

5D BIM IN A CONSULTING QUANTITY SURVEYING ENVIRONMENT

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Introduction

- Aims & Objectives
- BIM, 5D BIM
- 5D BIM in New Zealand
- Methods
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- Conclusions

Aims & Objectives

- To determine the perceived benefits and barriers of 5D BIM implementation within a single, multi-national quantity surveying practice (NZ & Australia-based QSs)

Building Information Modelling/Management

- Building Information Model: a digital representation of a building's geometric & non-geometric data, used as a reliable, shared knowledge resource to make decisions on a facility throughout its lifecycle

(NBIMS, 2010)

5D BIM

- 5D BIM contains objects & assemblies in the BIM model that have a cost dimension added to them:
- By incorporating cost data within the objects themselves
- OR
- By “live linking” to estimating software tools (e.g. Exactal CostX, Vico Office)

BIM in New Zealand

- **Masterspec (2013):**
- **BIM *awareness* up from 88% (2012) to 98% (2013) [UK-94%; Finland-87%; Canada-96%]**
- **BIM *users* up from 34% (2012) to 57% (2013)**

BIM in New Zealand

- NZ construction industry mostly at Stage 1B (*Intelligent 3D*)
 - Up to 3 different & separate models (Arch, Structural, MEP)
- A few projects operating at Stage 2A (*One way Collaboration*)
 - “A single BIM model shared amongst project participants, but updated in digital isolation from other discipline models” (AIA, 2009)

TOWARDS INTEGRATION

Taking the Australian Construction Industry forward



TOWARDS INTEGRATION

WHERE WE WERE

WHERE WE ARE

NEXT STEP

WHERE WE ARE GOING

0 - 2D

Manual and CAD based (2D or 3D)

1 - MODELLING

Single-disciplinary use of object-based 3D modelling software within one discipline

2 - COLLABORATION

Sharing of object-based models between two or more disciplines

3 - INTEGRATION

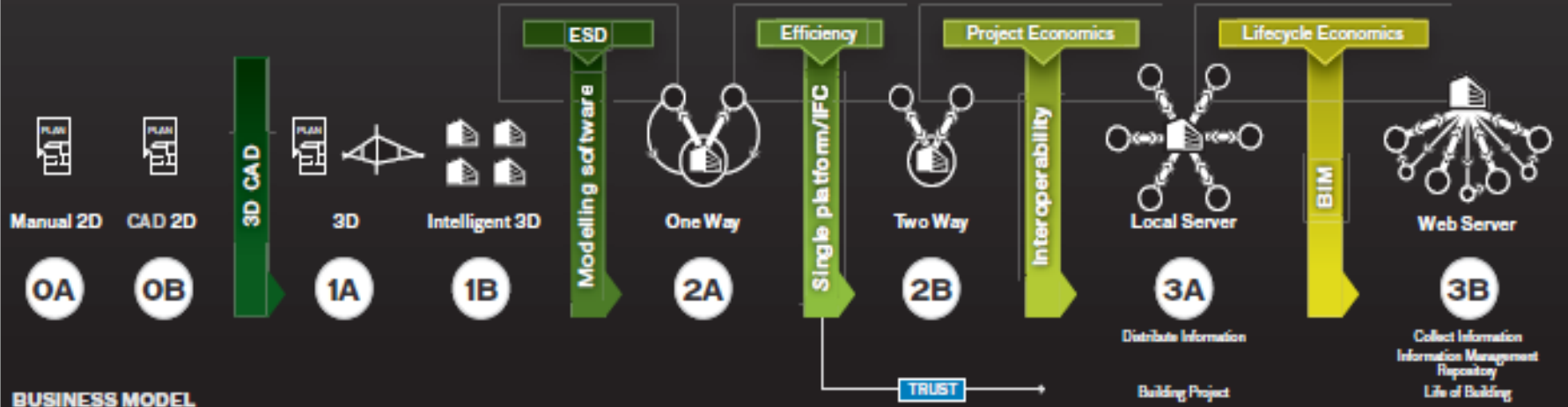
Integration of several multi-disciplinary models using model servers of other network-based technologies



Representation

Prototype

Full Information Capture

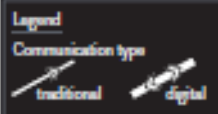


BUSINESS MODEL

ISOLATED

COLLABORATIVE

INTEGRATED



UPTAKE



Australian Institute of Architects



CRC Construction Innovation
SHAPING OUR FUTURE

5D BIM in New Zealand

- 5D BIM use growing (from a low baseline) amongst quantity surveyors
- Current practice is to “live link” BIM model object data to estimating software, either proprietary (eg Exactal’s ‘CostX’, Vico’s ‘Vico Office’), or in-house (eg Rider Levett Bucknall’s ‘Qubit’)

Research Methods

- Qualitative survey, using purposive, non-probabilistic sampling (BIM-experienced Qs from a single consultancy firm)
- Emailed questionnaire, incorporating closed questions (semantic Likert-type rating scale, 1-5)
- Follow-up face-to-face interviews, incorporating open, probing questions, relating to their questionnaire responses

Participant	Position	Years Experience	No of 5D BIM Projects
A	Senior QS	15	3
B	Senior QS	13	3
C	QS Director	20	3
D	Intermediate QS	5	5
E	Senior QS	14	9

Benefits of 5D BIM (n=5)

[NB: 1=Strongly Disagree, 5=Strongly Agree]	1	2	3	4	5
3-D function improves decision making, reduces inaccurate drawing interpretation and reduces the assumptions the QS needs to make.			2	3	
Enables more efficient <u>early</u> stage preliminary estimates (\$/GFA) (by auto-generation of quantities from BIM model objects).	1	1	2		1
Enables more efficient <u>detailed</u> elemental cost plans (by auto-generation of quantities from BIM model objects).			2	2	1
Enables more efficient <u>production</u> of schedules of quantities (by auto-generation of quantities from BIM model objects.)			1	3	1
Automatic quantities generation allows more time to be spent on other QS services for the client (e.g. cost advice on more design alternatives)		1	2	2	
Design changes can be more easily and rapidly identified by overlaying previous BIM models with revised BIM models.			1	2	2
Automatic quantities generation provides less room for human error.		2	1	2	
Improves the accuracy of estimates when there is insufficient time for detailed measures.		1		4	
Improves communication and access to information in the project team.			1	4	
Provides early construction schedule details which more accurately reflect the scope of work involved.			4	1	
Provides a commercial advantage over competitors.				4	1
Increases coordination through integration of specifications and clash detection				4	1

Benefits of 5D BIM

Visualization ✓

- *Although “If you are not familiar where the inaccuracies lie in the model, and you just trust that the quantities that you extract are correct, often you will not get accurate data”*

Efficiencies for early stage estimating ✗

- *“not at the moment, it is an experience thing, what you get out of the model is only as good as what the designer has put in, and at an early stage, the design is too inaccurate and insufficient”.*

Efficiencies for detailed estimating ✓

- but only for certain building items; extensive bulk checking and identification of missing items is imperative to ensure quantities are correct, and often manual adjustments are needed

Benefits of 5D BIM

Efficiencies for Schedules of Quantities ✓

- *But only a small efficiency gain, due to extensive bulk checking, and picking up of items not shown in the model*

Rapid ID of design changes ✓

- *Seen by some as a key benefit*

Improved accuracy, communication & accessibility ✓

- *“as designers get better coding, there will be less incorrect information in the model, and inherently that will increase the accuracy of our estimates when we use the information”*

Benefits of 5D BIM

Commercial advantage ✓✓

- *“we are one of the few QS practices that are getting into it at this stage, therefore if we can get good at this quickly, it will provide a short term commercial advantage until our competitors get on board, however by that time, we would have still gone through everything so hopefully we would still be ahead of the them”.*

Improved coordination & clash detection ✓✓

- Through integration of specifications and clash detection, as centralised BIM models have the ability to automatically update changes and rapidly disperse this information to stakeholders

Barriers to 5D BIM (n=5)

[NB: 1=Strongly Disagree, 5=Strongly Agree]	1	2	3	4	5
BIM model is not compatible with take off/estimating software tools.		5			
A high level of design detail at the early stages of a project can confuse decision-making.		2	1	2	
Data embedded into the BIM model objects by design consultants is not compatible with elemental estimating formats.			1	4	
Data embedded into the BIM model objects by design consultants is not compatible with schedules of quantities formats.			1	4	
Lack of industry standards/protocols that would facilitate the embedment of design data in BIM model objects that relate to estimating formats.				4	1
Use of BIM for quantity surveying services is too risky as there is no contractual framework governing its use.		2	1	2	
Time taken reviewing/checking extracted quantities means that 5D BIM is not significantly faster than doing manual take offs.		1	1	3	
Lack of direct government intervention to set up BIM standards/protocols reduces the likelihood of a common, agreed upon framework that is required to facilitate the process of 5D BIM (e.g. standardisation of use of IFCs, etc.).				5	
Allowances for wastes, jointing and lapping (for example) are not made as BIM superficially presents auto quantities, reducing the accuracy of estimates.				5	
The high cost and time associated with training staff in 5D BIM is too great for owners/directors.	1	3	1		
There is a cultural resistance to change from traditional QS approaches.		1		4	
Software and hardware upgrades associated with 5D BIM are too expensive for owners/directors.	1	4			

Barriers to 5D BIM

Software inter-operability issues ✘

- But due to data loss/inaccurate information exchange from Revit files, the firm abandoned the use of IFCs, and now mainly use DWFX with no issues

Model object data incompatible with QS formats ✔

- Designer-embedded object data often not compatible/insufficient for QS estimating: *“if you have had no input in the model...it won't be in line with the way we produce our estimates.”*
- But *“we will learn to use it better and better, and ...have a lot of input to the designers so that they provide what we need as part of the model for detailed estimating”*.

Barriers to 5D BIM

Lack of industry standards/protocols ✓

- *“we need to be careful how much we impose on designers, because they won’t want to work with us, that’s why standard coding is required”*

Legal & liability issues

- *Confusion as to whether or not the BIM model is a contract document needs resolution, particularly as sub-contractors are now beginning to price directly from BIM models.*

Manual review of extracted quantities necessary ✓

- But 5D BIM efficiencies will improve in the future

Barriers to 5D BIM

Lack of direct Government intervention ✓

- *Participants reflected Masterspec (2012) survey: lack of government intervention was limiting BIM implementation*
- *However, the NZ BIM Handbook, NZ BIM Schedule now published (2014)*

Lack of context for actual construction methods ✓

- *“if you have a beam that butts into a column, that’s not actually an object within the model, it’s a ghost if you like, but there is definite cost to that junction”*

Barriers to 5D BIM

Training issues ✘

- Time/cost for training not seen as a disincentive, but there is a critical shortage of 5D BIM expertise, seen as essential to remedy

Cultural resistance ✔

- *Some cultural resistance to change to 5D BIM from traditional quantity surveying techniques*

Prohibitive software/hardware upgrade costs ✘

- *Not seen as an issue for their firm, but smaller firms would find software/hardware upgrade costs to be a challenge*

Conclusions

Main benefits of 5D BIM implementation:

- Improved visualization; faster quantification, and identification & costing of design changes

Main barriers to 5D BIM implementation:

- Incomplete/insufficient model object data; lack of industry standards/protocols; lack of government intervention to support BIM