

Green Urbanism in Australia: An Evaluation of Green Building Rating Schemes

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Prepared for the 2015 State of Australian Cities (SOAC) Conference

Gold Coast, Queensland, Australia

Abstract:

Creating sustainable cities requires rethinking the built environment, a fundamental component of mitigating the environmental impacts of buildings. To evaluate this, stakeholders in Australia increasingly rely on third party verification via green building rating schemes. These rating schemes address and encourage a variety of green features which are incorporated into the design and construction of a building. They also set benchmarks and provide methodologies to enable the assessment of whether a green feature or reduction in negative environmental impact has been achieved. They are generally highly complex and require a professional level of knowledge to understand how a rating is achieved and what it means. This paper investigates the priorities of green building stakeholders and whether the available rating schemes in Australia address these. Green building stakeholders include building professionals including architects, engineers, builders and town planners; investors; building owners; tenants; the local community; and civil society affected by the impacts of development and construction. 102 green building stakeholders were surveyed to determine how stakeholders use the information provided by rating schemes to make decisions and what their priorities are in terms of green features, building performance and marketability. This information was then analysed and contrasted against the stated aims of the rating schemes and the green features that they promote. Findings indicate that green building rating schemes could be used more effectively if the priorities of all stakeholders were considered when selecting the rating scheme to be used and credits within a rating scheme to be targeted. It also appears that the residential sector is not being catered for adequately by the available rating schemes which could impact green urbanism outcomes. It is argued that a more comprehensive understanding of rating schemes by all green building stakeholders could result in better coordinated environmental outcomes across the built environment.

Abbreviated Title: "Green Buildings in Australia"

Keywords: Green Buildings; Sustainability; Real Estate; Green Urbanism; Built Environment; Ecologically Sustainable Design (ESD)

Introduction

Buildings have a significant impact on the environment. Globally, the building sector uses 40% of primary energy and a considerable amount of overall water requirements (Ghaffarianhoseini et al., 2013). As the service life of both new and renovated buildings reaches far into the future, buildings considerably influence envisioned energy and water needs for the next 50 to 80 years (Bauer et al., 2007). In Australia, buildings account for 130 million tonnes (Mt) of greenhouse gas emissions each year which represents 23% of Australia's total emissions (The Centre for Investor Education, 2005). They also contribute to waterway pollution (Vijayaraghavan & Raja, 2014); influence local microclimates (Ng et al., 2012); damage biodiversity (Kattwinkel et al. 2011; Sadler et al., 2005); and consume a vast amount of raw materials during construction (Venkatarama Reddy & Jagadish, 2003).

The movement toward 'green' buildings has been a response to the now widespread recognition that enhanced built environments lead to positive ecological and social outcomes (Conte & Monno, 2012; Heerwagen, 2000). In Australia, green buildings are defined, designed, evaluated and marketed using green rating schemes which provide sustainability guidelines, benchmarks and calculation methodologies for building attributes and performance (Green Building Council of Australia, 2015; United States Green Building Council, 2015; Australian Government Department of Industry and Science, 2015; NSW Office of Environment and Heritage, 2015). Most ratings are voluntary and it is this third party verification of sustainability in the built environment that green building stakeholders are dependent upon to ensure that a building is indeed green (Cole, 2005). Although the emphasis is usually on energy efficiency, rating schemes may also evaluate issues such as conservation of natural resources; reduced embodied energy; building site; re-used, recycled and recyclable materials; improved occupant thermal comfort and wellbeing standards; and alternative energy resources (Kim et al., 2013).

This aim of this paper is to investigate the relationship between the priorities of green building stakeholders and the stated aims of the rating schemes and the green features that they promote. After a brief introduction to green urbanism, the research methodology is discussed and the results are presented. A discussion follows in which a critical evaluation of various rating schemes is undertaken, with particular regard to how better stakeholder engagement might be encouraged through frameworks that reflect the objectives of those who finance, design, build, and ultimately use green buildings. Through a directed focus on green buildings in the Australian context, a contribution is made toward wider debates on sustainability in cities and to ensuring more sustainable urban futures worldwide.

Green Urbanism: An Overview

Green building rating schemes are one component of a much broader agenda that aims to enhance the overall sustainability of built environments and achieve significant reductions in consumption and its deleterious consequences (Ding, 2008). Aside from the building-specific impacts on energy, water, and ecological amenity, uncoordinated growth has led to urban sprawl. This has in turn been shown to yield negative environmental and social outcomes (Glaeser, 2011).

Though the concept of green urbanism and buildings has recently been deployed through a variety of discursive and policy-related ideals, the underlying principles of building human environments more sustainably has undergone numerous iterations throughout history (Basiago, 1996). In the realm of town planning, the 'city beautiful' and 'garden city' movements of the early 20th century, as well as more recent movements toward compact planning have informed the 'new urbanism' and 'smart growth' ideals (Grant, 2009), which have been implemented with varying degrees of success.

Given the sweeping sentiment that the built environment wields considerable influence on both the natural environment and the individuals that live and work within it, the impacts of individual buildings are increasingly considered in complement to neighbourhood and metropolitan-scale sustainability initiatives. Enhanced environmental consciousness is certainly one component of this, but financial

considerations have been fundamental drivers as well, particularly in Australia where real household energy prices have risen 73% for electricity and 54% for gas in the decade to 2013 (Swoboda, 2013). Over the last two decades, this has resulted in an increase in green building investment (Newell et al., 2014; Roth & Hudgins, 2015).

Evaluating the 'green-ness' of buildings is inherently complicated due to the various factors that contribute to environmental damage (Soos, 2015). For example, green rating schemes must consider water, energy and material consumption; impacts on ecosystems; and impacts on infrastructure, among many others. Many rating schemes also include features that support human well-being such as indoor environmental quality as a feature of sustainability. Justifiable and transparent calculation of environmental impact is imperative to prevent greenwash from occurring (Chen & Chang, 2012). Greenwash exists where organisations exaggerate their environmental performance or manipulate the representation of information to generate a sustainable image (Oxford Dictionaries, 2014). Therefore, green rating schemes are used by stakeholders to reliably identify, address and evaluate whether a building can be considered to have a reduced environmental impact.

The rating schemes analysed for this research project were Green Star, Leadership in Energy and Environmental Design (LEED), the Living Building Challenge, National Australian Built Environment Rating Scheme (NABERS), Nationwide House Energy Rating Scheme (NatHERS), and Urban Development Institute of Australia (UDIA) Envirodevelopment Tool.

Generally, ratings can be grouped into three different types – design ratings, as-built ratings and performance ratings (Bond, 2011). Design ratings look at the features of the design and rely on design report, drawings and contracts to determine the level of environmental impact of the development. In contrast, as-built ratings ensure that buildings are built in accordance with the design, which is usually design rated, and rely on assessment of construction documentation such as receipts, records of the quantities and types of materials used on site and assessment of the construction process. Performance ratings use at least one year of operational data such as energy and water bills to assess how the building is actually performing.

NABERS strictly offers performance ratings (NSW Office of Environment and Heritage, 2015). In contrast, LEED and Green Star offer all three rating types and the building owner, design team or developer decides which ratings to pursue (United States Green Building Council, 2015; Green Building Council of Australia, 2015). The Living Building Challenge mandates aspects of all three types within the one tool. UDIA Envirodevelopment and NatHERS are design ratings only (Urban Development Institute of Australia, 2011; Australian Government Department of Industry and Science, 2015).

Data and Methodology

This aim of this paper is to investigate the relationship between the priorities of green building stakeholders and the stated aims of the rating schemes and the green features that they promote. Green building stakeholders were identified as those with an interest in either the development, use or effects of green buildings including building professionals such as architects, engineers, builders and town planners; investors; building owners; tenants; the local community; and civil society affected by the development and construction.

A survey was conducted using SurveyMonkey. The 'Perspectives on Green Buildings' survey was opened in March 2015 for a period of two weeks. During this time, 102 responses were collected. The survey asked questions relating to prevalent green rating systems in use in Australia. Prevalence was described as more than five buildings being certified or registered for certification as of January 2015.

The survey aimed to measure stakeholders' levels of understanding as well as provide opportunity for open responses on stakeholders' views and opinions on prevalent green rating schemes in Australia. The survey initially asked for information on the type of stakeholder with which the respondent identified

and their environmental priorities. An identical set of questions was then provided for each rating scheme. These questions aimed to establish the respondent's understanding of the scheme, their level of satisfaction with the scheme and whether they believed that it was effective in reducing environmental impacts.

No identifying information was collected from the respondents and the survey was approved by the University of Queensland local ethics committee. The survey consisted of a total of 57 possible questions over 19 pages. Most participants did not complete the full complement of questions as a 'skip logic' was applied to ensure that participants only answered questions based on green building ratings with which they were familiar. The questions included multiple choice questions and the use of ordinal and Likert scales. It also allowed respondents to provide open responses to express their views on environmental issues and green building rating schemes.

The survey was distributed using a targeted sample with a snow-balling effect. The snow-balling effect was created by encouraging survey respondents to share the survey link via social media, in particular the website LinkedIn, and by email. The targeted sample was established by listing the companies involved in all green rating schemes over the last year whenever this information was publicly available for use. Furthermore, local and state governments and green building rating scheme governing bodies such as the Green Building Council of Australia, the Australian Living Building Institute and the NSW Office of Environment and Heritage were contacted.

The LinkedIn survey audience was targeted by posting the survey on group LinkedIn pages including the Australian Institute of Architects, Engineers Australia, The Australian Institute of Refrigeration, Air Conditioning and Heating (AIRAH), the Facilities Managers Association and the University of Queensland School of Geography, Planning and Environmental Management.

Survey data were analysed by collating comments and identifying common themes in the open responses collected. Trends in the level of understanding of each rating scheme were then identified and the differences between the results of the rating schemes were analysed. The priorities as identified by the green building stakeholders were then considered against the credits and issues addressed by each rating scheme.

Evaluating Environmentally Oriented Building Rating Schemes

Stakeholder Types

The majority of stakeholders were building design professionals such as engineers and architects, however, the second biggest group, at 14%, were respondents who identified as interested community members. The next largest group were building owners at 11%. The remaining respondents consisted of facilities managers, government employees, builders and building services contractors, town planners, green product suppliers and green rating scheme authorities.

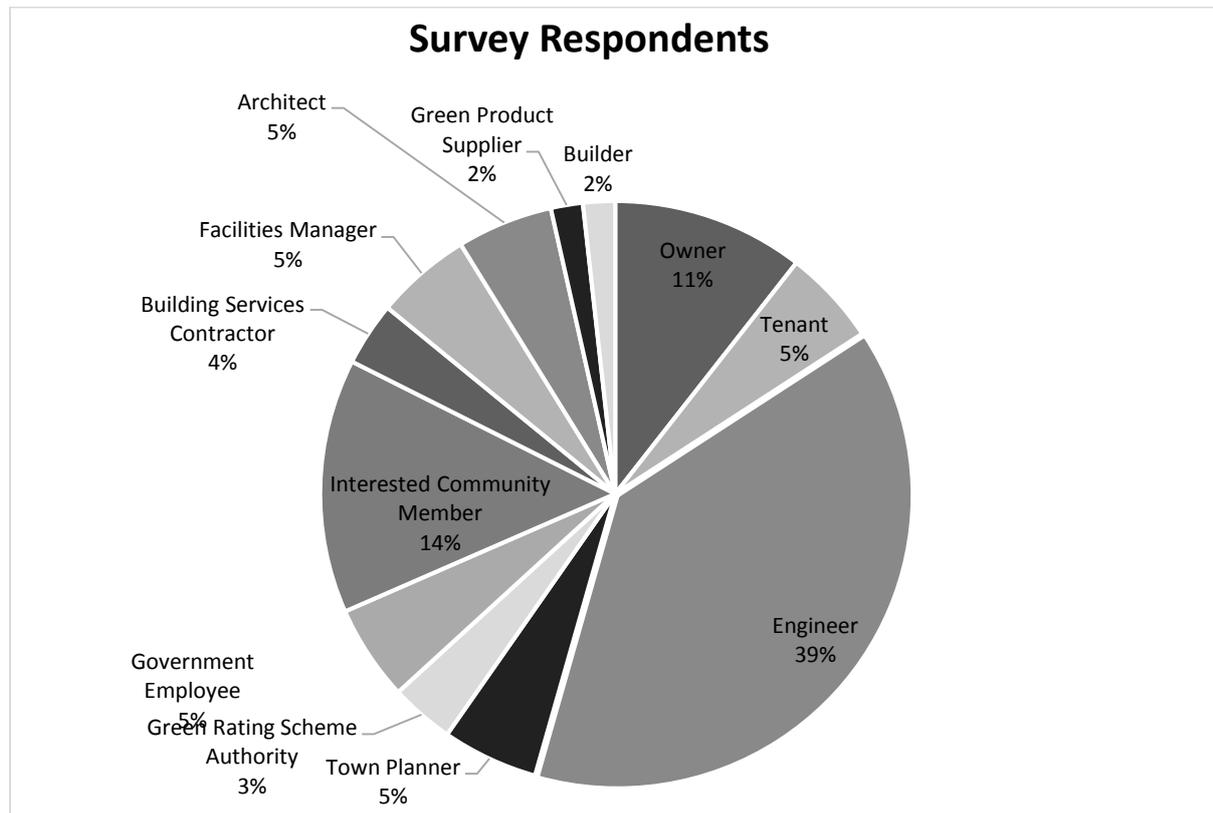


Figure 1 Survey Respondents' Stakeholder Identities

Stakeholder Priorities

Stakeholders demonstrated a variety of motivations and priorities toward green buildings. This was reflected in the range of responses when survey respondents were asked about their environmental priorities. There were some issues, however, that were on average more highly prioritised than others. The following table provides the green features in rank order of priority as rated by survey respondents. These features were identified by extracting green features promoted in the rating schemes analysed.

Figure 2 Survey Results - Ranking of Stakeholder Priorities

Ranking	Green Feature
1	Energy efficient building services design
2	Optimal building orientation
3	Optimised building fabric (e.g. insulation and double glazing)
4	Ecologically sound building location (i.e. not built on top of an area of ecological importance)
5	High levels of fresh air supply for occupant amenity
6	Lower embodied energy through material selection and dematerialisation
7	Effective waste management during demolition and construction
8	Water efficient fittings and fixtures
9	Effective stormwater management
10	Use of recycled and recyclable building and fit out materials
11	Close proximity to facilities such as shopping centre and public transport
12	Rainwater capture
13	Low or no volatile organic compounds in chemicals used for fit out
14	Bicycle facilities
15	Support of local biodiversity
16	Green building rating achieved (e.g. the number of stars achieved)
17	Architectural merit
18	Sophisticated building management system and controls
19	Educational opportunities for occupants and visitors
20	Use of modern showcase or cutting edge green building technology
21	Type of green building rating system used
22	Crime Prevention Through Design (CPTD)

Generally energy efficiency rates highest as a priority for green buildings. The first three priorities as ranked by stakeholders all relate to improving building operating energy efficiency. The comments surrounding the issue of energy efficiency also indicate that stakeholders are aware of issues surrounding whole-of-life energy efficiency and use of alternative energy sources. For example, one stakeholder commented, *"Current rating systems focus too much on reducing operational energy and not enough on embodied energy."* Energy efficiency was highlighted as a concern across all stakeholder types which may be due to the combination of economic and environmental benefits of saving energy.

The priority of having the building located in an ecologically sound location ranked as the fourth most important priority. The comments collected that relate to this green feature suggest that stakeholders are concerned with conserving areas of high ecological value. Stakeholders appear to believe that this issue is best addressed by the careful selection of building location, drawing a distinction between places for nature and places for people. For example comments were made such as, *"it is very difficult to estimate the long term damage to an ecosystem in sensitive areas and justifying building there considering the intrinsic and extrinsic value of the development would be equally hard,"* and *"it hardly matters what your building is like if it's in the wrong place."* The green feature of supporting local biodiversity was considered of relatively low importance ranked at position 15 of 22. Looking at this in combination with the stakeholders' level of concern for an ecologically sound building location also supports that stakeholders consider that places of high ecological value should be separate from places for people such as cities. This was again supported by concerns over urban sprawl.

The issue of urban sprawl was raised multiple times. Urban sprawl results in pressure on infrastructure and the spread of urbanisation into areas that could otherwise be left for conservation or outdoor recreation (Sushinsky et al., 2013). Rating schemes have typically dealt primarily with individual

buildings with only minor consideration of issues relating to urban sprawl. The idea of urban sprawl is beginning to be addressed by some credits in Green Star and LEED which encourage the reuse of land and the location of buildings in close proximity to transport and amenities, however without input from town planners, local governments and environmental managers it is very difficult to address these issues. Consideration of broader impacts of building development requires consideration from a holistic and systems thinking perspective.

Many of the green building ratings schemes analysed in this investigation can potentially address the main priorities of stakeholders as described above. However as stakeholders are not a homogenous group, the issues specific to the development and stakeholders need to be considered. Furthermore, the priorities of stakeholders may only be able to be addressed by certain rating schemes and also by certain elements within rating schemes. Many rating schemes allow for flexibility in what initiatives are pursued so although a rating scheme may encourage certain initiatives, it does not necessarily mean that the project team will target these. For example, Green Star may include features that encourage use of public transport but it also includes features such as indoor environmental quality. The project team can select which features to pursue and which not to pursue, as long as they target enough points overall to achieve the desired rating.

Stakeholder Views on Rating Schemes

Stakeholders generally believe that green rated buildings result in a reduction in negative environmental impacts when compared to a non-rated development. The Living Building Challenge was perceived by respondents to result in a better environmental performance than all other rating schemes and was also described positively in the commentary. This is likely to be because of the very high standards that the Living Building Challenge requires for a rating to be achieved. The Living Building Challenge requires a high level of commitment and capital cost to implement and can only be awarded after one year of building operation to ensure that the building is operating as per the design. These factors also contribute to the scheme relatively low implementation rate, of all the rating schemes analysed in this study, the Living Building Challenge has the lowest implementation).

In contrast, NatHERS was rated as having the least significant impact (only slightly better than neutral) and was also perceived to be unreliable in the open responses of the survey. For example, stakeholders claimed it was, *“inconsistently applied, gamed constantly, sad situation,”* and that, *“we could do so much better.”* Despite this, due to legislated requirements for its use, NatHERS has the highest implementation rate of all the rating schemes. This indicates that it could be the wrong rating scheme to be mandated for use by federal government via the Building Code of Australia (BCA) and state government via state based development codes or that it needs to be administrated more stringently to improve its integrity.

The importance of rating scheme integrity was a recurring theme. Rating schemes must be considered reliable, verifiable and accurate to be marketable. NatHERS was heavily criticised due to the lack of regulation of the scheme. Stakeholders are aware of the risk of greenwash and want to be confident that their rating schemes are reliable in their results and that they are verifiable and honest. Furthermore, it appears that integrity is key in the perception of impact. NatHERS is not well regulated as it relies on self-assessment using a software that stakeholders generally believe can be manipulated to yield the required result. In contrast, all other schemes are much more regulated with governing bodies that verify and audit building design and performance to ensure that the rating is justifiable. Overall, schemes that rely on measured building performance were deemed to have a greater reduction in negative impact. These schemes are NABERS and the Living Building Challenge which both require a minimum of one year of operational results before a rating is provided. Green Star and LEED have recently released performance tools to address this issue, however, as these are relatively new it is unlikely that stakeholders were reflecting on this variation of the available tools in the survey.

Stakeholders considered the Living Building Challenge and NABERS ratings as being of higher importance than all other ratings. Again, the shared quality between these two rating schemes is that they rely upon measured performance after construction. In all other ways they are vastly different rating schemes. Given that the intent of any rating scheme is to drive certain stakeholder behaviours, performance ratings are likely to be highly valued due to their ongoing influence after the construction of the building. Performance ratings evaluate how a building is performing year to year so the behaviour of the occupants, owners and facilities managers has an ongoing impact on the rating achieved. For example, the rating may encourage building occupants to switch off lights and computers when not in use; the owner to spend money to maintain and upgrade the building equipment as required; and the facilities manager to ensure that the building is operated correctly.

Toward a More Sustainable Model of Rating Buildings in an Environmental Context

The following table summarises the rating schemes and the stakeholder perspectives on each rating scheme analysed in this study. A table such as this could be by governments to consider whether the rating scheme selected for a development in a development application is the most appropriate for use.

Figure 3 Perceived benefits and best application of selected green building rating schemes in Australia^{1, 2}

Rating Scheme	Stakeholder Perceived Benefits	Best Applications
<p>Green Star</p> 	Excellent marketability. Meeting a wide variety of design goals, however, credits need to be selected carefully.	All non-residential buildings (except mixed used high rise multi-unit residential projects). Good for projects requiring high level of marketability.
<p>Leadership in Energy and Environmental Design (LEED)</p> 	Similar to Green Star but based in the United States. Covers broad spectrum of issues.	As for Green Star but covers a slightly wider variety of issues.
<p>Living Building Challenge</p> 	Results in high level of sustainability and positive health and well-being outcomes.	High budget, premium projects.
<p>National Australian Built Environment Rating Scheme (NABERS)</p> 	Measurable and meaningful results which can inform decision making for the building operation.	All non-residential buildings with appropriate metering.
<p>Nationwide House Energy Rating Scheme (NatHERS)</p> 	Not well regulated, use an accredited reliable assessor for best results.	Residential buildings which are focused on operational energy efficiency only.
<p>Urban Development Institute of Australia Envirodevelopment</p> 	Comprehensive and reliable.	Could potentially be rolled out across more residential projects as there is the ability to target only specific components of the scheme if desired.

¹ Image and Information sources for Figure 2 **Error! Reference source not found.** (Green Building Council of Australia, 2015; United States Green Building Council, 2015; Living Future Institute Australia, 2015; Australian Government Department of Industry and Science, 2015; NSW Office of Environment and Heritage, 2015; Urban Development Institute of Australia, 2011).

² Logos are copyright of the respective organisation.

This investigation found that selection of the most appropriate rating scheme and the implementation of that rating scheme is critical if stakeholder priorities are to be addressed. Furthermore, it was found that not all stakeholders have the same priorities, therefore, it is important that all stakeholders are considered in the decision making process around what rating scheme to use and which features of that rating scheme to target.

This investigation also found that the rating schemes used for commercial and institutional are better equipped to address stakeholder priorities than NatHERS which is the rating scheme mandated for use for residential buildings.

Residential development is being left behind in terms of sustainability, when compared to the commercial sector. The Australian Building Codes Board must reconsider the mandate of NatHERS as the appropriate rating scheme to address sustainability issues for residential buildings as it is inadequate. The BCA should be used as the mechanism through which the government can mandate environmental provisions that address all stakeholder priorities. The UDIA Envirodevelopment scheme is a holistic and transparent rating scheme that addresses the priorities of all green building stakeholders. The use of the UDIA Envirodevelopment scheme would result in far more sustainable residential communities for Australians. NatHERS was not well-regarded by stakeholders as it is unregulated, unreliable and does not address enough environmental priorities.

The potential for the use of green building rating schemes to address broader green urbanism issues was also uncovered in this investigation. Rating schemes could provide a mechanism for better collaboration between developers, building professionals, town planners and environmental managers to bring about better functioning, sustainable communities. This is particularly pertinent in Australia as our cities grow rapidly and urbanisation expands into Greenfield areas, causing urban sprawl. Consequently, there is a role for government to play in determining the type of rating scheme or combination of schemes used in a development to ensure that major environmental issues are addressed and that all stakeholders are considered. This may also include consideration of the targeted credits and how ratings are to be achieved at the development application phase of the project.

Green building rating schemes may also be able to be used to reduce urban sprawl by influencing stakeholder behaviours. For example, green building rating schemes such as Green Star reward buildings that are in close proximity to public transport and offer bicycle facilities. If occupants are encouraged to use these facilities, then living closer to these buildings may become more desirable. Local governments could consider mandating certain aspects of green building rating schemes for different building locations. For example, this could mean that a project team would have to target certain credits or points under the scheme such as the transport oriented credits.

Conclusion

The pursuit of urban sustainability requires multiple holistic approaches that target human behaviours, the built environment, and the hard and soft infrastructures that comprise contemporary cities. Green buildings are one component of this broader agenda, and the past two decades have seen great strides toward achieving more desirable ecological and social outcomes through better design. This translates to enhanced outcomes for a variety of stakeholders, with energy-related costs at the forefront of the matter. Ancillary benefits, ranging from conservation to better public security, are also relevant and green buildings ratings schemes provide means by which stakeholders can access metrics tied to each.

This study has revealed that the priorities of stakeholders are often misaligned with the frameworks provided by green building rating schemes. Energy-related and other engineering-related concerns consistently outranked more aesthetically oriented features such as architecture or the showcasing of new technologies. This suggests high potential for 'greenwash' in newly built green buildings as less-relevant categories may add to the points-based certification that falls short of desired objectives. Furthermore, it was found that some rating schemes are found to be more useful than others, with UDIA

Envirodevelopment, NABERS, Green Star, and the Living Building Challenge most appropriate in the Australian context. The abundance of good systems as well as the existence of less-useful ones suggests that there is an informational discord, and perhaps over time clear leaders will emerge that are more transparent and comprehensive in scope. Thus, while the status quo of green building rating schemes is found to be adequate, further enhancements are needed to ensure that those with non-expert knowledge are able to access and benefit from these schemes. As cities move toward more sustainable alternatives to shaping the built environment, developing 'green' frameworks that are accessible and clear is important to ensure positive future outcomes.

Opportunities for Further Research

Several avenues for further research emerge from this work. With adaptive reuse and urban regeneration as key themes in creating sustainable urban systems, future studies might focus on green features specific to retrofits, upgrades and repurposing of buildings. As cost has been suggested as one potential encumbrance to more widespread implementation, further research should also consider the degree to which finance constrains implementation. This is particularly relevant in residential buildings as the cost is borne by the property owner/buyer.

Future research might also look to evaluate the specific governance processes linked to green building implementation. A significant body of literature now concentrates on the role of urban governance facilitating sustainable outcomes, and this differs from context to context. A broader focus incorporating more survey responses from a wider geographical range (the majority of responses also appear to be from Queensland and New South) would provide a more holistic perspective. Also a wider diversity of respondents might better engage government and civil society (as engineers were overrepresented), whose priorities may not align with the private sector.

Urban sustainability requires new ideas and innovation upon existing ones. The 'greening' of buildings is a significant step toward more sustainable urban systems, providing a range of benefits from reduced energy consumption to waste reduction to the promotion of active transport. With public awareness of such issues increasing and industry practice constantly improving, green buildings are likely to play a vital part in shaping the future of cities.

Acknowledgements

The authors would like to acknowledge the respondents to survey. Any errors or omissions remain the authors'.

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