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Modelling Built Asset Performance in 3D Space

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PhD Research Topic: Modelling Built Asset Performance in 3D Space



OVERVIEW

The conceptual framework promoted by Langston and Smith (2012) extended the existing literature to create a novel decision-making tool for the management of existing built facilities. Known as *iconCUR*, this model used primary criteria of condition, utilization and reward to map property status in 3D space at any point in time. The x and y coordinates identified the appropriate property management decision and the z coordinate indicated the strength of that decision. The appropriate intervention response was based on the relationship between the existing physical condition of the property and its current utilization level.

The innovation in this research is to attempt to model built asset performance in 3D space over time. Up until now, this has never been demonstrated. One key benefit of *iconCUR* is that it produces a single asset performance value that combines a large number of considerations across a diverse spectrum. This is the essence of multi-criteria decision analysis (MCDA). Given that this value is on a fixed scale (0-5), properties can be compared within a portfolio to determine relative priority. Furthermore, the score can be used to judge current performance against minimum service expectations over time. The 'asset performance' score can be used to produce the standard asset management profile so frequently referred to in the literature, yet do so with real data rather than just a theoretical concept.

These profiles to date have been conceptual and two-dimensional. This research will demonstrate how a trail of asset performance in 3D space can be presented by reconstructing performance data derived from archival information for one prominent existing built facility – the Melbourne GPO. Trends will be produced for each of the three key variables defining asset performance over a life cycle of some 170 years. The three variables will be combined and modelled via *iconCUR* to produce a three-dimensional version of asset performance that has the potential to better visualize not only its past, but its future.

From such a model, relationships between condition, utilization and reward can be explored. A key question is whether utilization and reward follow similar 'decay' curves to those understood to occur with physical condition, and if not, what the combined curve actually looks like. It is here that the significance of this research is apparent. The literature demonstrates little understanding of how the performance of existing built assets can be measured objectively, and therefore we find little understanding of how to make better decisions concerning their ongoing care and future upgrade to be more environmentally appropriate.

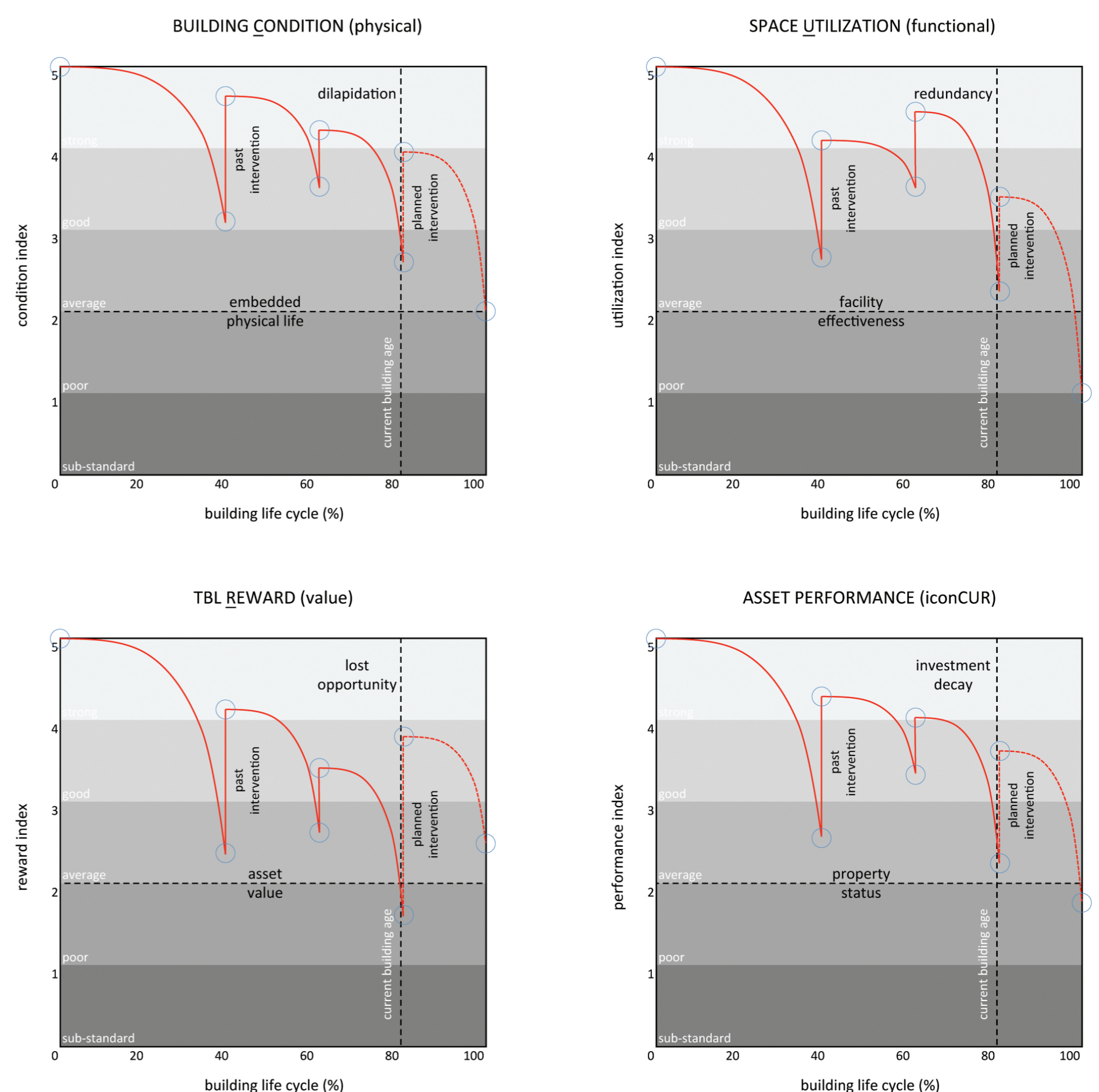
APPROACH AND METHOD

This study is part of an ARC Linkage Project (LP0990261) entitled 'Making better decisions about built assets: learning by doing'.

The advocated research approach is a retrospective case study of a well-known and beloved public building in the heart of Melbourne. Archival data collection will be used to compile a profile of the life of the Melbourne GPO from 1841 through to the present day. This activity is time consuming. Data are available from the State Library, Australia Post, and from consultants recently involved in the adaptive reuse of the building (2001-2003).

The following figure illustrates the relationships that will be explored in this research over the next 6-12 months. These give rise to the following research propositions:

- 1) Dilapidation, redundancy and lost opportunity (corollaries to condition, utilization and reward) can be measured using MCDA linked to standard assessment criteria.
- 2) Values for dilapidation, redundancy and lost opportunity are proportional and highly correlated, given:
 - a. dilapidation can lead to uninhabitable spaces (redundancy) and higher maintenance costs (lost opportunity).
 - b. redundancy can lead to lower earning potential (lost opportunity) and falling custodial interest (dilapidation).
 - c. lost opportunity can lead to less motivation to preserve (dilapidation) and less motivation to adapt (redundancy).
- 3) Asset performance can be mapped in 3D space to indicate what type of intervention is most appropriate at any point in time.



Dilapidation, redundancy and lost opportunity are shown as the areas above the curves for condition, utilization and reward respectively. Investment decay is the term used to describe the combined loss of performance.

Using the *iconCUR* model and the GPO retrospective case study, condition, utilization and reward will be measured and mapped over time. Asset performance is determined as the average of the other three variables. In addition to presenting it as a 2D chart, it can be mapped within the 3D *iconCUR* model so that the type of intervention (i.e. reconstruct/dispose, retain/extend, renovate/preserve, reuse/adapt) can also be identified.

KEY REFERENCE

Langston, C. and Smith, C. (2012), 'Modelling asset management decisions using *iconCUR*', *Automation in Construction*, 22, 604-613.