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Title: RISKS ASSOCIATED IN IMPLEMENTATION OF GREEN BUILDINGS

Theme: Beyond Today's Infrastructure

RISKS ASSOCIATED IN IMPLEMENTATION OF GREEN BUILDINGS

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Abstract

The whole process of implementing Green Buildings is subject to risks. It is important for decision makers to fully understand the risks involved in Green Building implementation. This paper reviewed more than 20 past research studies on the risks involved in the growth of Green Buildings. The significant risks have been clearly outlined and discussed in three stages of a project i.e design stage, construction stage and maintenance & operation stage. The decision makers in Green Building would have better understanding about the risks involved since they have been arranged according to the stages. The drivers of implementing Green Buildings are also listed and discussed in order to understand what the main drivers are. The three drivers are identified i.e (i) the implementation of new government policies that will help to promote or perhaps mandate eco-friendly features; (ii) Stakeholders perceive that Green Buildings will give higher profit in return and increasing awareness that green buildings tend to be more economical to operate; and (iii) the increase in level of awareness has been due to multiple researches on performance of green building.

Keywords: Green Building; Risks; Green Building Drivers; Building Performance

1.0 INTRODUCTION

According to Richardson & Lynes (2007) the term “Green Building” is described as a building that is more energy and resource efficient, releases less pollution into the air, soil and water, and is healthier for occupants than standard buildings Green building is a type of development that seeks to increase the sustainability and efficiency of buildings and development (Retzlaff, 2009). Many green buildings also seek to reduce the negative impacts of development on human health. While no standard definition exists (Kibert & Grosskopf, 2007), most green buildings focus on several issues, typically site selection and building orientation, energy consumption, materials selection, indoor environmental quality, water consumption, construction methodology, and life-cycle costing (Perzan, 2006; Zacharian, Kennedy, & Pressnail, 2002).

The expected output of a green building is that it will use less energy, less water, produce less waste and create a more liveable environment for its habitants and surrounding community, throughout the building’s lifetime (Colliver, 2007; Owens & Halfacre-Hitchcock, 2006; Richardson & Lynes, 2007). It is working towards zero fossil fuel use, zero greenhouse gas emissions, zero potable water use and zero sanitary waste entering municipal systems (Cole, 1999).

Green Building Councils from all over the world developed rating tool systems that can be used as a guideline to profile a building that is designed ‘green’ and designed non-green.

There are a number of existing rating tool systems such as Building Research Establishment Environmental Assessment Method (BREEAM) in the UK, Building Environmental Performance Assessment (BEPAC) in Canada, Leadership in Energy and Environmental Design (LEED) in the US, GREENSTAR in New Zealand and Australia, Green Building Index (GBI) in Malaysia and GBTool that is applicable worldwide. Each of the assessment rating tools has the common categories of what they assess. The categories are (i) Energy Efficiency, (ii) Water Efficiency, (iii) Materials, (iv) Indoor Environmental Quality, and (v) Sustainable Site Planning and Management. This is shown in Figure 1.0.

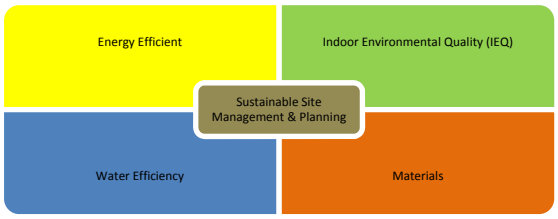

Figure 1.0 Categories for Assessment of a Green Building

Each of the categories, have been assigned to have its own weightings set by the Green Building Local Council in their respective countries. In general, more weighting would have more criteria's. A wider coverage of the scope of the categories will require more criteria to be obtained in order to achieve a higher level of certificate. Having more criteria such as the "GBTool" rating system, makes it difficult to comply with since some of the criteria do not apply to the country's climate condition and economy. "*Building environmental systems must reflect national, regional, and local differences if they are to be accepted and used*"(J. A. Todd, Crawley, Geissler, & Lindsey, 2001; J.A. Todd & Geissler, 1999) .This is the reason why some stakeholders would prefer to use the local sustainable rating tool as it had been tailored to suit the country's condition climate and economy.

2.0 DRIVERS TO IMPLEMENT GREEN BUILDING

The current market trends show that there is an increase in the number of Green Buildings being implemented. In the United States, the rate of growth in numbers of 'green' buildings have been rapidly growing with numbers doubling nearly every 2 years (Fuerst, 2009). In Germany, Lutzkendorf & Lorenz (2006) stated that great interest are shown by the key players of green buildings such as (i) increasing companies and corporations aim to demonstrate their contribution to sustainable development by using self-occupied property assets as an example of best practice and leadership; (ii) property valuation professionals, rating agencies and banks are now beginning to integrate aspects of a building's sustainability into property valuation and risk assessment processes; and (iii) suppliers and auditors of socially responsible investment products increasingly require proof of the economic, environmental, and social advantages of these products (e.g sustainable property funds or real estate investment trusts). In Switzerland, sustainable real estate have become increasingly interested by investors (Bugl, Leimgruber, Huni, & Scholz, 2009). In New Zealand, Mick Moffact, senior Quanity Surveyor of a commercial and residential construction company stated that sustainability is an area of the company's business that is growing fast("Sustainable building practice stacks up," 2010).

Based on this current trend, the author observed that the drivers for this growing trend are due to (i) the implementation of new government policies that will help to promote or perhaps

mandate eco-friendly features; (ii) stakeholders perceive that Green Buildings will give higher profit in return and increasing awareness that green buildings tend to be more economical to operate; and (iii) the increase in level of awareness has been due to multiple researches on performance of green building

(i) the implementation of new government policies that will help to promote or perhaps mandate eco-friendly features

The Government are interested in reducing environmental impact and at the same time fulfilling the needs for development (J. Yang & Lim, 2008). This is due to the impact of Global Pressure which drives the government to put high incentive towards movement of sustainability. Hence, the European Commission encourages Member States to take a leading role in the area of implementing principles of sustainable development in the property and construction sector (Lutzkendorf & Lorenz, 2006). The Government in Germany provide incentives to promote sustainable development, such as introduction of tax credit schemes and regulatory mechanisms as well as to assist the implementation of other economic instruments (e.g. favourable banking and insurance products, advantageous interest, and insurance rates) that support sustainable development in property and construction (Lutzkendorf & Lorenz, 2006). Similarly in United Kingdom, the government offers the industry lower taxes on sustainable properties to promote energy efficiency (Matters, 2009). In Australia, it was stated in the article published by the Sustainable Property company that new buildings must comply with the country's 'Green Star' sustainable performance measures (Matters, 2009).

(ii) Stakeholders perceive that Green Buildings will give higher profit in return and increasing awareness that green buildings tend to be more economical to operate

There are three parties of stakeholders that are involved in the implementation of Green Building i.e developers, owner-occupier and tenants. Developers which participate in the implementation of green building for the commercial and residential buildings are driven by the profit that they are able to make through selling properties with eco-labelling (Fuerst, 2009). Hence to the developers, are looking for a good return for what they have invested either in short and long term period. In other words, they are interested in expanding their business.The owner-occupier and the tenant are interested in the low operating cost of the green building. The studies carried out by McGraw Hill Construction, (2006) and GVA Grimley, (2007) reported that the occupiers are willing to pay for the additional costs of green buildings through higher rents provided in return that they will achieve the four benefits i.e reduced operating costs, improved productivity, improved image for occupiers and owners and reduced operating and regulatory risks. In brief, the stakeholders are driven by cost-benefit and cost implications. Provided they are convinced of benefiting from their investment they will be acting in a socially responsible way in line with the government aspiration.

(iii) the increase in level of awareness has been due to multiple researches on performance of green building

Through research and publications, the level of awareness on the benefits of Green Buildings has been increased over more than 10 years. The research carried out by (Heewagen, 2000; Heewagen & Wise, 1998) outlines the benefits of green buildings in promoting awareness to the key players of sustainable development. Another study by (Z. Yang & Yang, 2009)

highlighted the mutual benefits of sustainable housing which contributes to the level of awareness. A study by (Seewald, 2009) suggested to the relevant authorities to use a software to measure benefits of green buildings and this is also a contribution to promote the level of awareness. A recent research by (Baird, 2010) which studies the occupants level of comfort has helped to emphasis the benefits of Green Building.

The abovementioned drivers have contributed towards the growth of implementing Green Buildings. However, there are also risks in Green Buildings that needs to be mitigated in order to accelerate the growth. Knowing the significant need of a Green Building, it is essential to explain the types of risks involved in the design, construction management, operation and maintenance of green buildings. The next section will focus on explaining the types of risks involved in the design, construction, operation and maintenance of green buildings.

3.0 RISKS IN GREEN BUILDING

Risks associated with green building have received less visibility as compared to conventional buildings. This is probably due to green buildings are still at a growing stage. Understanding the risks and the suitable approaches to manage and mitigate them would accelerate the growth of green buildings. This section explores some of the major risks related to green building projects. The risks will be discussed in detail in all three stages of a green building implementation i.e design stage, construction stage, and maintenance & operation stage.

3.1 Design Stage

During the design stage, the major concern is designing a building within a budget constraint. Risks lie in the level of design effectiveness to meet green building requirements. The building must be designed in such a way to incorporate and support green building characteristics as well as are user-friendly. The designers are responsible for incorporating these characteristics into design consideration while keeping to the allowed budget. Three risks are identified as below.

3.1.1 Financial Risk

A study by Colliver, (2007) has classified financial risk at the design stage as a soft cost that is associated with designing, permitting, certifying the project, including delay cost. The expensive soft cost can be a barrier in implementing green buildings (Cupido, Baetz, Pujari, & Chidiac, 2010). In a report by Marsh (2009), cost of the green building certification process is listed as the risk to the growth of implementing green buildings. This is in line with a report by Hanatani (2009), that the cost of the Green Building certification process is expensive. It was claimed that the estimates of the soft costs of going for certification ranged roughly from USD$40,000 to USD$200,000, depending on the size of the project. This can impede the growth of Green Buildings. In the author's opinion, a reduction of the cost of certification process could perhaps accelerate the growth of green buildings.

Another issue in relation to financial risk is the lack of knowledge and experience resulting in wrong perceptions that can lead to decision not to go green. A study by (Richardson & Lynes,

2007) stated that the perception of the high initial capital cost and the long payback time to recuperate the initial cost are risks in the growth of green building. Another study by (Cupido, et al., 2010) found that the perception of Green Buildings in general cost more than conventional buildings. These perception affects the decision making process to not to go green. This perception contradicts to the research carried out by (Bordass, 2000; Hydes & Creech, 2000; Intrachooto & Arons, 2002; Scofield, 2002) which claimed that green buildings do not necessarily result in higher initial capital costs for design and construction. Two studies by Abidin (2009) and J. Yang, Lin, & Skitmore (2003) stated that this perception is considered to be the first cost mentality, which means that there is fear to invest in high costs with uncertain return of the cost revenue.

3.1.2 Standard of Care/Legal Risk

Standard of care/ legal risks are identified to be at the design stage. A report by (Marsh, 2009) outlined specific issues associated with Standard of Care/Legal risk as below :

- *Not attaining the level of Green certification expected by owner, tenant, or other third party*. When the sustainable building expert certify the building below the expectation of the client upon the completion of the project, the issues of liability of this failure must be indicated clearly in the contract prior to the construction of the project.
- *Challenge of determining an appropriate standard of care as green building expertise continues to evolve*. Until appropriate standard of care/ legal risk has been legally determined, the consequence of risk at the design stage will continue to occur.
- *Evolving building codes with potential for application of a strict liability standard*. Until appropriate green building code is established, the risk at this stage is unavoidable.
- *Untested contract language* (Elovitz, 2010). The contract document must be clearly expressed to whose liability between designers, builders and clients. Often there is blurred area in allocating the faults when it comes to failure in achieving the expected level of certification and building performance.

3.1.3 Regulatory Risk

A report by Marsh(2009) identified that the shift in government priorities, such as maintaining green regulations, but removing tax incentives and subsidies as one of the risks in implementing green buildings. Removal of tax incentives and subsidies contributes to the factors of barriers in implementing green buildings. A study by Ashuri (2010) stated that tax and regulatory incentives that are not uniform and tend to change from state to state, and over time. Based on the study, the non-uniformity and instability of the tax and regulatory incentives can be considered as the risks towards accelerating the growth of green buildings. It was further added that the dates of expiration on the incentives were uncertain which would affect stakeholders decision making process in implementing green buildings to postpone or cancel on the implementation of the project.

3.2 Construction Stage

There exist multiple risks in the construction of green building. The risks are explained as below:

3.2.1 Inexperience consultants and contractors

A report by Marsh (Marsh, 2009) identified that lack of experience consultants and contractors with respect to green projects results in schedule delays of the project. Another study by Ashuri (2010) identified that contractors may lack of the skills to properly implement green oriented technology. As a result this could hinder the technology effectiveness. Ashuri (2010) also stated that possible unforeseen conditions of retrofitting existing buildings to become green are a common risk identified under the construction stage. This reason supports the significant need to have experienced consultants and contractors in constructing green buildings. These risks eventuate upon selection of inexperienced and lack of knowledge by consultants and contractors. It is significant to choose the sufficient experienced consultants and contractors with a good track record for implementing green buildings.

3.2.2 Financial Risk

Financial risk is a risk under the construction stage as the cash flow during the construction stage process is critical in implementing green buildings. A study by Marsh (2009) identified that the credit capacity of the contractors is listed as one of the risks faced by contractors in implementing green buildings. Ashiru (2010) and Marsh (2009) both stated that fluctuation of the price of green materials is also a risk in the implementation of green buildings. New materials in market would have high cost which requires contractors to have a strong credit capacity to implement green buildings. The clients are also faced with this risk.

3.2.3 Availability of green materials risk

A study by Tredrea & Mehrtrens(2008) stated that the availability of green materials in the market is a risk during the construction stage. This is a challenge to contractors as sourcing materials become difficult. The consultants are then faced with the challenge to audit the work of the contractor to ensure compliance. These risks hinder the growth of implementation of green buildings.

3.3 Maintenance and Operation Stage

The risk associated at this stage is the performance of the green building that is expected to reduce the operation cost due to being more energy efficient, and also increased productivity due to better living indoor environment.

3.3.1 Performance Risk

According to a report by Marsh (2009), the building performance risk is rated to be one of the highest risks in the growth of implementation of green buildings. Ashuri (2010) stated that the building performance of a Green Building has a significant influence in the decision making process to implement green buildings that will affect the market position.There are a number of researches that had been carried out to show that Green Buildings are underperforming. For example; some of the LEED rated buildings uses more energy than it was intended designed to be (Newsham, Mancini, & Birt, 2009). A similar research by Gabe (2008) was conducted on a research building that was designed to be an energy saving building, but in operation it turned out that the building used double the energy as expected. Another study by Bordass, Cohen, Standeven, & Leaman (2001) also found that the Green Buildings were using more energy than expected. In a report by Turner & Frankel (2008), some of the LEED rated buildings were found to be high energy usage.

Based on the above studies, the author identified the common reasons of this inefficient energy building performance is mainly due to the actions of the occupants and facility managers in the building. Malfunction of technologies and systems in the buildings has also been identified to be the reasons of inefficient energy building performance. Another reason identified is that the benchmark or estimated energy is inappropriate for buildings that are high energy usage i.e research building that consists of laboratory.

There is a need to investigate more on the reasons of the deviation of the energy building performance in order to help improve future modelling and benchmarking. Also, there is a need to calibrate the user needs and building design in order to optimize building performance.

4.0 CONCLUSION

In conclusion, this paper reviewed research studies on the risks in the growth of implementing green buildings. The author has attempted to outline and discuss the risks under three stages of a project implementation i.e design stage, construction stage and maintenance & operation stage. At the design stage, three risks i.e financial risk, standard of care/ legal risk and regulatory risk are discussed. At the construction stage, three risks i.e inexperience of consultants and contractors, financial risk, and availability of green building material risk are discussed. Lastly, at the maintenance and operation stage, only the performance risk had been discussed. This paper is aimed to help the decision makers to better understanding on the significant risks that must be considered seriously in order to accelerate the implementation of green buildings. However, the author has not discussed on the strategies to mitigate the abovementioned risks. Further studies shall be conducted to make recommendations to eliminate all the risks.

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