# BIM – WHERE TO NEXT?

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**ABSTRACT**

In March/April this year buildingSMART held conferences in Brisbane, Sydney and Melbourne responding to the BEIIC BIM Economic Study which shows that the adoption of this innovative digital technology can bring substantial benefits to the construction sector.

MESH 2011 focussed on this challenge: **if digital technology is so good as predicted how are we as the Built Environment sector going to make sure we ensure a national, whole of industry benefit**?

What are the blockages that we need to solve and other necessary actions to realise the improvements in sustainability, productivity, quality etc?

buildingSMART Australasia is negotiating with DIISR to develop a formal plan for the implementation of a National Initiative and the resources required to deliver it successfully and expects to complete this for the beginning of 2012.

The six priority areas established for the National Initiative are

- Product Information and BIM Libraries
- Adoption of Common BIM Guidelines & Information Exchange
- Compliance and Certification
- Procurement, Legal Issues & Insurance
- Business Process Change
- Multi-disciplinary BIM education

Some of these initiatives are in progress already while others will need to be established or encouraged. There has been overwhelming support from Industry with over 65 persons across Australia offering personal and organisational resources.

Most projects today using BIM are exploiting the advantages of clash detection, which underpins lower risks to contractors and clients.

But what about design optimisation and product quality?

This paper will elaborate the challenges to the industry in its increasing adoption of BIM and references the structural steel supply chain as an example.

**Keywords**: building information modelling, buildingSMART, IFC, BEIIC, BIM Guidelines

## Context

In March/April this year buildingSMART held conferences MESH 2011 - in Brisbane, Sydney and Melbourne responding to the Built Environment Industry Innovation Council (BEIIC) BIM Economic Study[1] which shows that the adoption of this innovative digital technology can bring substantial benefits to the construction sector.

MESH 2011 focussed on this challenge: **if digital technology is so good as predicted how are we as the Built Environment sector going to make sure we ensure a national, whole of industry benefit**?

Chuck Eastman in a paper **New Opportunities for IT Research in Construction**[2] identified the opportunity that BIM and related activities would bring:

"3D parametric modelling and rich attribute handling are making increasing inroads into standard construction practice, worldwide. This fundamental change of building representation from one that relies on human readability to a machine readable building representation, opens broad new opportunities for enhancing design and construction in ways that have been dreamed about over the last two decades. The new technology and its facilitated processes are called Building Information Modelling, or BIM. BIM design tools provide a few direct and obvious benefits. These are based on a single integrated representation from which all drawings and reports are guaranteed to be consistent, and the easy catching of spatial conflicts and other forms of geometrical errors.

*Even the first step of realising these basic BIM capabilities requires new practices* regarding design development and coordination between design teams". (this writer's italics)

What are the blockages that we need to solve and other necessary actions to realise the improvements in sustainability, productivity, quality etc?

buildingSMART believes that the widespread adoption of BIM will lead to a genuine process of substantive innovation for the construction sector. It will make Australia internationally competitive, keep us at the forefront of nations now adopting BIM and support Australia's challenge to be sustainable and energy efficient.

The BEIIC report highlights a range of issues that constrain adoption or prevent the maximum potentials being realised. As an industry, we must turn those impediments into seven key priorities for concerted action. Everyone has a role to play in this, and it is only as each one plays their part that we will realise those national benefits.

## The National BIM Initiative

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1 Allen Consulting Group, 2010, **Productivity in the buildings network: assessing the impacts of Building Information Models**, report to the Built Environment Innovation and Industry Council, Sydney, October 201

2 **New Opportunities for IT Research in Construction**, Chuck Eastman, Professor in the Colleges of Architecture and Computing, Georgia Institute of Technology, Atlanta, GA in I.F.C. Smith (Ed.): EG-ICE 2006, LNAI 4200, pp. 163 – 174, 2006. © Springer-Verlag Berlin Heidelberg 2006

We recommend the establishment of a National Technology Implementation Program with the objective to implement building information model technology and information networks in the construction processes and to make it possible to manage information flows during the entire life cycle of buildings.

This program, if adopted, would set Australia as a leading player in the global construction sector.

The priorities are:

**Priority 1: Product Information & BIM Libraries**

This ensures that all the components that make up a building are properly specified, fit for purpose and correctly integrated in to the fabric of the building.

The responsibility for action here lies with product manufacturers, suppliers, Natspec, industry bodies and software vendors. The challenge is to establish agreed object library formats and appropriate methods for integrating those in to the array of BIM software tools employed by all sectors of the industry across the full building life cycle.

**Priority 2: Adoption of Common BIM Guidelines**

While some excellent model building guidelines have been developed (see CRC-CI 2009 http://buildingsmart.org.au/home-page/digital-modelling-guidelines-review), there is a need for further work to document best industry practice in each client portfolio as a basis for effective collaborative working.

This requires concerted action by government client agencies, as well as primary industry and professional standards organisations, private owners and property developers. This could involve a review of our approach to briefing, development of BIM-based design standards, a rethink of asset management protocols and the adoption of comprehensive naming and classification conventions.

The Australian National BIM Guide, developed by NATSPEC is a reference document to be read in conjunction with a Project BIM Brief which outlines the particular requirements for each project.

Adapted by permission from the US Veteran Affairs BIM Guide, the National BIM Guide is to assist clients and consultants to clarify their BIM requirements in a nationally consistent manner. This will reduce confusion and duplication of effort.

**Priority 3: Compliance and Certification**

BIM provides superior ways to measure, simulate and analyse performance, with its integrated data of building & service system elements, GIS context and definition of human and related activities.

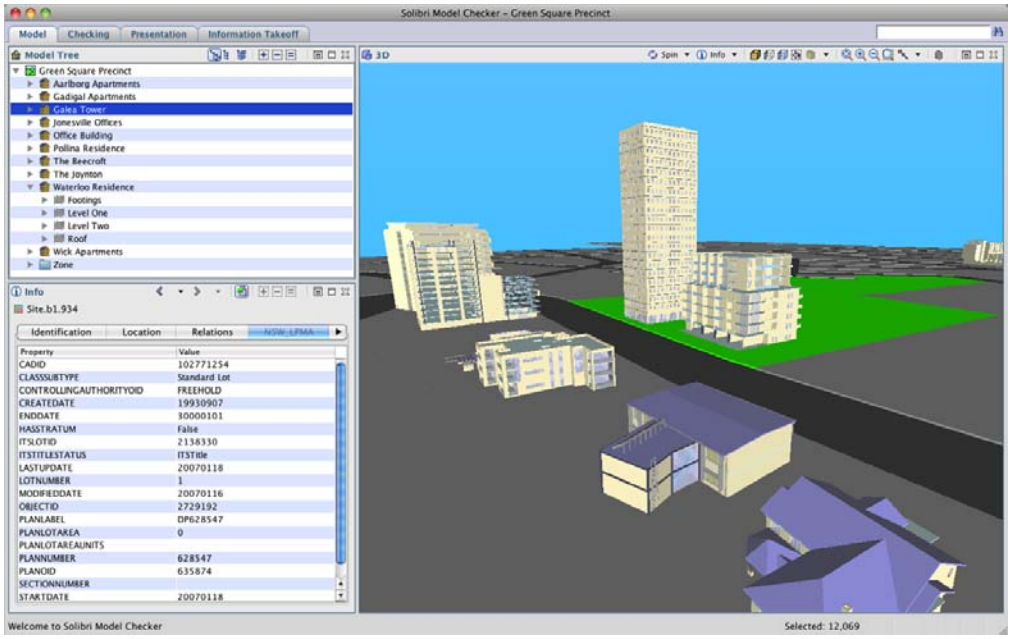


**Figure 1:** Green Square Precinct prototype model, urbanIT research project, FBE, UNSW, 2010

To underpin sophisticated analysis and performance measurement, we need to understand the urban context of building development, in this example for urban planning of new precincts etc. In Figure 1 above the prototype urban model incorporates precise cadastral data with its coordinate reference systems etc and other land data - e.g. the NSW LPMA cadastral data sets. The addition of zoning, planning, earthquake zone etc adds to the integrated data.

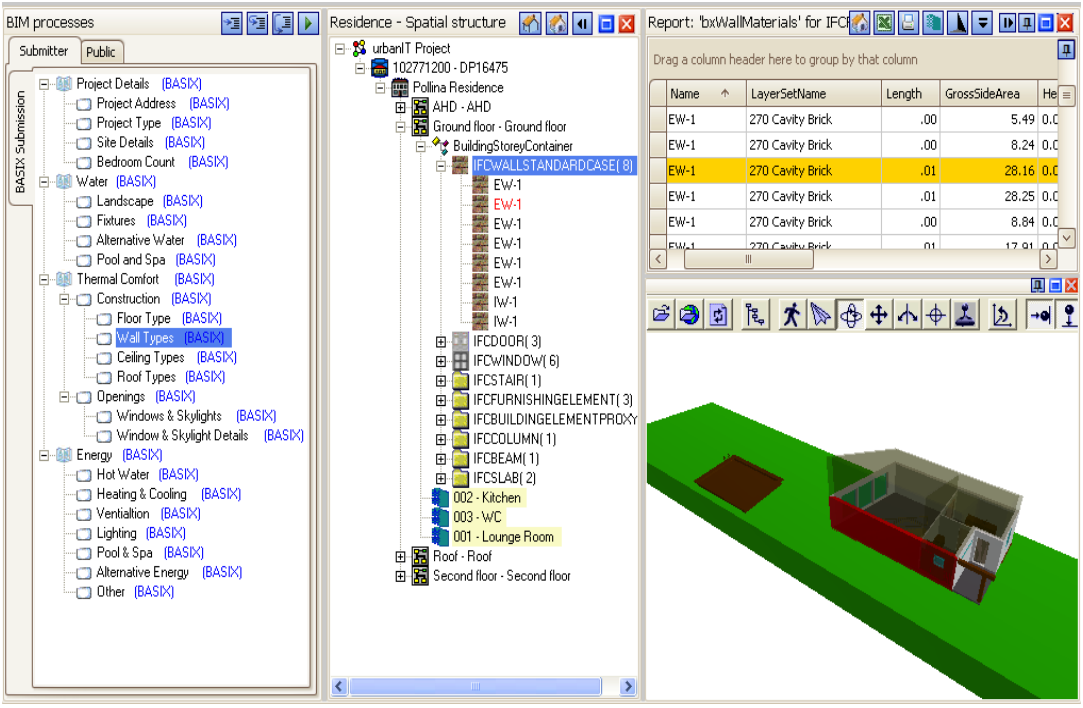


**Figure 2:** BIM based compliance checking, NSW BASIX sustainability assessment, urbanIT research project, FBE, UNSW, 2010. The tree view in the centre pane above, shows the hierarchy of the building elements by storey. The report pane (RH) lists each wall element with its key attributes and quantities. The LH pane stores the individual compliance scripts for each step in BASIX.

As a demonstration of these new capabilities, the NSW BASIX assessment system was implemented in part in an IFC compliant building model server. The example shows determination of Construction wall types. The code checking script has accessed each wall element in the building, and then tabulated the wall type name, the layerset name, length, etc from the model data. Such systems provide 24x7 availability, promote greater efficiency and rely on the calculation of performance data rather than manual interpretation.

**Priority 4: Procurement, Legal Issues & Insurance**

A logical consequence of integrated project delivery is its impact on current consulting services, management of risk, fee structures, responsibilities, intellectual property, legal liability and indemnity insurance. All these are seen as significant impediments to the adoption of BIM.

These matters can be resolved, but only through informed and rigorous debate of probity issues among groups such as the APCC, state agencies, legal practices, professional indemnity insurers and Standards Australia Contract Committees. There is a need to develop new forms of contract that facilitate alliancing and take advantage of the opportunities afforded by model-based collaboration, performance assessment and information sharing.

**Priority 5: Multi-disciplinary BIM education**

Widespread use of BIM requires a high level of knowledge and expertise in the use of specific software and the capability or ‘know how’ to exchange appropriate model data at critical times during the building design, construction and management processes.

Educational institutions at all levels, from Universities and TAFE through to Secondary Schools, need to take the lead here, but they must be strongly supported by professional accreditation bodies and groups such as the Construction Industry Training Board.

**Priority 6: Business Process Change**

There is little history of good process management in the construction industry, giving rise to an urgent need for cultural as well as process change. Many factors contribute to this, including reluctance to adopt new technologies and methods, cost of implementation, fragmentation of the industry and the need for all parties to move at once, and a general reluctance to share information.

A key enabler for the effective adoption of BIM is the smooth exchange of information between all project participants at every stage of the building procurement process.

buildingSMART International has undertaken an exhaustive program over more than a decade to develop a robust and comprehensive data model able to represent any building project, incorporating local nomenclature where appropriate, as well as defined methods for identifying the precise information needed to support industry processes.

The adoption of these technologies requires concerted effort by industry players to define effective collaborative processes that capitalise on the opportunities, plus a commitment from clients, industry professionals, software vendors, manufacturers and suppliers to implement those protocols.

Process change must be encouraged and facilitated by peak industry bodies, supported by process specialists, education providers, supply chain alliances and the development of guidelines.

**Pilot Projects by Early Adopters**

The outputs of the National Technology Implementation Program would be used and tested through a series of National Pilot Projects with in-kind commitment of project teams that test and confirm these issues.

We need to test new protocols, procurement methods and collaboration scenarios.

This initiative must come from clients, both private and government, since ultimately they are the beneficiaries of quality and increased productivity in the industry. Pilot projects would form a series of case studies that would disseminate results and feedback to the program.

These actions would provide leadership in the built environment, give industry confidence to adopt the new technologies, and make more efficient use of resources within a know time frame.

## CIB Integrated Design & Delivery Solutions

Several key bodies internationally have been examining where the adoption of BIM is leading, and CIB[3] in response to this challenge have developed a white paper.

"Integrated Design & Delivery Solutions (IDDS) [4] is aimed at transforming the construction sector through the rapid adoption of new processes, such as Integrated Project Delivery (IPD), together with Building Information Modelling (BIM), and automation technologies, using people with enhanced skills in more productive environments. The development of IDDS is about radical and continuous improvement"

Skills and software tools at this present stage can only achieve modest demonstrations of these potentials, but many are starting to understand that the industry's focus on geometrical clash detection - which reduces risk for both designer, builder and client - is just the beginning of a much larger construction sector transformation, *much more* significant than the adoption of 2D CAD in the 90s.

Future IDDS is defined by CIB to be " Successful use of IDDS involves changes in each of the project phases: conceptual planning and making the business case; all parts of design, supply

3 International Council for Research and Innovation In Building and Construction, see http://www.cibworld.nl/site/about_cib/index.html

4 CIB White Paper on IDDS **Integrated Design and Delivery Solutions**, CIB Publication 328 ISBN: 978-90-6363-060-7

chain, construction, commissioning; operation; retrofit; and decommissioning. For each of these phases, key changes in the structure and culture of the project team, including the firms that contribute its members, create a favourable context for IDDS.
Examples of these changes include: a team approach; support for innovation and tolerance of failure; strong lateral linkages and decentralised decision making; networks of commitment; and new forms of contracting, transparency and risk management (including insurance models)."

**The Structural Design Industry**

This specialist sector has a substantial record of model based adoption, with the development of the CIS/2 data exchange protocols (DEPs) undertaken in the middle 90s and widely adopted across the steel design, detailing and fabrication industry.

Eastman believes the use of BIM ensures "…many other benefits are available, such as integrated feedback from analysis/simulation and production planning tools. BIM allows tools for structural, energy, costing, lighting, acoustic, airflow, pedestrian movement and other analyses to be more tightly integrated with design activities, moving these tools from a long loop iteration to one that can be used repetitively to fine tune architectural design to better achieve complex mixes of intentions. Many of these capabilities have been outlined in the research literature for decades and they now have the potential to be realised" [5].

But the long time BIM has taken to become popular in the architectural and building services professions has left it "on a limb" and missing the building model data source that would have made a more efficient and accurate context for structural design and construction. So a proactive approach is needed to apply it more systematically to integrated BIM based projects to achieve more efficiency in the supply chain.

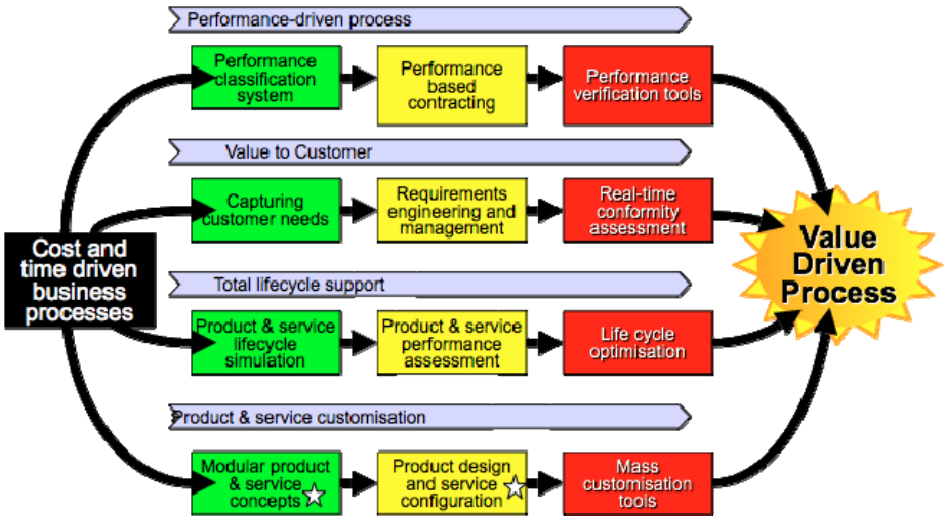


**Figure 3:** Value-driven process, Global Construction ICT Roadmap Development (from CIB)

The roadmap projects reviewed by Froese and Amor[6] identify a change in the way the construction sector can work (underpinned by these new technologies) moving to value driven processes in contrast to the current least cost procurement market.

There is much work to be done. buildingSMART is committed to forming a national initiative to expedite this movement. Your industry needs to be fully engaged in this activity.

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5 Eastman, ibid.

6 **Global Construction ICT Roadmap Development,** Thomas Froese, Professor, Department of Civil Engineering, The University of British Columbia & Robert Amor, Associate-Professor and Head Department of Computer Science, The University of Auckland, buildingSMART International Forum, 13 - 14 November 2007, Brisbane.

The objective today is to work together with all parts of the industry so that the the built environment is both environmentally responsible, provides a first class habitat for its citizens and is sustainable in a local and global context.

# Appendix

## buildingSMART International

buildingSMART is an international body, with members formed in 11 National chapters drawn from both public and private organisations in the Construction Sector devoted to the improvement of the built environment through better digital communications and the use of building information Modelling (BIM) technologies.

buildingSMART is the author of the only global openBIM standard IFC. It is a neutral and open specification that is not controlled by a single vendor or group of vendors, facilitates interoperability in the building industry, and is a commonly used format for Building Information Modelling (BIM). The IFC model specification is open and available to all. It is registered by ISO as ISO/PAS 16739.

**Vision**

A Sustainable built environment

**Mission**

Contribute to sustainable built environment through SMARTER information sharing and communication amongst all stakeholders in the building and construction sector, private and public.

**Goals**

1. Develop and maintain open international standards for Building Information Modelling (OpenBIM)
2. Accelerate market assimilation of interoperability through successful sustainable projects
3. Provide networking opportunities, specifications and written guidance.
4. Resolve high value problems that hinder sustainability.

**Benefits**

- Realisation of public and private sustainability agendas
- Better buildings faster and cheaper (value for money).
- More predictable outcomes (reduced risk).
- High performing, energy efficient buildings.
- New business opportunities

See the international site here http://www.buildingsmart.org/ or the Australasia chapter http://www.buildingsmart.org.au

## International Council For Research And Innovation In Building & Construction

CIB was established in 1953 with the support of the United Nations, as an association whose objectives were to stimulate and facilitate international collaboration and information exchange between governmental research institutes in the building and construction sector.

Amongst the CIB member organisations are almost all the major national building research institutes in the world, as well as many other types of organisations in the building and construction sector who have joined us since. And although within the CIB programme considerable attention is still given to technical topics, there are now also activities focused on topics like organisation and management, economics of building, legal and procurement practices, architecture, urban planning and human aspects.

At present CIB is the world's foremost platform for international cooperation and information exchange in the area of building and construction research and innovation.

The design, construction, and commissioning sectors have been repeatedly analysed as inefficient and may or may not be quite as bad as portrayed; however, there is unquestionably significant scope for **Integrated Design and Delivery Solutions (**IDDS) to improve the delivery of value to clients, stakeholders (including occupants), and society in general, simultaneously driving down cost and time to deliver operational constructed facilities. CIB's white paper on IDDS is a definitive roadmap for the global construction sector.

See here http://www.cibworld.nl/