

Evaluating building sustainability from a systems approach

Research Question

The construction industry is globally a significant consumer of resources and producer of waste and GHG emissions.

Green building rating tools exist, however, the approach used is too often reductionist with criteria fragmented between environmental, social, economic attributes. The existing approach also often focuses on the building itself and not the building within its environment (besides climate).

This research proposes to take a systems approach to evaluate building sustainability from a more holistic perspective, using the complex systems theory.

As Clayton and Radcliffe (1996) suggest, sustainability issues are multi-dimensional and can only be addressed properly by a non-reductionist approach, an approach that highlights the trade-offs instead of ignoring them by simplifying the situation.

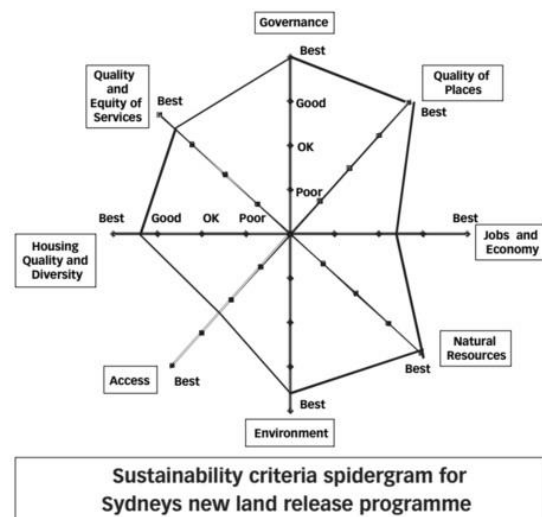


Figure 1: An example of an existing representation of sustainability assessment from a systems approach.

→ How can a systems approach enable a framework of guidelines to better assess or design and build sustainable buildings?

Methodology

The first part of the project consists in an extensive literature review to gather the existing representations of sustainability from a systems approach. This will involve defining the fundamental attributes underlying sustainability of the whole social-economic-ecological system at the building level. Two case studies will be used to define these attributes by comparing traditional construction to lightweight prefabrication of two typologies of residential buildings.

In turn, this approach will be used to represent the sustainability of the two previous case studies from a systems point of view. It will then be applied at the precinct scale, for the comparison of a sustainable innovative precinct with a business-as-usual scenario.

Finally, the principles and practical applications studied will help create a set of guidelines for decision-making at the design stage, which will be applied to Greater Curtin's future planning.



Figure 2: Artist representation of Greater Curtin.

Results

The research began recently and no hard results or conclusions are available yet. The

literature review is well underway and a set of existing representations, at the global and city scale, has already been identified. The literature review continues with a focus on existing representations at the building scale.

The two case studies comparing traditional construction to lightweight prefabrication are done using a reductionist approach and are now being used to define the attributes and a representation of sustainability using a systems approach. The sustainable innovative precinct has been identified as WGV in Fremantle (WA) and modelling and simulation are underway.

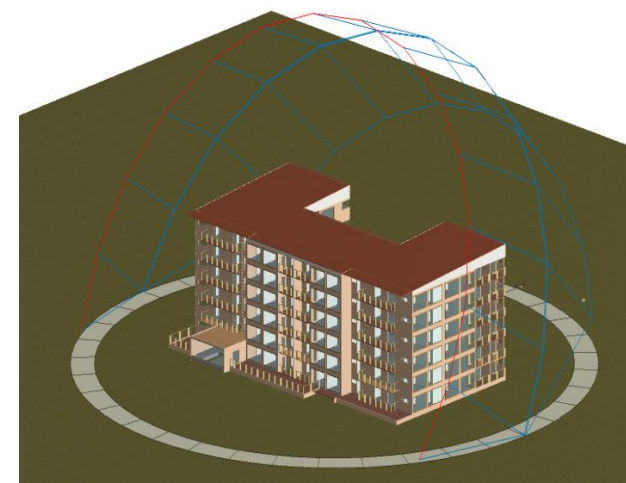


Figure 2: 3D model of case study multi-storey residential prefabricated building, for the evaluation of operating energy and later the carbon footprint.

Conclusions

As there is a rising concern about climate change and the sustainability of our built environment, the need to complement the existing green rating tools with a high level and more holistic approach is pressing. The objective of this research is to provide architects and developers a method to evaluate the sustainability of a project, and more importantly highlight the trade-offs,

right from inception. This approach will assist the decision-making process very early in the planning to ensure the project has the right genes and considers the neighbourhood, instead on focusing on the building and relying only on green rating tools later at the design stage.

Anticipated impacts

This research should provide a foundational framework for the construction industry to shift from designing low carbon buildings to creating low carbon living. It should also foster the introduction of innovative and even disruptive ideas and technologies since their value and trade-offs will be considered earlier in the project.

It is hoped this tool will reinforce the link between sustainable buildings, sustainable precincts and sustainable cities.

Key statement

Sustainability is complex and multi-dimensional and ticking boxes or adding "sustainable" solutions in a construction project doesn't ensure the resulting building will be sustainable. Green rating tools are necessary but they need to be complemented by a higher level tool using the systems approach.

Further information

<https://www.landcorp.com.au/innovation/wgv/>

<https://properties.curtin.edu.au/whoware/masteplan.cfm>

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