hays (2009) assess that more and more projects are procured with reference to some elements of IPD, thereby applying impure IPD or ‘IPD lite’ as a closer fit between aspiration and current market dynamics.

With early excitement about IPD fading, researchers and practitioners alike increasingly turn to alternative contract types to be considered in the light of BIM. For each of those, BIM can play an important role in fostering collaboration and information transfer across participating parties.

3. BIM and procurement – the broader context

BIM in its ideal state affects the entire project life-cycle from procurement, feasibility studies through to design, engineering, construction, operation, and demolition. The importance procurement plays as part of this cycle has long been underrated. Even further, it is not only the effects of procurement on BIM one should consider, but ultimately also the opportunities BIM offers in revolutionising the way projects are procured in the first place. The below diagram (Figure 1) picks up on some typical processes associated to BIM that can be applied across different contract procurement methods. They include the use of BIM as template for generating tender documents, tight integration from Design BIM by consultants with Construction BIM by contractors and subcontracting parties, early involvement of contractors, lifecycle BIM (moving from BIM to Facilities Management - FM), and risk sharing of collaborating parties. The saturation of the dot suggests the potential to facilitate these processes under common varying contract types. The author accepts that variations to these occur depending on project-specific clauses in the contract.

![Figure 1: Matrix of delivery method and BIM characteristic.](image)

4. The impact of government policy and mandates

It appears that one key obstacle to the propagation of BIM is a lack of client demand (Goh et.al. 2014). Historically, there is truth to that. At the same time, one cannot ignore the ever growing list of
governments, or government departments that start to ask for BIM for publically commissioned work in one way or another. These requirements/ mandates range from specific and well defined (e.g. spatial programme validation) BIM requirements such as those brought forward in 2006 by the US General Services Administration (GSA), to the provision of major financial incentives, such as those by the Building & Construction Authority (BCA) in Singapore from 2010. Next to mandates in some Scandinavian countries, the most prominent example appears to be the UK with their step by step approach to achieving Level 2 BIM on Government projects by 2016. What sets the UK approach apart from others is its well-considered integration of policy across a number of industry and government stakeholders. In support of these developments, several industry frameworks are being established by the UK BIM taskforce (who produced the PAS 1192:2 and PAS 1192:3 frameworks in conjunction with the UK British Standards Institution BSI) that specifically address information requirements by various stakeholders across the building life-cycle. It is this life-cycle thinking and the inclusion of information-requirements by clients which may prove the key to success in the future (no matter if the 2016 deadline is ultimately achievable or not). The signals stemming from the UK have such an impact on a political level, that the European Union Parliament recently pushed through reforms for the EU Public Procurement Directive that include recommendations for the uptake of BIM on public works contracts by all its members (CM, 2014).

Next to guidelines and specifications for collaboration, a number of legal documents have been developed overseas. Most notably two strands of documents coming from the US: Firstly, the Consensusdocs 301 BIM addendum, released by the Associated General Contractors of America (AGC) back in 2008. The addendum highlights that there is no need to restructure contractual relationships; instead the BIM Addendum acts as a bolt-on document to a master contract. The key benefit of the document is its clear language and the clarity assigned to establishing BIM definitions that cut out ambiguity and increase clarity in terms of contract language. Secondly, the American Institute of Architects’ (AIA) 2013 suite of documents E203, G201, G202 (ex E202) and C106. These have been developed over time and they cover a range of BIM related policies from execution planning, data protocols, BIM project protocols and data licensing agreements.

At the point of writing this paper, the author’s research has not revealed any government-wide response to BIM by the Commonwealth of Australia. Despite advocacy from the industry group buildingSmart (2012) and their release of a National BIM Initiative document, no government-wide policy on BIM has been issued to date. In 2014, there has been an acknowledgement about the usefulness of BIM in the procurement of publically funded projects as part of a Productivity Commission’s inquiry into public infrastructure. Individual departments in various state governments start to request BIM for the delivery of their projects, but an encompassing guideline is missing.

5. BIM – focus on contract procurement methods

Following from the above comparison chart of contract procurement methods, this chapter analyses the characteristics of BIM-use for a number of distinct contract procurements methods as applied in Australia.

5.1. Construct Only

Still the most commonly applied form of contract to regulate construction projects in Australia, the ‘Construct Only’ method sees a separation between responsibilities and risk by the consulting and the contracting side. The ‘design-bid-build’ approach inherent to this form of contract procurement aims to
increase competitiveness in the bidding process, but at the same time does not necessarily guarantee the most integrated line of communication and reporting among consultants and contractors. Further, possibilities to interface BIM from the consultants and contractors to the Facility Management are limited, unless clients appoint those early on and push for dialogue across the entire project team. Such dialogue is often difficult due to the fact that project team members tend to get appointed sequentially with little opportunity for engagement when it counts most for life-cycle BIM.

Figure 2: Graphic representation of possible ‘Construct Only’ line of reporting.

Summary of typical opportunities and issues encountered under ‘Construct Only’ procurement:

- There exists a disconnect between Consultants and Contractor BIMs
- Separate BIM Management Plans for Design and Construction
- Consultants need to make assumptions on BIM requirements by Contractors
- Risk: Model handover for precision tendering is not guaranteed
- Consultants may be concerned about their professional indemnity if they hand over models
- Contractors are not likely to receive the information they need from BIM
- BIMs are likely to be set up with little consideration about operational needs.

5.2. Design and Construct (DnC)

The DnC project delivery method increasingly gets applied on medium and large projects where clients aim to reduce risk by having a Head Contractor oversee both the design and construction process. There are some variations of this delivery method, but often design consultants get novated to the contractor beyond the delivery of Level of Development (LOD) 300 BIM. DnC contracts benefit from transparency of information flow as consultants are aware that their BIM models will be handed over to subcontracting parties for high-precision tendering and for other knowledge-transfer purposes. Still, the DnC delivery method does not guarantee smooth transition of BIM from the consultants to the contractor and beyond.
Summary of typical opportunities and issues encountered under ‘DnC’ procurement:

- The DnC approach facilitates increased transparency in setting up & pricing tender packages
- Stakeholders can set up their models up with Construction BIM requirement in mind
- The DnC approach increases the potential for interfacing information between Consultants & Trade-contractors in Construction Documentation
- The risk lies with the Contractor to maximise BIM knowledge transfer
- BIM under DnC contracts Requires skilled Contractors who understands BIM workflows
- Input from client to help define operational requirements is not automatically guaranteed

5.3. Managing Contractor / ECI

Under the ‘Managing contractor/Early Contractor Involvement (ECI) method, there is an increased chance for BIM collaboration to unfold among the various project team members (Rahmani, et. al. 2010). In this two-stage process, clients involve Contractors early on to oversee the costing of early design proposals. In particular where contracting parties are involved at the outset of a project, BIM knowledge-transfer can occur early on, thereby benefitting common goals of BIM delivery. Under the Managing Contractor model, various stakeholders usually work side-by-side to advance solutions in an iterative process. The method also allows clients to voice their requirements and oversee the adherence to BIM lifecycle deliverables early on.
Summary of typical opportunities and issues encountered under ‘Managing Contractor’ procurement:

- The Managing Contractor model facilitates iterative information feedback with contractors
- It has the advantage of involving the Managing Contractor and the Suppliers during LoD 200
- The Managing Contractor, Designers, QS and Trade Contractors work side by side on BIM
- This procurement model helps to facilitate the BIM induction process for Trade-Contractors
- There exist increased opportunities for clients to communicate lifecycle BIM requirements.

5.4. Public Private Partnership (PPP)

PPPs don’t literally represent a delivery method; they refer in principle to the method of financing projects. Predominantly applied on large infrastructure projects, PPPs are principally run similar to DnC contracts with the advantage of a Joint Venture agreement between those providing design and construction services and facility management service provision. Tight collaboration is executed with a life-cycle view that encourages those using BIM to orient their efforts towards minimising lifecycle cost and maximising sustainability on the project.

Figure 5: Graphic representation of possible PPP line of reporting.

Summary of typical opportunities and issues encountered under ‘PPP’ procurement:

- In principle: PPPs are run with separate DnC & Operating Contracts
- Contractors & Consultants engage in a Joint Venture and work towards common BIM goals
- Unified BIM Management Plan, including post-delivery considerations as part of D&C
- There exist opportunities to share risk to achieve common goals

5.5. Alliancing / Integrated Project Delivery (example: Project Alliance)

Considered as a form of relationship contracting, Alliancing or IPD methods show most potential for intelligent sharing of digital project information across all stakeholders due to the non-litigious nature of collaboration. The relationship agreement is likely to be based on a shared project procurement
supported by equal gain & pain sharing among stakeholders. Information management is open and transparent with substantial knowledge-transfer across all stakeholders.

**Figure 6:** Graphic representation of possible Alliancing/IPD line of reporting.

Summary of typical opportunities and issues encountered under ‘Alliancing/IPD’ procurement:

- Relationship agreement: sharing pain & gain
- Alliancing/IPD contracts entail opportunities to include operational considerations by clients
- BIM collaboration can occur from very early stages
- Knowledge-transfer across entire project team (incl. Trade Contractors)
- A unified BIM Management Plan can be applied across the team from the start
- Data-capture for handover & FM already occurs during design & construction process
- Shared Risk – Activities undertaken within the Alliancing model are likely going to require project insurance (instead of individual stakeholder insurance)

### 6. Procurement: impact on BIM Execution Planning

Depending on the contract method, the focus in generating a BIM Execution Plan (BEP), also known as BIM Management Plan (BMP), should ideally be multi-layered. It can be about generating two separate plans, one covering BIM coordination for consultants, and one covering BIM coordination for contractors only. This will most likely the case on ‘Construct Only’ type contracts where planning by consultants happens with little consideration of the detailed processes undertaken by contractors (as these are yet unknown). An attempt to align consultants and contractor requirements makes little sense as stakeholders would need to base their modelling effort on assumptions that may be incorrect. On contracts that see the Head Contractor in control of the entire collaborative effort (such as DnC or Managing Contractor delivery), a BEP/BMP should consider BIM coordination all the way through from consultants, to the subcontractors, in particular tacking the issue of transition from Level of Development (LOD) 250-350. Modelling requirements by consultants should be defined precisely in sight of their models’ usefulness for tendering and coordination by subcontractors (but in clear consideration of the limited liability associated to ‘Design BIM’). Such approaches appear to make most sense under a ‘Design and Construct’ and ‘Managing Contractor’ procurement method, as well as a Design & Construct with ‘Early Contractor Involvement’.
Going further a ‘lifecycle’ BEP/BMP would help to address operational needs beyond design, planning and construction. It would be particular useful for facilitating projects with a vested interest for long-terms benefits of BIM by owner/operators. In order to facilitate such a framework for collaboration, one should include the Employer Information Requirements (EIR) for Facilities and Asset Management in the way the BEP/BMP is set up in the first place.

This requires an approach for conceiving BMP/BEP templates that can cater for teams that span entire consultant/sub-contractor/client stakeholder-groups. To achieve integrated information flow between those parties, an Asset Managers and Facility Managers (or even an Information Manager) should be involved in the setup of the BEP/BMP from day one. Despite the fact that key stakeholders are known, their key requirements may not be that certain in the earlier project stages. The latter approach to managing BIM collaboration facilitated via a BEP/BMP framework would most likely be suited for an Alliancing/IPD procurement method.

7. Conclusions

Contract Procurement methods in the construction industry have a major impact on the way BIM can be applied collaboratively throughout different stages of design, construction and operation. BIM becomes a powerful instrument to orchestrate information flow in a standardised fashion if the end goals are well defined and parties can start sharing building data with clear deliverables in mind. Currently applied project delivery methods and contract procurement methods do not always align with best practice BIM. Clients and their legal advisors can nevertheless counter-balance (to a degree) some known BIM roadblocks across any delivery method as long as they are aware of the implications of the line of reporting and the timing of stakeholder engagement. Whereas IPD as an idealistic framework for project delivery will still need to grow, more commonly applied methods of contract procurement have the potential to be revised and adjusted in order to synergise collaborative efforts and foster the uptake of BIM. Ultimately, BIM is set out to increase certainty and transparent information-sharing on construction projects. BIM is no silver-bullet to solve all problems across the construction industry but it is a means to increase communication and certainty. As a result, BIM can help stakeholders to reduce risk and increase productivity. Those engaged in the proliferation of BIM and those developing local policies and guidelines for its adoption need be aware of the interplay between contract procurement and the potential/willingness of the industry to respond to regulatory frameworks. Limitations of the (still predominantly conceptual) study presented here relate to the comparably recent adoption of BIM across the Australian construction industry. There are as yet no solid benchmarks available to measure BIM efficiency and no studies have been undertaken within our jurisdiction where its success is measured according to predefined metrics. In the future, once novel contract procurement documents get issued that consider the use of BIM, possibilities are likely to emerge to validate the benefits of BIM under various procurement models in a more quantitative fashion. More research is required to provide policy-makers with guidance about the right balance to adjust existing delivery methods whereby collaboration is fostered without the danger of over-constraining innovation across the construction industry with excessive layers of regulation.

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