

Independent Review of Infrastructure Australia

Submission relating to The Evolvement of Digital Asset Information Management in the Built Environment

Prepared by:

Ammar Shemery, COO, Sustainable Built Environment National Research Centre (SBEnrc), Australia, Curtin University, Perth

Professor Keith Hampson, CEO, Sustainable Built Environment National Research Centre (SBEnrc), Australia, Curtin University, Perth

August 2022

About the SBEnrc

Australia's [Sustainable Built Environment National Research Centre](#) (SBEnrc) offers a unique industry-government-research collaboration to improve Australia's built environment industry.

The SBEnrc has the broadest built environment research alliance in the country, with Core Members including ATCO Australia, BGC Australia, the Western Australian and Queensland Governments, Curtin University, RMIT University, Western Sydney University and Griffith University, all of which are represented on the Centre's Governing Board.

The SBEnrc is the successor to the [CRC for Construction Innovation](#) (CRCci). Established on 1 January 2010, the SBEnrc is a key research facilitator between industry, government and research organisations servicing the built environment industry. The three research streams focus on environmental, social and economic sustainability – areas identified by national industry stakeholders as the key areas that will drive productivity and industry development in the built environment industry.

The Centre actively works towards realising its vision to be an enduring world-class research and knowledge hub in sustainable infrastructure and building design, construction and management to enhance the performance of Australia's built environment industry.

sbenrc.com.au

About the authors



Ammar Shemery
COO, Sustainable Built Environment National Research Centre (SBEnrc)

Ammar Shemery is an international senior manager with more than 20 years of experience in a variety of sectors including construction, assets, facilities, engineering and education, coupled with strong business transformation experience and stakeholder management across government, industry and research clients. He currently serves as the COO of SBEnrc. His qualifications include – MSc FM and a BEng Mechanical. Ammar is also a Certified Facilities Manager CFM (IFMA/US), a Certified Member of the British Institute of Workplace Management (CIWFM) and an Associate Member of Facilities Management Association of Australia (FMA).



Professor Keith Hampson
CEO, Sustainable Built Environment National Research Centre (SBEnrc)

Professor Keith Hampson is recognised globally for his award-winning collaborations translating research into practice in the construction industry. He established and is Chief Executive Officer of the Sustainable Built Environment National Research Centre and its CRC for Construction Innovation predecessor. He is also current immediate past President of the International Council for Research and Innovation in Building and Construction (CIB). Keith holds degrees in Civil Engineering (Hons) from Queensland University of Technology (QUT), an MBA from QUT and a PhD from Stanford University. He holds fellowships at the Australian Academy of Technology and Engineering, Engineers Australia and the Australian Institute of Company Directors. Keith has authored more than 200 publications, delivered on millions of dollars in industry research and mentored future leaders globally.

Scope and stakeholder perspective

This submission comprises the authors' reflections as academic research practitioners on *Digital Asset Information Management* to improve project procurement and delivery of infrastructure in Australia.

The authors also reflect on comments made to them by research colleagues internationally.

Over Two Decades of Adding Value to Built Assets in Design, Construction and Operation through Digital Technologies

The SBEnc and its predecessor the CRCci have built a substantial record of industry driven digital asset management research. The CRCci left a legacy of 15 national projects completed over a nine-year period whilst the SBEnc has already completed 14 projects and continues to be active in this area.

Cooperative Research Centre for Construction Innovation (2001-2009)

The CRCci's early research projects in the area of digital technologies and built assets delved into the development of e-business tools and information technology that reached into all three Building Information Modelling (BIM)/Digital Engineering (DE) enablers: technology, process, and procedures. Research focused on both macro and micro challenges: from implementing BIM/DE innovation at an industry level to solving specific problems such as enabling collaboration over mobile networks and working with parametric models (CRCci Projects 2001-012-A, 2002-057-C, 2002-060-B). Working in this way the CRCci was able to provide benefits to both industry influencers and early adopters of BIM/DE. The former benefited from the development of business cases demonstrating the value and potential of BIM/DE and route maps for industry-wide adoption. The early adopters were provided with tools with which to progress their work. For both groups the CRCci delivered critical networking opportunities to share knowledge, experience, challenges and expectations. The more critical and significant CRCci work investigated the adoption of digital technologies in the Architecture, Engineering and Construction (AEC) sector. Projects 2001-008-C "Project Team Integration: Communication, Coordination and Decision Support" and 2003-003-A "E-business Adoption" considered investment, training, benefits and barriers to ICT implementation.

The CRCci's ground-breaking and industry peak award winning 'Sydney Opera House: FM Exemplar' project took research into real-world digital applications to a new level. With the vast majority of built assets already in existence, a major challenge for the widespread adoption BIM/DE is how to bring digital technologies to existing buildings. The Sydney Opera House project tackled this issue head-on in a huge leap in ambition from the modest aspirations expressed at the end of the CRCci's research into the use of parametric modelling during the early stages of built asset design

The Sydney Opera House project leap-frogged the intermediate stages and the entire construction process to arrive at facilities management and building operations. At the same time it enabled BIM/DE research to reflect back to the design and construction phases with a new view, a vision from the building owner and operator perspective.

The immersion in BIM for FM further highlighted the need for a standardised, national, approach to asset information management, which led to Project 2007-002 EP (2007-2009). In one of its last major research projects the CRCci developed national and industry-wide BIM standards and practices to enable fully collaborative model-based working. Demonstrating through case studies the importance of open standards and change management.

Sustainable Built Environment National Research Centre, Australia (2010-Present)

Creation of the SBEnc in 2010, provided an opportunity to renew and refresh major research themes. In consultation with industry and university partners the SBEnc adopted a focus on asset lifecycle management across three programs: Environment, Processes and Productivity. Under this

new framework, the SBEnrc has completed 14 BIM/DE related research projects and continues to work in this field. Of the completed projects ten addressed process improvement and four productivity. Ten projects have focused on asset information and lifecycle management in the context of BIM/DE, two projects on specific BIM/DE applications for scaffolding and two on BIM/DE adoption in general. In a deliberate broadening of reach, linear assets such as roads and water infrastructure gained prominence alongside traditional vertical built assets.

Project 2.21 “New Project Management Models for Productivity Improvement in Infrastructure’ and Project 2.24 “Integrated Project Environments” (IPE) were early industry improvement initiatives by the SBEnrc into transport linear assets and infrastructure. The SBEnrc projects followed a similar route to CRCci Projects 2001-008-C “Project Team Integration” and 2003-003-A “E-business Adoption” by investigating current business capability and the status of implementation strategies for the adoption of BIM and VDC (virtual design and construction). The success of Projects 2.21 and 2.24 led to further research to address specific challenges identified in the research outputs with Project 2.33 “New project management structures: Infrastructure modelling (BIM) and Location (GIS)”. In a continuation of the CRCci’s success in winning Australian Research Council (ARC) funding, the SBEnrc won support for Project 2.33(ARC). Under the auspicious of this project the SBEnrc developed a data exchange protocol for infrastructure projects - CONie (Construction to Operations Network information exchange).

A further major investment into pragmatic infrastructure research followed with Project 3.28 “National BIM Guidelines and Case Studies for Infrastructure”. As with Projects 2.21 and 2.24 this new project drew inspiration from earlier CRCci work, in this instance “BIM National Guidelines and Case Studies” (2007-002-EP) that had focused on commercial buildings.

Following Projects 2.21 and 2.24, consultative forums with SBEnrc partners and stakeholders led to the launching of a larger and broader BIM research project; “Driving Whole-of-life Efficiencies through BIM and Procurement” (Project 2.34). In delivering this project the research team returned to a popular and successful route of using case studies to demonstrate innovation. The result was three very different case studies covering the asset lifecycle use of BIM/DE:

Design	New generation rollingstock depot (Queensland)
Construction	Perth Children’s Hospital (Western Australia)
Asset Management	Sydney Opera House (New South Wales)

The Sydney Opera House case study revived the former CRCci’s connection with the performing arts centre and supported the House’s development of a BIM interface for facility management to link existing and disparate systems, and establish documentation standards for future building projects.

This well-received research project led to numerous publications and presentations in academic and industry forums (listed at: <https://sbenrc.com.au/research-programs/2-34-driving-whole-of-life-efficiencies-through-bim-and-procurement/>). The findings and recommendations were brought together in a major textbook, “Delivering Value with BIM” and set-out a practical and strategic framework for realising benefits from BIM¹.

A significant observation from Project 2.34 was the absence of clearly defined industry benchmarks by which to evaluate the benefits of adopting BIM. The publication ‘Delivering Value with BIM’ sought to resolve this with the inclusion of a dictionary describing 31 benefits of adopting BIM. Research Project 2.46 “Whole-of-life Value of Constructed Assets Through Digital Technologies” took this a step further by developing an online tool to collect benefits data from consultants, contractors and built asset operators. The collated data would then be used to compare BIM and non-BIM outcomes, identify best practice and the greatest benefits from adopting BIM.

Project 2.51 “Developing a Cross Sector Digital Asset Information Framework for Asset Information” was another mammoth undertaking on the scale of the BIM Guidelines work and Project 2.34’s

investigation of whole-of-life efficiencies from BIM. The project also illustrates the growing breadth of the SBEnc's digital asset management research, tackling the areas of facilities management, housing, buildings and transport infrastructure. Once again, the strength of the SBEnc's research highlighted the Centre's ability to bring together disparate partners and produce outputs that combined academic knowledge with industry experience. Project 2.51 resulted in a substantial guide to digital asset information management with accompanying case studies and a Good Practice Guide published in partnership with the Facilities Management Association of Australia (FMA).

Concurrent and subsequent projects leveraged the digital asset information framework established by Project 2.51 to investigate how digital asset information could inform whole-of-life decision making. The success of Project 2.51 led to ARC funding for research into the specific asset information requirements for lifecycle management of water infrastructure. The research demonstrated that by combining advanced sensing, digital modelling and computational intelligence it was possible to maximise the planning and operational effectiveness of water utilities in maintenance, repair and rehabilitation.

Project 2.64 "Unlocking Facility Value through Lifecycle Thinking" built on the CRCci / SBEnc tradition of using case studies to illustrate innovation and best practice. This project reviewed 33 published case studies and applied the knowledge acquired to three new Australian case studies. The SBEnc's industry report showed how the use of data in a BIM model supplemented with innovations in sensing, tracking and image processing enabled enhanced decision-making to realise facility value throughout an asset's lifecycle.

Project 2.72 "Leveraging an Integrated Information Lifecycle management framework" conducted an extensive review of international and local practice. The project demonstrated how data can be collected, exchanged, stored and used at various life cycle stages when supported best practice in information management. The final industry report provides important guidance on the adoption of HBIM (Heritage BIM), to date an under-developed practice in Australia. In setting-out best practice, advice is provided on selecting an appropriate level of HBIM modelling, available technologies for capturing geometric and qualitative data, and overcoming social, technical and legal barriers to HBIM.

SBEnc's existing Project 2.82, with five national case studies, seeks to examine the industry best practices and international standards related to the value of DE and BIM and develop a practical approach that can efficiently guide industry people to keep their DE models alive after construction and handover.

The SBEnc's research in digital asset information management is an on-going journey. In 12 years (2010-2022) the SBEnc has addressed many of the important issues confronting industry practitioners in adopting BIM/DE across the asset lifecycle. Over time the research focus has shifted from policy and collaboration to emphasise methodologies for developing digital asset information frameworks to support whole-of-life asset management. These developments have reflected the AEC industry's growing ease with BIM/DE and the sector's need for researchers to address the "how?" rather than "why?" that featured in earlier work in this field.

Conclusion

A key success factor to digital asset information is an effective data structure methodology that supports consistent curation of digital information for designing, constructing, maintaining and operating infrastructure assets. This is particularly challenging with existing built assets for which asset information is typically available in various digital and non-digital formats, each with its own approach to data structuring.

The SBEnrc’s research in digital asset information management is an on-going journey. In 12 years (2010-2022) the SBEnrc has addressed many of the important issues confronting industry practitioners in digital asset information management across the asset lifecycle. Over time, the research focus has shifted from policy and collaboration to emphasise methodologies for developing digital asset information frameworks to support whole-of-life asset management. These developments have reflected the AEC industry’s growing ease with BIM/DE and the sector’s need for researchers to address the “how?” rather than “why?” that featured in earlier work in this field.

Mr Shemery and Professor Hampson are available for consultation as may be required to add clarity and/or depth in this key area of assessing infrastructure effectiveness.

Contacts

Ammar Shemery
COO, Sustainable Built Environment National Research Centre, Australia



Professor Keith Hampson
CEO, Sustainable Built Environment National Research Centre, Australia

