Australian Government
Australian Research Council

Engagement and Impact 2018

RMIT University

RMT09 (ST) - Impact

Overview

Title

(Title of the impact study)

Evidence-based management of community buildings

Unit of Assessment

09 - Engineering

Additional FoR codes

(Identify up to two additional two-digit FoRs that relate to the overall content of the impact study.)

01 - Mathematical Sciences

12 - Built Environment and Design

Socio-Economic Objective (SEO) Codes

(Choose from the list of two-digit SEO codes that are relevant to the impact study.)

87 - Construction

Australian and New Zealand Standard Industrial Classification (ANZSIC) Codes

(Choose from the list of two-digit ANZSIC codes that are relevant to the impact study.)

30 - Building Construction

Keywords

(List up to 10 keywords related to the impact described in Part A.)

asset management

building degradation

local councils

depreciation

maintenance

council asset management system

artificial intelligence

stochastic degradation model

civil engineering

Sensitivities

Commercially sensitive

No

Culturally sensitive

No

Sensitivities description

(Please describe any sensitivities in relation to the impact study that need to be considered, including any particular instructions for ARC staff or assessors, or for the impact study to be made publicly available after EI 2018.)

Aboriginal and Torres Strait Islander research flag

(Is this impact study associated with Aboriginal and Torres Strait Islander content?
NOTE - institutions may identify impact studies where the impact, associated research and/or approach to impact relates to Aboriginal and Torres Strait Islander peoples, nations, communities, language, place, culture and knowledges and/or is undertaken with Aboriginal and Torres Strait Islander peoples, nations, and/or communities.)

No

Science and Research Priorities

(Does this impact study fall within one or more of the Science and Research Priorities?)

No

Impact

Summary of the impact

(Briefly describe the specific impact in simple, clear English. This will enable the general community to understand the impact of the research.)

Victorian council buildings deliver essential community services and represent a $15 billion dollar infrastructure investment. The difficulties in understanding and planning for degradation of council buildings have led to a 40% funding shortfall for building maintenance, harming the delivery of essential community services. Professor Sujeeva Setunge created new probabilistic models to predict degradation of community buildings. In partnership with local councils, she developed and deployed the Council Asset Management System (CAMS), a cloud-based software solution and app for more efficient building management. CAMS has informed building management across Victoria, enhancing community services, reducing costs and more efficiently allocating limited council resources.

Beneficiaries

(List up to 10 beneficiaries related to the impact study)

City of Melbourne

Brimbank City Council

Greater Dandenong City council

Glen Eira City Council

Hume city council

Integrate Australia Pty Ltd

Kingston City Council

Monash City Council

Mornington Peninsula Shire Council

Municipal Association of Victoria

Countries in which the impact occurred

(Search the list of countries and add as many as relate to the location of the impact)

Australia

Details of the impact

(Provide a narrative that clearly outlines the research impact. The narrative should explain the relationship between the associated research and the impact. It should also identify the contribution the research has made beyond academia, including:
- who or what has benefitted from the results of the research (this should identify relevant research end-users, or beneficiaries from industry, the community, government, wider public etc.)
- the nature or type of impact and how the research made a social, economic, cultural, and/or environmental impact
- the extent of the impact (with specific references to appropriate evidence, such as cost-benefit-analysis, quantity of those affected, reported benefits etc.)
- the dates and time period in which the impact occurred.

NOTE - the narrative must describe only impact that has occurred within the reference period, and must not make aspirational claims.)

Community buildings are the second largest asset class managed by local councils. Buildings are fundamental to service delivery across the community, including accommodation, gyms, community centres, and homeless shelters. Building assets belonging to Victorian councils represent a $15 billion dollar investment, however there has been an estimated $280 million annual funding deficit for these assets. Professor Sujeeva Setunge developed an asset management system that predicts the deterioration of buildings and allows councils to make better decisions about maintenance and repair activities. This has been implemented at four local councils, managing over $4 billion of public assets.

The $280 million funding shortfall arose because of the methods used by councils for allocating expenditure. Annual expenditure had been based on the previous year's budget allocation, without consideration of buildings' life cycle performance, operational costs, risk of failure, and the impact of not meeting functional thresholds. The compounding effect of this underspend was identified by the Municipal Association of Victoria (MAV) as a risk to service delivery to the community. MAV were challenged by the lack of appropriate tools to correct this underspend and so partnered with Professor Sujeeva Setunge to first model building degradation, then develop and implement these models into cloud software called Council Asset Management System (CAMS). Using building inspection data, CAMS predicts life cycle costs and allows councils to plan and justify building expenditure. From 2015-2016, CAMS was deployed at the Cities of Melbourne, Brimbank, Port Philip, and Kingston, as well as at RMIT University.

CAMS supports faster, data-driven decision-making about asset management tailored to the needs of community organisations. Councils must routinely make decisions whether to 'keep' or 'sell' an asset, and how much to invest in it. According to an asset manager at the City of Melbourne, "CAMS has become the primary means by which to make these decisions." The data management and forecasting tools of CAMS allow councils to see where they are in real time. In 2015-16, Melbourne City Council analysed 200 buildings using CAMS, making decisions to demolish or refurbish two of those buildings, and allocating millions of dollars of operational and capital expenditure, on the basis of CAMS projections. According to the City of Melbourne, "CAMS analyses each and every component based on their condition to predict the future cost of operating a building. This gives us the confidence to decide on a keep or sell decision."

CAMS has enabled councils to target spending. The City of Brimbank has relied on detailed physical condition and structural assessment of over 280 building assets generated using CAMS. The information collected was used to inform over $1 million targeted major rehabilitation works each year, and formed the basis of complete reconstruction of a $35 million facility. Anthony Ziem, Team Leader Facilities Maintenance of Kingston Council, says "When we started off we had a lot of buildings that were in very very poor condition. We've been able to focus on the buildings that not only were in poor condition but were also at high risk because they were highly utilised."

At a macro scale, CAMS has provided greater insight into proper budget allocation and contributed to the closing of the infrastructure funding gap. At the City of Kingston, the implementation of CAMS enabled property managers to increase the maintenance budget allocated for community buildings by more than $500,000 in 2016 because the future risk profile could be more accurately quantified. Dr Ziem says "Using this system has given us clarity

and transparency of approach and the ability to quantitatively demonstrate where buildings are of poor quality." At Brimbank Council, Asset and Property Services Manager Dominic Di Martino says "We've now been able to unify data about public utilisation and maintenance, allowing us to consider all those variables and determine where the funding should go, taking into account both condition and utilisation. This gives us confidence that we're spending appropriately."

Mark Thompson, Coordinator, Asset Management, at the City of Port Phillip says "the componentization of CAMS has allowed us to depreciate our buildings, and fund our buildings properly, so we can give the desired level of community service." At Kingston Council, the utilisation of CAMS was a key contributor to achieving an increase in building user satisfaction from 60% to 90%.

In response to council requests, a CAMS mobile app was developed by RMIT and released in 2016 to enable field inspectors to directly enter data into the CAMS while on site. The mobile application has had immediate benefit to Kingston Council, where Dr Ziem reports that the cost of doing a round of building condition audits was immediately reduced by 30-40%. In addition "you've got the reliability that the data's accurate and it's available instantly". According to Darren Hughes, Asset Planner at the City of Port Phillip, "For the first time, CAMS allows us to begin the process of 10 year forecasting, enabling the council to create and cost long term asset renewal programs."

Existing building management software did not meet council needs. "CAMS is competing with well-established systems in the marketplace. Those well-established systems have a lot of limitations." says Mr Di Martino "Local government are just one of many clients trying to guide the development of those applications, and we have a small voice." CAMS has empowered councils to capitalise on their own expertise to become proactive about infrastructure and engage in innovation to solve pressing community problems. As a result, the asset funding gap has been reduced and service delivery to the community, including to those most at risk, has improved.

Associated research

(Briefly describe the research that led to the impact presented for the UoA. The research must meet the definition of research in Section 1.9 of the EI 2018 Submission Guidelines. The description should include details of:
- what was researched
- when the research occurred
- who conducted the research and what is the association with the institution)

From 2007 to 2012, Professor Sujeeva Setunge and her team at RMIT University developed stochastic predictive models for degradation of building components based on the Markov process. Sujeeva, along with Professors Kevin Zhang and Ron Wakefield, conceived and directed the research. Real world data based on asset inspections at Melbourne City Council were used by PhD candidate Hessam Mohseni to build the degradation models and calibration methodology. Markov chain transition matrices were derived using the Metropolis Hastings algorithm and Markov Chain Monte Carlo simulation as well as a direct absolute value difference technique. A decision making method was developed by PhD candidate Pushpitha Kalutara incorporating sustainability indicators derived through consultation with 107 local councils in Australia compiled using a fuzzy logic based approach. The probabilistic building component deterioration model and risk-cost optimisation method for building refurbishment were implemented in CAMS software from 2012 onward. Informed by a series of workshops with end users, CAMS has been designed to fulfil the needs of local councils, universities, and community organisations in managing their buildings. Kanishka Atapattu has managed CAMS development while undertaking a PhD researching and developing an efficient energy retrofitting module for CAMS.

FoR of associated research

(Up to three two-digit FoRs that best describe the associated research)

09 - Engineering
01 - Mathematical Sciences
12 - Built Environment and Design

References (up to 10 references, 350 characters per reference)

(This section should include a list of up to 10 of the most relevant research outputs associated with the impact)

Edirisinghe, R., Setunge, S., & Zhang, G. (2015). Markov model—based building deterioration prediction and ISO factor analysis for building management. Journal of Management in Engineering, 31(6), 04015009.

Edirisinghe, R., Setunge, S., & Zhang, G. (2013). Application of gamma process for building deterioration prediction. Journal of Performance of Constructed Facilities, 27(6), 763-773.

Atapattu, K., Setunge, S., & Zhang, G. (2014). An innovative software tool for enhanced building life cycle management and maintenance forecasting deployed via cloud. 7th International Conference on Information and Automation for Sustainability, Colombo.

Setunge, S., Zhu, W., Gravina, R., & Gamage, N. (2015). Fault-tree-based integrated approach of assessing the risk of failure of deteriorated reinforced-concrete bridges. Journal of Performance of Constructed Facilities, 30(3), 04015058.

Yousefikia, M., Moridpour, S., Setunge, S., & Mazloumi, E. (2014). Modeling degradation of tracks for maintenance planning on a tram line. J Traffic Logist Eng, 2(2).

Ziem, A., Setunge, S., & Zhang, G. (2015). Payback period based prioritization of building retrofit technologies: an innovative use of critical path method. In Proceedings of the 19th International Symposium on Advancement of Construction Management and Real Estate (pp. 357-368). Springer, Berlin, Heidelberg.

Mohseni, H., Setunge, S., Zhang, G. M., & Wakefield, R. (2013). Condition monitoring and condition aggregation for optimised decision making in management of buildings. In Applied Mechanics and Materials (Vol. 438, pp. 1719-1725). Trans Tech Publications.

Kalutara, P., Zhang, G., Setunge, S., Wakefield, R., & Mohseni, H. (2014). A proposed decision-making model to prioritize building elements maintenance actions toward achieving sustainability in community buildings in Australia. In Engineering Asset Management 2011 (pp. 139-151). Springer, London.

Hasan, M. S., Setunge, S., Law, D. W., & Koay, Y. C. (2015). Forecasting deterioration of bridge components from visual inspection data. International Journal of Engineering and Technology, 7(1), 40.

Mohseni, H., Setunge, S., Zhang, G., & Kalutara, P. (2014). Deterioration prediction of superstructure elements of community buildings in Australia using a probabilistic approach. In Engineering Asset Management 2011 (pp. 689-698). Springer, London.

Additional impact indicator information

Additional impact indicator information

(Provide information about any indicators not captured above that are relevant to the impact study, for example return on investment, jobs created, improvements in quality of life years (QALYs). Additional indicators should be quantitative in nature and include:
- name of indicator (100 characters)
- data for indicator (200 characters)
- brief description of indicator and how it is calculated (300 characters).)