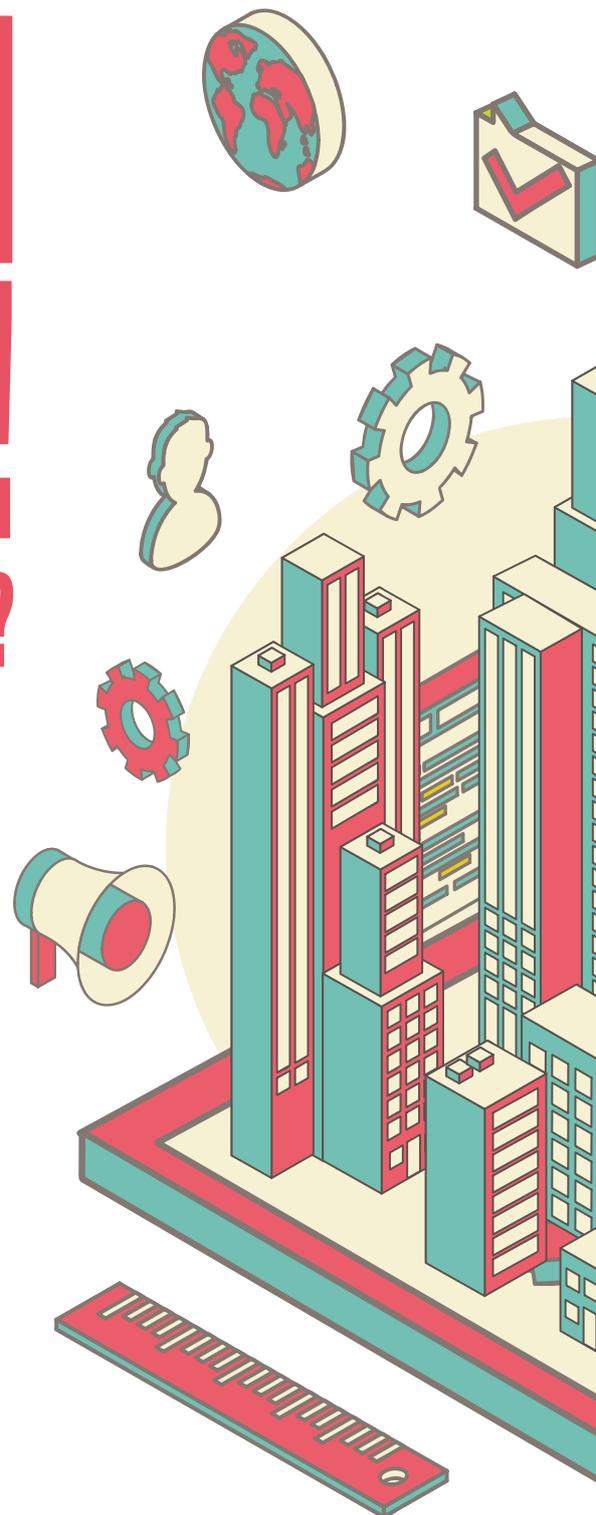




THE DIGITAL REVOLUTION IS UPON US! BUT WHAT ABOUT THE HUMANS?

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INTEGRATION IN CONSTRUCTION (IICON) THROUGH HER WORK AT THE SUSTAINABLE BUILT ENVIRONMENT NATIONAL RESEARCH CENTRE (SBENRC, HEADQUARTERED AT CURTIN UNIVERSITY). CURRENTLY, SHE TEACHES AT THE UNIVERSITY OF NEW SOUTH WALES AND UNIVERSITY OF TECHNOLOGY SYDNEY AS WELL AS CARRY OUT RESEARCH INTO URBAN RESILIENCE POLICY, INCLUDING THE USE OF INFORMATION SYSTEMS TO IMPROVE DECISION-MAKING PROCESSES.





In Australia, and globally, we are facing challenges due to economic unpredictability, changing climate and technological advances. In 2013, the Australian Department of Industry identified lifting productivity and economic growth as one of our most important challenges. Internationally, governments around the world have also tried to increase the efficiency and sustainability of the built environment industry by embracing new digital technologies and integrating information across organisations and software platforms. In Australia this is being done, among other ways, under the banners of smarter cities, digital engineering and building information modelling (BIM).



These approaches have been heralded to represent a paradigm shift in how we plan, deliver and manage built assets that will bring a bounty of returns. These benefits have been and continue to be widely researched and showcased across the world, leading to government and private actors setting ambitious goals for implementation. The UK Government for example mandated BIM starting 2016 and has developed a vision for a “digital Britain”. Like them, many other governments and state departments have also moved to lead by example. In Australia, the Transport and Infrastructure Council published their Digital Engineering Principles and has a task group working on developing them more comprehensibly. At the state level, different government departments have already pledged to implement BIM across major infrastructure projects or are currently considering it. The digital revolution that has been coming seems to be almost upon us. Should we fear it or embrace it with opened arms and no qualms?

THE DIGITAL VS THE HUMAN

While I am an enthusiastic advocate for information integration, our research at the Sustainable Built Environment National Research Centre (SBEncr) has shown that the answer is not that simple. BIM for example is not a single software package that you just “plug and play”. This means that for an implementation strategy to be most successful it should be framed by clarity around what specific benefits are expected and a clear understanding of potential hurdles and basic requirements such as standards, skills, information management protocols, etc.

More broadly speaking, a more integrated digital built environment has the potential to transform our lives and the world we reside in. As rightly pointed out in Digital Britain though, this transformation will require addressing both digital and human factors simultaneously. What does this mean? The digital factors are basically information and technology,

which in the near future will include things like real-time remote sensing and monitoring of assets and network performance, automated control systems, 3D printing and smart factory automation, open data and internet services. The “human” factors, though, are as important if we are to successfully transition into this brave new world. These include things like the cultural change required to work within more integrated project environments as well as finding a balance between business elements such as systems and strategies with social issues that include values, skills, staff requirements and management style.

Australia’s brief National Digital Engineering Policy Principles mention the potential value of these new approaches. Here, benefits like higher efficiency, value for money, productivity and innovation are balanced against more process-oriented goals such as standards and protocol harmonisation across government organisations and life-cycle phases, collaborative efforts to drive best practice across industry and government, capability building and the collection and active incorporation of lessons learned.

International research also exemplifies these contrasting aspects of a more digitally integrated built environment. A French research published earlier this year, presented two studies of large asset managers who sought to improve the energy performance of their portfolio through the use of more integrated information management approaches. The first case included the use of a centralised control station for the renovation, operations and maintenance of 18 high schools. This approach provided the operator, administrator and occupants

* “Digital Engineering may be defined as the convergence of emerging technologies such as Building Information Modelling (BIM), Geographic Information Systems (GIS) and related systems to derive better business, project and asset management outcomes” (Australian Government, 2016, National Digital Engineering Policy Principles).



with access to energy usage and equipment performance data almost in real-time. This eventually led to achieving ambitious energy saving targets and improving coordination of tasks.

The second case was a social housing company who digitised its housing stock to improve their strategic asset management using BIM (they manage 32,836 dwellings servicing some 65,000 tenants across France). They wanted to “promote information sharing, monitoring and transfer and to integrate 3D modelling with facility management and operations processes”. Taking advantage of the size of their stock, the cost of digitising this information came down to less than \$50 (€32) per dwelling. This company reported immediate benefits such as more accurate tenders for restoration of facades, time and financial savings by contractors, more reliable information and better informed strategic asset management decisions.

Despite both studies reporting benefits resultant from their respective approaches, the study concluded that turning digital data into actionable information requires being aware of the specific context of each project. The approaches used in the two cases can be defined as socio-technical. This means that

THEIR SUCCESS DEPENDS ON THE INTERACTION BETWEEN PEOPLE AND DIGITAL SYSTEMS.

These types of approaches have a strong organisational impact on procurement and management processes.

These studies speak of how leveraging more integrated information systems

presents both technical and human challenges. In the social housing case, the main issue was related to the lack of interoperability between software packages used at renovation and operational stages. In the high school case, however, the main barrier to realising benefits was human. The high turnover in the managing company led to a continual loss of knowledge and expertise which was accompanied by the administrator and occupants not having the skills to interpret the information they were given. All of this initially limited the energy saving they were able to achieve from the renovation and more integrated system. This study also concluded that the benefits of new approaches such as BIM have to be evaluated over the long term because of the time that takes to develop the rights skills and integrating the new processes into business as usual.

However, until now a significant fraction of what is published about more integrated information systems focuses on technical aspects of creating and managing digital information. The “people” aspects are often not as thoroughly investigated and developed. But, “people are information integrators, independently of the physical information carriers” .

In Australia, the Sydney Opera House has recently started implementing its BIM4FM interface. Here, key lessons from the implementation journey have include highly social aspects Their BIM interface aims to be “an open solution, robust yet adaptable, able to link to multiple information sources and to become the single source of truth for all information queries” . This meant to them that “to succeed, everyone had to be taken through the journey to increase ownership and ensure that the final outcome was relevant and useful”. It also meant that many people without necessarily having a BIM background would need to use the interface in an

everyday basis. One of the ways they have dealt with this is by having an information systems support group. “These are the super users: highly capable and BIM experienced team members who form a special task force of sorts to start the project and help less experienced users”. Other lessons learnt included the importance of having and encouraging a culture of engagement across all organisational levels, and developing and nurturing a new set of skills beyond technical expertise.

WHAT ABOUT SMES?

Cultural barriers in the form negative attitudes towards skills development have historically been one of the greatest hurdles affecting Small and Medium Enterprises (SMEs) in the building sector. In the UK in 2013, 23% and 15% of respondents to a survey by the Royal Institution of Chartered Surveyors (RICS) identified culture and lack of collaboration respectively as barriers to implementing BIM. These have since been reduced in the case of BIM and other information integration approaches through the use of on-the-job and/or more informal training where the direct link between cost and benefit is more visible. In contrast, a survey carried out in Australia in 2016 showed that while 42% of SMEs here have adopted basic levels of BIM, the majority is still on the fence due to uncertainty about potential returns .

SMEs also tend to find adapting to the changes of particular clients more difficult than larger companies. This is often due to the financial cost burden of using different software

* In Bougrain, F (2017) Turning energy data into actionable information: The case of energy performance contracting, in A.X. Sanchez, Hampson, K.D. and London Geoffrey (Eds), Integrating Information in Built Environments: From Concept to Practice, London: Routledge.



* Meistad, et al. (2017) Stakeholder perspectives and information exchange in AEC projects, in A.X. Sanchez, Hampson, K.D. and London Geoffrey (Eds), Integrating Information in Built Environments: From Concept to Practice, London: Routledge.

* Linning, C. et al. (2016) Tips with Hindsight, in A.X. Sanchez, Hampson, K.D. and Vaux, S. (Eds) Delivering Value with BIM: A Whole-of-life Approach, London: Routledge.

* Hosseini, R et al. (2016) BIM adoption within Australian Small and Medium-sized Enterprises (SMEs): an innovation diffusion model, Construction Economics and Building, 16(3): 71-86

* McGraw-Hill Construction (2012) "The business value of BIM for infrastructure: Addressing America's infrastructure challenges with collaboration and technology SmartMarket report", Bedford, MA: McGraw-Hill Construction.

packages and upskilling their workforce. However, a survey carried out in the US in 2012 found that, due to their shorter duration, small projects present more opportunities to introduce the use of BIM and the smaller size of organisations is advantageous in driving higher levels of implementation. This survey showed that 67% of all BIM users reported a positive return on investment for BIM use in infrastructure projects. A similar survey in Australia in 2014 across designers and contractors, reported that 70% for buildings and 94% for infrastructure reported moderately to very positive returns on investment with only 25% of all surveyed having more than 5 years of experience.

IN SUMMARY

Integrating information strategies for

decision-making requires processes that ensure that the data gathered matches the question that needs answering rather than just gathering data for "data's sake".

TECHNICAL SOLUTIONS SUCH AS BIM AND ADVANCED ICT GENERALLY MUST THEREFORE BE PROMOTED HAND-IN-HAND WITH STRATEGIES AND APPROPRIATE LEADERSHIP TO OVERCOME PROCESS AND CULTURAL BARRIERS.

Value management and communication are a key part of this journey, especially for SMEs and risk-adverse organisations.

While there is some advancement in this area for BIM with tools such as BIMValue, the BIM Dictionary and the BIM Toolkit, this issue of technical versus human aspects is but one of the many complexities, challenges and opportunities found in the growing and broader field of information integration. There is still much work remaining to capture and leverage the lessons learned from successes and difficulties encountered on the path to a more integrated built environment industry.