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Green Buildings: A Framework for Social Sustainability

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Abstract
Despite the ongoing debate surrounding climate change, sustainability is increasingly a key consideration for building owners and tenants with the 'triple bottom line' as desired outcomes. The triangulated social, economic and environmental goals of sustainability are now the mantra of many businesses. While much has been written of the benefits of green buildings to its occupants, comparatively fewer studies have been devoted to investigating the perceived drawbacks and measures to improve the social sustainability factor, i.e., user satisfaction. Therefore, the purpose of this paper is to consider the impacts of green buildings on its occupants by drawing together past empirical findings and summarizing the results. In addition, the paper will also present a case study of the Institute of Sustainable Development and Architecture, which is Australia's first 6-green star, rated educational building. Through these methods, the paper will identify gaps between green building performance and user satisfaction. Thereafter, it will introduce a social sustainability framework that seeks to improve the social performance of green buildings. The 6-P model is a holistic framework targeting the following factors that can influence user satisfaction of green buildings. These factors are: public perception, price, policies, psychological, physical and personal.

Keywords
Green buildings, Social Sustainability, Green building performance, Occupants

1. Introduction

The sustainability agenda started about thirty years ago with scientists, environmentalists and social activists cautioning the catastrophe awaiting current wanton consumption of the world's natural resources. More recently, this message was given a boost by Al Gore's film ''An Inconvenient Truth''. The World Commission on Environment and Development (WCED)(1987) has provided a widely-accepted definition of sustainable development. This is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs''. Today, the 'triple bottom line' is a common framework for analysing the impacts of sustainability. Clarke and Clegg (2000) note that ''....sustainability is becoming a key business imperative, as the eternal search for domination over nature is replaced by the challenge of achieving environmental balance''.

There is a clear trend that buildings in Australia are becoming 'green'. Since 2002, the Green Building Council of Australia (GBCA) has developed its own Green Star building rating tool which considers energy use, indoor and outdoor environmental quality, pollution, transport, land use, materials, water and

economics. A 4-star rating represents ''Best Practice'' and is awarded when a building obtains 45 points and above. A 5-star rating implies an Australian Excellence standard and is given to buildings with 60 points and above. Finally, a 6-star rating is bestowed upon buildings of a world leader standard with 75 points and over. To date, 11 % Australia's CBD commercial office buildings are Green Star certified (GBCA, 2010).

Green buildings are increasingly popular with developers for several reasons. First, the Australian government is strongly supporting the move towards green buildings through the introduction of both incentives and mandatory compliance. For example, owners and lessors of commercial property space, with an area of 2,000 sqm or more are now required to disclose energy efficiency information to prospective buyers or tenants during sales, leasing or subleasing negotiations. More recently, the government has also released a consultation paper calling for industry feedback on the following proposed scheme. From 1 July 2011, it is proposed that businesses that invest in eligible assets or capital works to improve the energy efficiency of their existing buildings would be eligible to apply for a one-off bonus tax deduction of 50 percent of the cost of these improvements. Second, sustainability is made more palatable by the increasing evidence of the economic gains by going green. Von Paumgartten (2003) argued that companies with an environmental stance have realised substantial financial benefits. He provided evidence from the US stock market performance. During the five years before August 2001, the Dow Jones Sustainability Index outperformed the Dow Jones Global Index with an annualised return of 15.8 per cent versus 12.5 per cent. The Sustainability Index, he explains consists of the top 10 per cent of companies in 68 industry groups in 21 countries that are seen as leaders in environmental development. Bosch et al (2003) also noted that economic benefits from green buildings are typically derived from energy, water, and other resource savings over the facility life cycle, reduced environmental liability and impact, and lowered initial capital investment. Third, corporate image is also a key driver for green buildings, particularly for the larger companies. According to a tenant survey by a major developer in Australia, 92% of the tenants ranked sustainability as important or very important (Blundell, 2010a).

From the above discussion, it appears that there is a good alignment between the economic and environmental goals of the triple bottom line in green buildings. However, green buildings should not be about chasing after green star rating as an end. Buildings are built for people. According to Anthony McNulty, GPT's head of development, "creating a social context is as important as sustainable technology. Social sustainability is about creating spaces where people want to spend their time rather than designing buildings around technology." (Blundell, 2010b). In other words, social sustainability can be conceived as user satisfaction with green buildings. So, how socially sustainable are green buildings? The purpose of the paper is to investigate the current state of user satisfaction/dissatisfaction with green buildings and to recommend a social sustainability framework that would improve user satisfaction of green buildings. The next section will provide an overview of the impacts of green buildings on occupants by drawing together the findings from past empirical studies. Following which, a case study is presented of the Institute of Sustainable Development and Architecture (ISDA) building which is Australia's first 6 green-star rated educational building. Next, a 6P social sustainability framework is introduced before the paper ends with some concluding remarks.

2. Impacts of Green Buildings on Occupants

In general, the current literature on green buildings appears to support a positive link between green workplaces and worker satisfaction (e.g., Heerwagen 2000; Palmer and Mariscal 2002; Kumar and Fisk 2002). According to a paper published by The Royal Institution of Chartered Surveyors in 2005, the most significant impacts of green building on occupants include increased occupant productivity and satisfaction, exceeding even the projected environmental benefits. Similarly, the latest *Office Tenant Survey* by Colliers International showed that major corporations perceived green buildings to offer not only cost savings through reduced energy consumption but also benefits such as increased productivity,

decreased employee turnover, less sick leave and better morale (Blundell, 2010a). These positive benefits of green buildings are often important justifications for a firm's transition to a green workplace. Heerwagen (2000) delineated some of the common technical features of green buildings that may contribute to productivity gains. These include:

1. Improved ventilations systems to increase airflow and reduce airborne infection
2. Selection of less toxic building materials and furnishings
3. Reduced energy use and improved interior illumination through day-lighting
4. Use of high quality, energy efficient lighting to reduce computer glare
5. Increased use of natural light to create a natural environment
6. Improved maintenance to reduce build-up of microbial contamination

However, some other empirical studies of the impacts of green buildings on occupants have reported more modest findings. For example, a study from the Buffalo Organisation for Social and Technological Innovation found only a 6 to 16 per cent gain in productivity from increased worker effectiveness, as well as reduced absenteeism and fewer errors and sick days. Further, the concept of productivity is in itself a difficult variable to measure as multiple factors can influence this at the same time. Consequently, it is hard to isolate a single factor such as green buildings as the causal factor for the improved productivity. In a comparative post-occupancy evaluation of 22 green buildings and 23 conventional buildings in Australia, Leaman et.al (2007) the green buildings studies are not better in all categories of the survey. In particular, thermal comfort conditions in summer are generally poor while winter conditions can often be too cold. Perceived productivity scores are also marginally lower on average although a number of successful green buildings surpass conventional ones. The biggest complaint was on internal noise. In a latest study on green buildings by Kato and Murugan (2010), occupants from 31 Green Star Certified buildings that had been operational for more than 12 months were surveyed. The study findings showed that the strengths of green buildings according to the occupants to be natural lighting, spacious open plan layout, convenient location and access to an external view. On the flip side, the most common complaints were the instability of air temperature, lack of privacy, noise and difficulty in operating green features. Further, staff also indicated that self-assessed health and productivity are not significantly improved in Green Star certified buildings and offices.

The above discussion suggests that while there are some clear benefits of green buildings to its occupants, there are also gaps between user expectations and their actual perceptions of certain aspects of such buildings. These findings will now be validated against the case study findings of the Institute of Sustainable Development and Architecture at Bond University.

3. Case Study – The Institute of Sustainable Development and Architecture (ISDA)

The project was conceptualised in 2005. A key focus was to look beyond the various green building rating systems and holistically target ''World's Best Practice'' in green buildings. The triple bottom line goal of achieving environmental, economic and social harmony was applied. A unique feature of this iconic building is the provision for a living laboratory. This facility serves as an educational tool in driving home the message the importance of sustainable development to students and visitors alike. It allows high school students and visitors to experience first-hand the sustainable features of the building and how it can advance the goal of sustainability.

The sustainable features include:

a) Optimum orientation: A north-south facing was selected. This runs contrary to the overall grid of the other university buildings and special permission was required to have this changed to minimise heat transmission to the building

b) Energy efficient lighting and power: The building is designed to optimise natural lighting with large glass window panels and frosted glass panels to throw light into circulation corridors. In addition, a regenerative drive lift produces clean power and saves 3,588 kilowatt-hours of electricity per year.

c) Ecologically designed stormwater and waste water treatment: Rainwater is collected from the roof and treated to supply both potable and non-potable water. Storm water and waste water will be treated and supply water for cooling, irrigation and toilet flushing. The organic waste will be composted in a composting facility in accordance to Australian standard.

d) Natural ventilation strategy: The building's optimum orientation maximises solar gain and captures prevailing breezes. All offices have operable internal and external windows to promote cross-ventilation, and ceiling fans to reduce the demand for air conditioning, a major consumer of energy. When outdoor conditions are optimum the ISDA building utilises a 'natural ventilation mode'; the building's management system senses favourable outdoor conditions and ceases operation of the air conditioning plant and building occupants open their windows to control air temperature and movement to achieve thermal comfort.

e) Carbon neutral building

f) Refrigerants with zero ozone depleting and minimal global warming potential

g) Uses recycled materials: The timber and bricks used for construction are recycled material. Where possible, the furniture within the building was also made using recycled material.

h) Construction waste recycled and reused.

Construction of the building began in early 2007 and was completed in July 2008. Figure 1 is a picture of the building.

Figure 1: Aerial View of the ISDA Building

3.1 Welcoming Green Features of the ISDA Building

Sick buildings with poor indoor air quality has been linked to headaches, eye, nose, and throat irritation, dizziness and fatigue among occupants. The elderly, children and pregnant women are particularly vulnerable to fumes from paints, carpet and other decor in poorly ventilated buildings. Many products are now available that reduce indoor air pollution. In this regard, the ISDA green building has performed well in ensuring occupant health, as the interior paint in the ISDA used is low-odour and the other interior decor materials such as the carpet and furniture also do not produce harmful and toxic emissions, i.e., they are low volatile organic compound (VOC) materials. The ISDA building design offers occupants generous access to natural lighting and ventilation. Additionally, occupants are also provided with individual control of room temperature and lighting. In terms of prestige, the ISDA building is a tangible source of pride for its occupants winning many national and international awards such as the 'World Environment Day Awards 2010: Szencorp Green Building Award by the United Nations Association of Australia and the 'Sustainable Industries Award for Sustainability in the Built Environment' by the Government of Queensland in 2009.

3.2 Less Occupant-friendly Green Features of the ISDA Building

While the natural lighting is mostly welcome by most occupants of the ISDA building, it is also a source of glare for some depending on the location of their office. To achieve maximum natural lighting, a large glass window with no blinds is put in place for regulation. The natural lighting and ventilation strategy also mean occupants have little flexibility in reconfiguring the layout of their workspace. Further, sophisticated green features means having to learn how to operate them to achieve its optimum effect. This can place some restriction on the convenience of usage. For example, in order for the air-conditioning to start, louvers above the door, windows and doors must be closed. Additionally, lights and the air-conditioner can only be only activated by inserting the room key into a wall switch. This implies either leaving the room without locking the door, which may compromise security or frequent switching on and off of the systems, which may not be ideal from an operational and building efficiency point of view. Further, once the air-conditioner is turned off (by taking out the key from the wall switch), it cannot be re-activated until ten minutes later.

The case study of the ISDA building in some measure mirrors that of the literature review findings on the impacts of green buildings on occupants earlier in Section 2. More importantly, these two sections highlighted the gaps between expected and perceived green building benefits. In this regard, there is definite room to enhancing the fit between green buildings and user needs. For this purpose, the next section will introduce a social sustainability framework for improving user satisfaction of green buildings.

4. A Social Sustainability Framework: The 6-P Model

The preceding discussion has shown that green buildings do not always meet user expectations. Specifically, users are often critical about the lack of privacy, noise, thermal comfort and glare in sustainable workplaces. However, simply turning the attention to address these deficiencies does not automatically ensure social sustainability within green buildings for several reasons.

First, it is not possible to create a 'perfect' green building that would satisfy all users. Current green marketing literature suggests that consumers/users can be classified into different shades of green according to their inclination towards environmentally friendly products. It would be folly to assume that all green building occupants belong to the deepest green niche and would readily embrace green features. However, study has shown that occupants of green buildings are more tolerant and forgiving than conventional buildings. While green buildings have many of the features that occupants like, the study

also found that these buildings are more likely to perform poorly in the very area which occupants tolerate the least and which can skew the overall satisfaction with green buildings, namely thermal discomfort (Building Use Studies, 2007).

Second, satisfaction of users with green buildings depends on various contextual factors (Kempton et al., 1992). In a sociological study of green buildings, Rohracher and Ornetzeder (2002) noted that 'different groups of users may develop diverging patterns of use of these (green) technologies and buildings and may attach different symbols and meanings to them. Consequently, the concept of sustainability upon which these buildings are based is contested by users in various ways.' According to this study, a key factor that influence user acceptance of green buildings is the extent of user participation in each phase of the entire building life cycle i.e., research and development, planning, construction and operational phase. Similarly, Leaman et al. (2007) observed that increased user satisfaction and tolerance occurs when there is a comprehensive strategy to inform and educate users of the technologies within green buildings as well as to monitor and improve the performance of sustainable features. From a different perspective, green marketing literature suggests that for vast majority of the users, personal benefit is a key determinant in their purchase decision. Ottman et al (2006) suggest that apart from environmental benefits, there are five qualities that consumer look for in a green product. These are cost effectiveness, health and safety, performance, symbolism and status, and convenience. These characteristics are also applicable to green building users and they are therefore potential factors influencing user satisfaction of green buildings (Too, 2008). Additionally, there is substantial evidence in the current literature of psychological factors influencing eco-centric behaviour. For example, the *reasoned action paradigm* (Kaiser et al., 1999), the *norm-activation model* (Thorgersen, 1999) and the *value/belief-attitude-immediate sequence-behaviour* school (Scott and Jobber, 2000). Although these theoretical models may vary in their names and descriptions, they share a common conceptual foundation, i.e., environmentally sensitive behaviour and starts with individuals having an understanding of the consequences of their behaviours (knowledge). This then affects their attitudes about the environment leading to behaviours congruous with the sustainability agenda.

Consequently, Kato and Murugan (2010) argued strongly for a comprehensive strategy and incentives to improve the social sustainability of green buildings. The need for a targeted approach is further accentuated by the industry's current lack of basic sustainability policies and the failure to report or communicate with stakeholders and investors in this regard (Elmualim et al., 2010). The proposed social sustainability framework below draws upon the knowledge and findings from psychology, marketing, sociology, environmental studies and built environment to develop a holistic framework for improving social sustainability. Figure 2 below diagrammatically depicts the 6-P model which identifies six factors that can influence user satisfaction of green buildings. These are: psychology, personal, physical, policies, public perception and price.

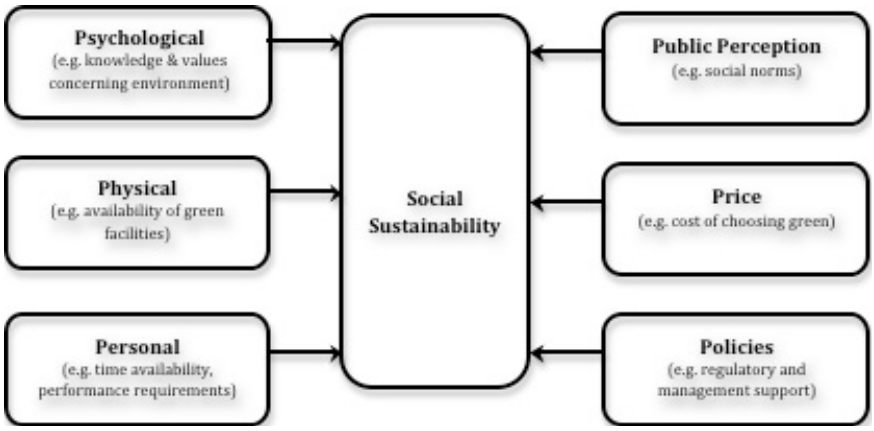

Figure 2: A 6-P Social Sustainability Framework

Psychological - Knowledge about environmental issues will affect the attitude toward the environment which in turn influences environmentally sensitive/non-sensitive behaviour. Therefore, users of green buildings who are better informed of the consequences of their behaviour and actions are likely to be more receptive of the green features and technologies.

Physical – This refers to the availability and ease of operating green facilities. Leaman et al. (2007) noted that when people understand how things work, they are more likely to be tolerant of environmental conditions even if systems do not always operate as intended. To this end, user-friendly controls that indicate what they are supposed to do and provide feedback on whether they have been properly utilized are helpful in gaining user satisfaction of green buildings.

Personal – As previously discussed, personal benefit is a key motivator of user acceptance. This can be in the form of convenience, time-saving and performance. As such, it is important that all efforts are taken to ensure that systems are working properly so that users can enjoy optimum performance of the green building without wasting productive time. Better management and feedback and intervention means less down time and disruption to work and therefore yielding less dissatisfaction.

Public Perception – Corporate image and public perception is a key driver of engagement for tenants and occupants. In general, there is now greater awareness of green issues within the general community and they are demanding more responsibility from companies. Tenants with NABERS energy tenancy rating rose from just 8% in 2005, to 17% in 2008 and 21% in 2010. The need to conform to social norm is a powerful motivator in enhancing user acceptance of green buildings.

Price - One of the biggest selling points of green buildings is its potential energy and resource efficiency. While the rent may be higher, long-term operational cost savings can convince tenants to choose green. In the light of increasing energy and resource prices, this provides a strong reason to occupy a green building. In a survey of office tenants by Colliers International, 53% of organizations surveyed thought there were strategic value in occupying a green building and would be prepared to pay more rent for it, with tenants citing operational cost savings and corporate social responsibility as the most common driving factors.

Policies - Senior management support and behaviour is crucial in influencing the tolerance level of occupants. Through their leading by example, occupants are more likely to accept the changes that have to be made in using green space. Kuusela and Spence (1999) termed this the behavioural/attitudinal paradigm in making a behaviour shift. For many people, there is an innate desire to follow others' leads. The effectiveness of new products (in this case a green building) needs to be demonstrated. Where there is strong endorsement of the building by the management and work policies to support them, users are better prepared to accept green workplaces. For example, senior management's approval in using multiple work stations and alternative mode of working in a green office.

5. Concluding Remarks

Green buildings and offices are becoming more common due to both push and pull factors. Not only do green buildings yield economic benefits, developers and tenants are under increasing pressure from the community and government to undertake greater corporate social responsibility towards the environment. While there are many recorded benefits of green buildings to the business and environment, green building performance are not always aligned with occupant expectations. Increasing the social sustainability of green buildings is important for maintaining a productive workforce. This paper has highlighted some areas of dissatisfaction and argued that improving social sustainability required a

holistic approach. The 6-P model identified six factors in which the user satisfaction level with green buildings can be affected. Future research is needed to validate this model.

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