Critical Factors of Promoting Market Demand of Sustainable Housing in Australia

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Abstract: Strong regulatory pressure on environmental issues and the improved public awareness will continue to influence the market demand for sustainable housing in the coming years. Despite this potential, the voluntary up-take rate of sustainable practices is not as high as expected within the new built housing industry. This is in contrast to the influx of emerging building technologies, new materials and innovative designs as seen in office buildings and exemplar homes built worldwide. One possible reason for this is that key stakeholders such as developers, builders and consumers do not fully understand and appreciate the tangible and mutual benefits of sustainability in their professional and business activities. This situation warrants the study of a multifaceted strategy that integrates the needs of multiple stakeholders.

This research investigates multiple factors that affect key stakeholder's benefits in sustainable housing implementation. Drawing insights from a quantitative study on a questionnaire survey and a qualitative study of in-depth interviews with key stakeholders in the Australian housing industry, 11 critical factors of driving market demand for sustainable housing were unearthed. Their inter-relationships were identified with the aid of Interpretive Structural Modelling. The study concludes with a hierarchical model that amalgamates the strategies for the decision making of key stakeholders.

Keywords: sustainability; housing; stakeholder; benefits; market demand.

1 Introduction

Sustainable housing is a significant environmental challenge and requires concerted global response. The housing sector alone accounts for approximately 25% of carbon emissions (Commonwealth of Australia, 2009), demanding the market uptake of sustainable housing to protect ecological processes and safeguard the welfare of future generations. To this end, a large number of sustainable practices have been applied and driven into maturity, such as passive heating and cooling design, insulation, water conservation and solar panels (Yang & Alder, 2005). Well-designed sustainable housing with such innovative features potentially provides not only high ecological performance, but also the affordability and social advantages. Despite its technical viability, the voluntary uptake of sustainable housing is still in its infancy in Australia and only driven by pioneering motives because major stakeholders are reluctant to change current industry structures and general behaviour that could potentially places their respective demands at risk (Yang, 2005). This research aims to promote the implementation of sustainable housing through recognizing and promoting the mutual benefits among key stakeholders to facilitate integrated decision making processes. Questionnaires and semi-structured interviews across seven groups of key stakeholders were conducted to identify the critical factors that drive the market demand (CFDMDs) of sustainable housing. Interpretive Structural Modelling further extracted the hierarchical significance of CFDMDs to facilitate stakeholder decision-making recommended.

2 Sustainable Housing Development in Australia

2.1 Defining Sustainable Housing

The early conception of sustainable housing was formed in the 1970s, when oil

shortages stimulated interest in solar energy homes. Sustainable housing development took off in early 1990s after 'The Brundtland Report', broadening its focus to include environmental impacts and health and social benefits (Deneen & Howard, 2007). Recent thinking on sustainability tend to add the institutional or governance dimension to the existing triple bottom line, in order to facilitate implementation (Birkeland, 2008). Sustainability in the new century also starts to highlight a positive concept that allows people to improve life quality and advance ecosystem health rather than alleviate the negative impacts from industrial growth. For example, Birkeland (2008) defined sustainable housing as 'Designed and built to minimize its impact on the environment and can respond to people's changing lifestyles and circumstances'. Considering the particular objectives and context of this research, sustainable housing in this research is defined as residential buildings that are designed and constructed using practical, affordable and durable environmental solutions (Housing Industry Association, 1999).

2.2 Current Trend of Sustainable Housing Implementation

The stimulus for sustainable housing development in Australia to date is still more regulatory than market-driven. Nationwide, a mandatory House Energy Rating Scheme (NatHERS) prescribed in Building Code of Australia (BCA) was employed in 2003 to address primarily energy efficiency performance for new housing stock (Commonwealth of Australia, 2010). Many new dwellings have been built claiming for NatHERS five stars or above standard. However, no specific number was officially realised by federal or state authorities. On the other hand, voluntary up-take of sustainable housing on both supply and demand side is still waiting to bloom. *Green Star-Multi Unit* Residential and EnviroDevelopment were developed to encourage best practices and promote market uptake. Nevertheless, only a modest 17 and 33 projects across Australia have been certified under each scheme (Green Building Council Australia, 2011; Urban Development Institute of Australia, 2011). Gane & Hefferan (2007) argued that unless professionals, businesses and the wider community can understand and relate to increased benefits without significant risks, sustainable housing and related innovation would not lead people out of their comfort zone of traditional housing practices.

2.3 Key Issues for the Implementation of Sustainable Housing

In establishing a theoretical knowledge base to guide through the data collection and analysis, the upfront review was conducted to understand what are the key issues that affect stakeholder benefits and in turn influence their decision-making towards sustainable housing practices. 19 issues were identified from existing literature as the initial key issues for further evaluation (Adeyeye, Osmani, & Brown, 2007; Lorenz, Truck, & Lutzkendorf, 2007; Lowe & Oreszczyn, 2008; Lutzkendorf & Lorenz, 2007; McGraw-Hill Construction & US Green Building Council, 2006 van Bueren, 2007; Vandevyvere & Neuckermans, 2005; Wilkinson & Reed, 2007). This issue list was validated through a pilot study and shown in Table 1 together with their ranks in the following result section.

3 Research Methodology

This research aims to promote the uptake and implementation of sustainable housing in Australia, by identifying the critical factors that drive market demand of sustainable housing and their interrelationships. A quantitative research was firstly conducted via an on online questionnaire to collect and compare individual-level views about the 19 key issues based on the analytical protocol. Such surveys could allow various stakeholders

to be involved in discovering the "real" needs and demands (Saunders et al., 2009). 50 valid responses out of 163 attempted deliveries were received with a response rate of 30.7%, conforming to the acceptable respondent rate of approximately 30% for a survey focusing on gaining responses from construction industry practitioners (Akintoye, 2000). Findings of the questionnaire were augmented through 20 semi-structured interviews by further exploring the current status, mutual influences and potential solutions of the 19 key issues of sustainable housing implementation. The end-product of the interview is the critical factors that drive the market demand (CFDMDs). It is noteworthy that all the questionnaire respondents and interviewees well spread over 7 key stakeholders groups for their decisive roles in housing development, including government body, developer, architect/designer, builder, other consultants, financial institution and end users. These informants come from four states of Australia, among which a majority (60.4% and 85%) hold a manager or director position. In the third and final step of this research, Interpretive Structural Modelling (ISM) was used to investigate the hierarchical significance of the CFDMDs based on their contextual relationship. Understanding of the hierarchical significance of the CFDMDs will in turn optimize the relevant strategies, and provides a hierarchical model to facilitate stakeholder decision making on their mutual benefits.

4 Results and Discussion

4.1 Significance of Issues that Drive the Market Demand of Sustainable Housing

The level of significance of the 19 key issues was identified based on the questionnaire and interview findings as shown in Table. 1. The mean values of the 19 key issues ranging from 3.35 to 4.12, which indicates a discrepancy in significance among various key issues. Modest values of standard deviation (0.73 to 1.21) suggested an insignificant diversity in respondent's rating.

Table. 1 Ranking of the 19 Issues of Sustainable Housing Implementation

	Key issues	Mean	Std. Dev.	Rank
	Economic factors	**4.08**		
E2.	High investment cost	4.12	0.86	1
E1.	Unclear benefits from future legislation, policy and market change (e.g. increasing energy price and carbon tax)	4.08	0.93	2
E3.	Inadequate or inefficient fiscal or other investment incentives (e.g. green land-use price and access possibility, green mortgages and funding, or other government subsidies)	4.06	0.82	3=
	Institutional Factors	**3.84**		
I5.	Lack of comprehensive code or policy package to guide action regarding sustainability	4.06	0.83	3=
I3.	Inadequate policing of green-washing and unsustainable practices	4.02	0.85	5=
I4.	Slow and unwieldy administrative processes in certificating and policy making	3.84	1.01	8=
I1.	Lack of collaborative integration (e.g. clear leadership and roles among stakeholders)	3.82	0.73	10=
I6.	Duplication and confusion arising from parallel policies/legislation	3.78	0.96	12
I2.	Lack of inter-stakeholder communication networks (e.g. a central knowledge hub)	3.55	0.87	16
	Technical and design Factors	**3.74**		
T4.	Lack of integrated design and life-cycle management	4.02	0.95	5=
T5.	Insufficient interdisciplinary research to demonstrate the cost-benefit data	3.90	0.98	7
T2.	Lack of professional education and training programs	3.82	1.17	10=
T3.	Lack of methodologies and tools to consistently define and measure sustainability	3.61	0.95	13
T1.	Inadequate or untested sustainable technologies or materials	3.35	1.11	19
	Socio-cultural Factors	**3.58**		
S1.	Reluctance of leaving the comfort zone and changing traditional practices	3.84	0.99	8=
S4.	Insufficient media promotion of scientific advantages from sustainable housing	3.59	1.19	14
S3.	Lack of social conscience in climate change and natural resource preservation	3.57	1.21	15
S5.	Contested functionality for end users (e.g. health, comfort, maintenance ease)	3.53	1.14	17
S2.	Insufficient reputation increase, brand recognition and competitive advantage	3.37	0.95	18

Stakeholders believed economic challenges affect their benefits the most (mean value=4.08) among the four micro categories of key issues. "High investment cost" (E2) (mean value = 4.12) is the most significant issue identified among all. Similar results were

obtained in the interview, as one consultant stated, “If housing is to be sustainable it’s got to be affordable.” “Unclear benefits from future legislation, policy and market change” (E1) and “Inadequate or inefficient fiscal or other investment incentives” (E3) also received high levels of importance (4.08 and 4.06), which revealed that the housing industry in Australia currently values economic return over all other forms of softer or hard-to-quantify benefits.

An overall second rank (mean value=3.84) of institutional challenges confirmed that it is imperative that the current industry pursues better policy-making and intensive collaborative structure. “Lack of comprehensive code or policy package to guide action regarding sustainability” (I5) (mean value = 4.06) was ranked the third most significant with a small standard deviation (0.83), which signified a collective need for a consistent mechanism to systemise available instruments for sustainability, rather than a one-sided energy efficiency mandate. Next down the list in this category is “Inadequate policing of green-washing and unsustainable practices” (I3) (mean value = 4.02). It is interesting to find that “Lack of inter-stakeholder communication networks” (I2) was only ranked 16th. This probably indicated that communicating information and knowledge would remain secondary for stakeholders before beneficial information and knowledge are well established. In fact, interviewees generally believe that stakeholders will take the initiative to look for communications once they realise it could enhance the opportunities to expand their business or make extra profits.

The questionnaire revealed that sustainable technologies and design are economically viable and do not jeopardise stakeholder benefit largely. Highlighted issues include “Lack of integrated design and life-cycle management” (T4) (mean value=4.02, ranked 5th) and “Insufficient research to demonstrate the cost-benefit data” (T5) (mean value=3.90, ranked 7th), both oriented to the life-cycle thinking of the industry. Particularly, all interviewees reinforced the significance of establishing a longitudinal cost-benefit data platform. “Inadequate or untested sustainable technologies or materials” (T1) scored only 3.35 and was ranked the least significant challenge among all.

While much research has been switching focus from technical barriers to cultural obstructions in recent years, the results of this questionnaire indicate that the Australian housing industry does not consider the latter to be of great hindrance to stakeholders’ benefits (mean value=3.58, ranked fourth among 4). “Lack of social conscience in climate change and natural resource preservation” (S3), “Contested functionality for consumers” (S5) and “Insufficient reputation increase, brand recognition and competitive advantage” (S2) were all ranked in the bottom five with a mean value of 3.57, 3.53 and 3.37, respectively. This would indicate the attitudinal readiness and the lofty environmental awareness of government officials, industry practitioners and consumers.

4.2 A Hierarchical Model of Critical Factors that Drive the Market Demand of Sustainable Housing

Eleven critical factors that drive the market demand (CFDMDs) of sustainable was extracted from the synthesized findings on the significance and the current status of the 19 key issues of sustainable housing implementation from survey and interview study. Their hierarchical significance was investigated through Interpretive Structural Modelling (ISM) technique. Figure 1 presents these factors, and four levels of implementation based on their interdependency (driving force and dependence).

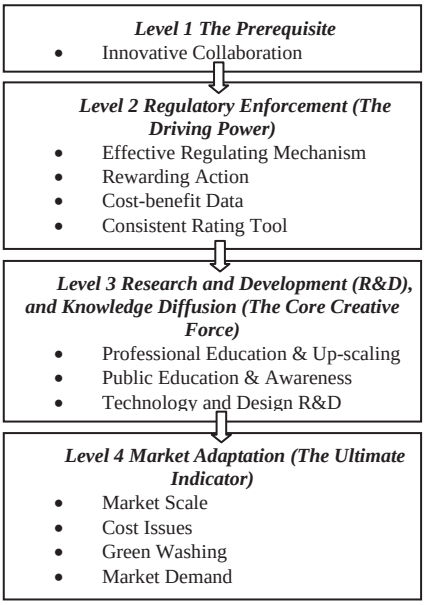

Figure. 1 The Hierarchy of CFDMDs

The first level as shown in the top column in Figure 1, Innovative collaboration, is the fundamental factor in the framework which leads to the creation and communication of mutual benefits for multiple stakeholders every step along the implementation. As such, it serves as "the prerequisite" for the other eleven factors in the framework. It highlights a clear stakeholder structure that explicates the leadership, individual roles and how each stakeholder ultimately benefits from engaging in a new context of sustainable housing as opposed the conventional housing.

Level 2 addresses the regulatory and institutional issues of sustainable housing development, which constitutes the initial driving power of the framework. It comprises an effective regulating mechanism, a reward system, a solid cost-benefit database and a consistent nationwide rating tool, which represents four essential components of an holistic code for sustainable housing development that is seen missing in the broader sustainability sense. A sound combination of regulatory factors, i.e. the so-called top-down approach, would trigger a positive cycle for sustainable housing development before the mainstream market buy-in occurs.

Level 3 includes technology and design R&D, professional education and up-scaling and public education and awareness. These four factors are defined as core components of sustainable housing development because they represent the original value-adding process. Sound strategies on level 3 will increase the professional skills of industry practitioners, which in turn contributes to the improved technology and design R&D. Serving as the original value-adding activity, this educational process contributes to market demand and therefore assists the mainstream of sustainable housing if credible cost-benefit data can be effectively obtained and communicated. In fact, the increased public education and awareness (the core approach) creates geometric effects in influencing market demand, and has always been a stronger power than regulatory factors (the top-down approach) in boosting the market scale.

Level 4 reflects upon the market characteristics of sustainable housing. It includes four dependent yet decisive factors that ultimately indicate the mainstreaming of sustainable housing, namely, market scale, cost issues, green washing and market demand itself. This market adaptation process has limited creative force itself. However, factors on this level could be driven by higher-up levels, and create momentum to keep circulating towards the market escalation of sustainable housing. Specifically, market scale, market demand, and cost issues form another self-enforced loop, where exterior positive power input to any point in the loop will create momentum within the system towards a positive cycle. In other words, providing the successful implementations of their higher-up factors, the market of sustainable housing is able to enforce itself.

5 Conclusion

This research aims to establish a hierarchical framework that encompasses the critical factors of driving the market demand (CFDMDs) of sustainable housing in Australia. This was achieved based on findings of a quantitative questionnaire study, a qualitative interview study and interpretive structural modelling. The systematic framework prioritized 11 CFDMDs and recommended strategies that require attention from industry practitioners and government officials. Market scale is identified as a key determinant of mainstreaming sustainable housing for its influence to technical and design advance and corresponding economies of scale. This key indicator of market mainstreaming could be driven either by regulatory actions (the top-down approach) or the market demand resulted from the educational system (the bottom-up approach). While the former is considered to be a quick fix, the latter bears the stronger and ultimate power. However, the second approach is dependent on the improvement of the educational system, which will take a long time to achieve changes. To this end, a longitudinal cost-benefit research regime and a government-led reward system need to be developed. However, environmental collaboration should be acted upon as the prerequisite. These three elements lay the foundation of this framework and lead the implementation of all other elements in the framework.

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