Leveraging R&D Investment

for the Australian Built Environment

Project Update 2
May 2012

Sustainable
Built Environment
National Research Centre

The Sustainable Built Environment National Research Centre (SBEnrc) is the successor to Australia's CRC for Construction Innovation. Established on 1 January 2010, the SBEnrc is a key research broker between industry, government and research organisations servicing the built environment.

The SBEnrc is continuing to build an enduring value-adding national research and development centre in sustainable infrastructure and building with significant support from public and private partners around Australia and internationally.

Benefits from SBEnrc activities are realised through national, industry and firm-level competitive advantages; market premiums through engagement in the collaborative research and development process; and early adoption of Centre outputs. The Centre integrates research across the environmental, social and economic sustainability areas in programs respectively titled Greening the Built Environment; People, Processes and Performance; and Driving Productivity through Innovation.

Among the SBEnrc's objectives is to collaborate across organisational, state and national boundaries to develop a strong and enduring network of built environment research stakeholders through collaborative industry research teams.

Essential to SBEnrc achieving its goals is this core project *Leveraging R&D Investment for the Australian Built Environment*. The overarching goal of this project is to maximise the benefits of R&D to Australia's infrastructure and building industry through better matching funding strategies to industry needs.

Phase 1 of this project was an audit and analysis of private and public R&D investment in the Australian built environment since 1990 to understand past trends. This update focuses on the outcomes of Phase 2.

Phase 2
Case studies of past R&D investment in Australia

Researchers undertook three case studies of past R&D investment in Australia to illustrate the:

• nature of such investments
• drivers, successes of and barriers to investment
• organisational capabilities which contributed to outcomes
• impacts of these initiatives.

These case studies complement:

(i) the Barlow report (2011) R&D Investment Study: 1992-2008 (Phase 1)

(ii) the Construction 2030 Roadmap (currently being finalised) (Phase 3)

Together these documents will inform Phase 4 of this project - the development of policy guidelines for future R&D investment.

Methodology

Formal interviews were the main source of data, along with project and program documents. Thirty-five face-to-face interviews were conducted in late 2011 – early 2012.

To ensure a cross-section of understandings, interviewees represented: organisational executive; innovation champion; project leader; implementer; supplier; consultant; contractor; industry representative; allied agency representative; and a research representative.

Understanding the cases

The characteristics in common across the three cases include:

• Drivers: government drivers for change; enhancing best-practice; increased efficiency; and making use of new tools and technologies

• Implementation activities: developing new skills; updating processes to align with innovations; and investing in relationships

• Process needs: training; better communications and collaboration; new work practices and processes.

• Impacts on values and culture: the need for behavioural, work-practice and cultural change

• Supply chain impacts: the need for integration of new skills and knowledge

• Key successes: improved strategic and project outcomes, work environment and deliverables, and improvement in supply chain knowledge and outcomes

• Barriers: business process and procurement-practices; an entrenched resistance to change; improving awareness of initiatives and benefits

• R&D engagement: R&D needs to be focused and practical. Each agency has links with external R&D providers which complement internal efforts.

KEY FINDINGS

• **External innovation linkages are essential**
• **Timely and practical research should be a priority**
• **Agencies need access to a range of innovation pathways**

Case study 1
Road construction safety

Queensland Transport and Main Roads (QTMR) are committed to ensuring a safe working environment for road construction workers in Queensland. They were a core partner in the Construction Safety Competency Framework project (CRC for Construction Innovation, 2006). Recent initiatives have contributed to further performance in this area including the development and implementation of:

(i) the Mechanical Traffic Aid
(ii) the Thermal Imaging Camera
(iii) Trailer-based CCTV (camera).

These three initiatives are the basis of this case study, which had a formal R&D process (Figure 1) that included trials, options analysis and deployment.
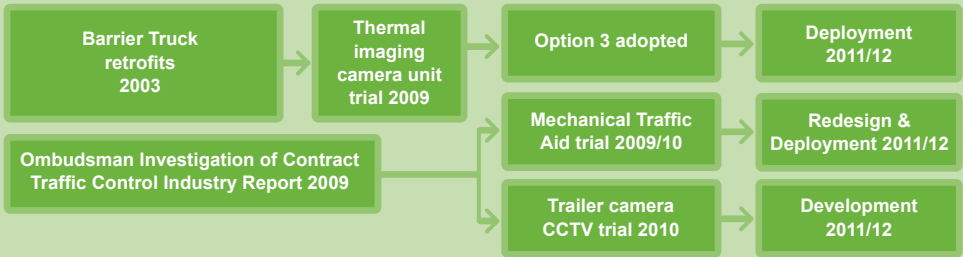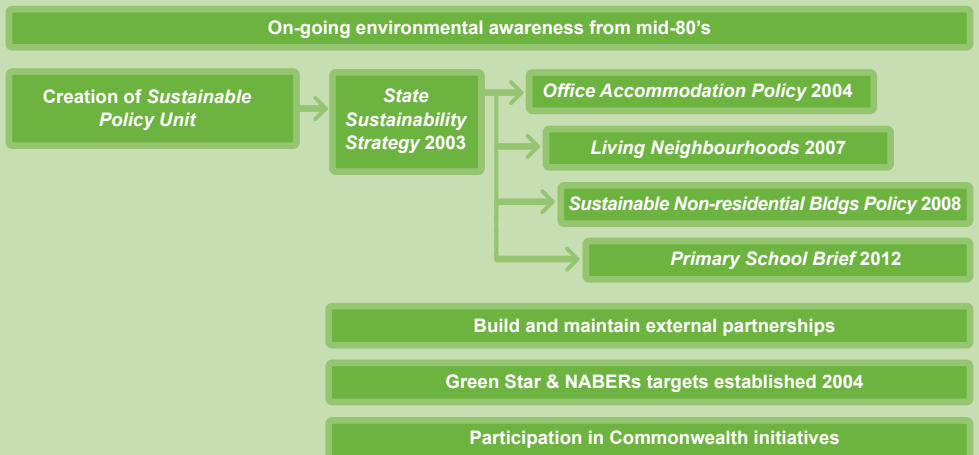
Figure 1 - *Road construction safety pathway*

Barrier Truck retrofits 2003 → Thermal imaging camera unit trial 2009 → Option 3 adopted → Deployment 2011/12

Ombudsman Investigation of Contract Traffic Control Industry Report 2009

Mechanical Traffic Aid trial 2009/10 → Redesign & Deployment 2011/12

Trailer camera CCTV trial 2010 → Development 2011/12

Figure 2 – *Green buildings pathway*

On-going environmental awareness from mid-80's

Creation of *Sustainable Policy Unit* → *State Sustainability Strategy* 2003 → *Office Accommodation Policy* 2004

Living Neighbourhoods 2007

Sustainable Non-residential Bldgs Policy 2008

Primary School Brief 2012

Build and maintain external partnerships

Green Star & NABERs targets established 2004

Participation in Commonwealth initiatives

Case study 2
Green buildings

The Western Australian Government has taken a leadership role for a number of decades in developing policies, guidelines and regulations to green the built environment. In the past decade a number of key initiatives have been introduced to contribute to:

(i) greening the stock of government buildings

(ii) providing leadership in the development of other non-residential commercial buildings.

Figure 2 illustrates the pathway taken in this case study. It includes a key investment in the formation of the Sustainable Policy Unit in 2003, along with a focus on policy development, building external relationships and establishing targets for green commercial building outcomes.
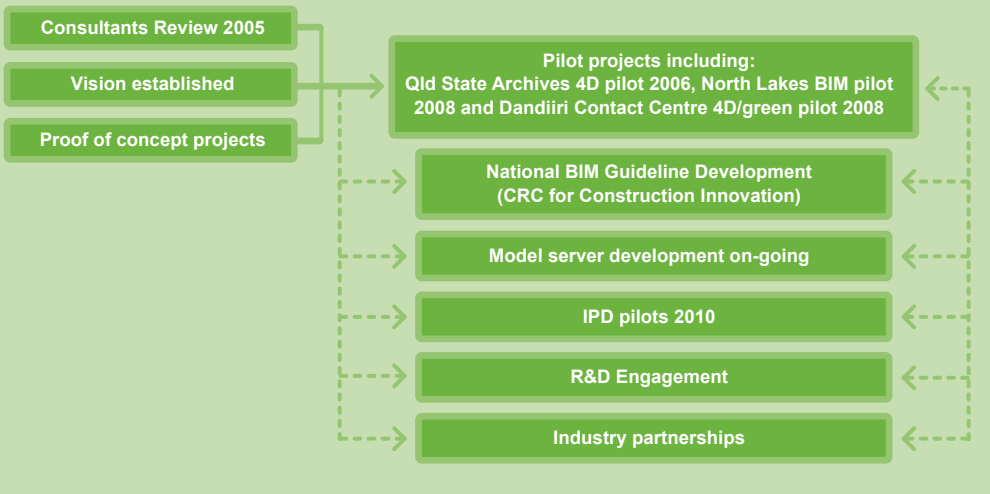
Case study 3
CADD to IPD

This case study explores the evolution of project delivery in Project Services (a division of the Queensland Department of Public Works (QDPW)) from initial implementation of computer aided design and documentation (CADD) in the mid-1980's to experimentation with and implementation of building information modelling (BIM) from the mid 2000's; to current moves towards integrated project delivery (IPD).

Project Services has provided national and international leadership in this field, characterised by strong research partnerships, industry consultation and engagement.

Figure 3 illustrates the recent steps taken by Queensland Project Services. This is characterised by a focus on developing more efficient delivery mechanisms through the use of new technology enablers, coupled with process change including pilots, strong researcher engagement, industry leadership and partnerships.

Figure 3 – CADD to IPD pathway

- Consultants Review 2005
- Vision established
- Proof of concept projects

- **Pilot projects including:** Qld State Archives 4D pilot 2006, North Lakes BIM pilot 2008 and Dandiiri Contact Centre 4D/green pilot 2008
- National BIM Guideline Development (CRC for Construction Innovation)
- Model server development on-going
- IPD pilots 2010
- R&D Engagement
- Industry partnerships

Impacts of research

Case study 1
Road construction safety

Recent trials in QTMR explored in the current case study responded to both an internal drive to improve safety for road construction workers and the travelling public, and the 2009 Queensland Workplace Rights Ombudsman Report on Traffic Control. Assessments of the trials were carried out with the following outcomes.

- Thermal imaging cameras – being installed in 27 Barrier Trucks across QTMR's fleet

- Mechanical Traffic Aid - currently being redesigned for use in Queensland conditions including development of specifications and deployment guidelines

- Trailer Camera - approved for implementation with supporting deployment guidelines being incorporated within QTMR's systems.

Case study 2
Green buildings

Impacts have been achieved through a combination of informal, formal and integrated R&D activities. The establishment of the Sustainable Policy Unit was pivotal. This led to the publication of the WA State Sustainability Strategy (2003), which has informed subsequent policy documents. Additional leverage has been achieved through the establishment of relationships with external organisations including: other state and local planning authorities; research institutions; supply chain partners; and industry associations including the Green Building Council of Australia.

Along with a growing number of significant green buildings in WA, impacts have included embedding outcomes in policies, regulations and guidelines including:

- Office Accommodation Policy (2004)
- Department of Housing and Works Sustainability Matrix (2003)
- Liveable Neighbourhoods Policy (2007)
- Sustainable Non-Residential Buildings Policy (2008)
- Primary School Brief (2012)

Case study 3
CADD to IPD

QDPW Project Services have an ongoing integrated informal R&D process with the incremental adoption of new technologies and work practices. Internal proof of concept has been achieved on a project-by-project basis, which was complimented with formal R&D engagement through core involvement with CRC for Construction Innovation from 2001 to 2009, and now with SBEnrc. Complementing this, they have been involved with a number of ARC Linkage projects with QUT and RMIT. Key outcomes include:

• Mareeba Court House and Police Station (2006) – first BIM pilot

• Queensland State Archives (2006)
  – 4D model developed

• North Lakes Police Station (2008)
  – BIM approach further developed. Structural steel design provided to the fabricator from Project Services

• Dandiiri Contact Centre (2008) - 4D model developed including energy modelling - building awarded the highest environmental performance of any Australian building under construction at that time

• Development of National BIM Guidelines through the CRC for Construction Innovation.

Impacts on the industry include QDPW Project Services being considered as a national and international leader in this field with extensive dissemination of of leading work-practices to other industry researchers, external contractors, suppliers and vendors.

Conclusions

The analysis of these case studies highlights the:

1. different pathways available to agencies to implement innovation
2. importance of lateral communications structures with external organisations
3. incremental nature of the implementation
4. coupled nature of technology and process change
5. need for practical and timely research through existing relationships
6. need for on-going and complementary skills development

Questions and challenges raised for future research include:

1. How does an organisation determine the best pathway to innovation?
2. How to most effectively and efficiently develop relationships with researchers and industry?
3. How can industry accelerate the uptake of BIM to improve productivity?
4. How can organisations become more agile given the rate of change of technology?
5. What are the most effective mechanisms to facilitate practical and timely research?
6. How best to deliver training and skills to a industry dominated by SMEs in the environment of on-going technological change?

Next steps

The retrospective evaluation of previous investments and impacts described through these case studies, coupled with a prospective industry road map will inform the development of policy guidelines for future R&D investment in this sector.

This research wouldn't be possible without the ongoing support of our industry, government and research partners:

Project endorsed by:

Australian Built Environment Industry Innovation Council (BEIIC)

Project informs international Task Group:

CIB (International Council for Research and Innovation in Building and Construction), TG85: R&D Investment and Impact

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