Sustainability of Sustainable Real Property Development

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Abstract The paper investigates commercial buildings users' perception of the benefits of green buildings and how this perception influences their decision to occupy and/or invest in them. A survey of 400 commercial real estate users in Singapore reveals that they are aware of, and appreciate the benefits of green buildings. However, they are not willing to occupy and/or invest in green buildings as they are concerned with monetary returns. Price, reliability, and effectiveness of green features, as well as apathy towards environmental issues, are impeding the sustainability of sustainable commercial real estate in Singapore. Notwithstanding, since it was found that cost saving and higher property value benefits statistically influence respondents' willingness to invest in, or occupy green buildings, turning the sustainability advocacy into realistic economic advocacy could ensure sustainability of sustainable real estate development.

The concern about the ability of the land resource base to meet, indefinitely, the ever increasing demand for ''land'' because of the rapid pace of technological advancement and socio-cultural and economic developments, vis-à-vis global warming, has made sustainable development a hot topic worldwide. Environmental concerns have plagued mankind for ages. As early as the nineteenth century, Marsh (1864:36) made this telling observation: ''Man everywhere is a disturbing agent. Wherever he plants his foot, the harmonies of nature are turned to discord.'' *The Ecologist* (1972:15) states:

> ''The principal defect of the industrial way of life with its ethos of expansion is that it is not sustainable...We can be certain, however, that sooner or later it will end (only the precise time and circumstances are in doubt) and it will do so in one of two ways: either against our will, in a succession of famines, epidemics, social crises and wars; or because we want it to—because we wish to create a society which will not impose hardship and cruelty upon our children—in a succession of thoughtful, humane and measured changes.''

The world has gradually woken up (by, among other things, environmentalists, scientists, natural disasters, and Al Gore's Academy Award-winning documentary, ''An Inconvenient Truth'') to the harsh truth that unless it bridles its insatiable quest for the ''good life,'' which manifests itself in the unwonted exploitation of the ecosystem at a faster rate than can be replenished, its very existence could be

in jeopardy. This awakened consciousness has swelled the green tidal wave for sustainable development. However, the critical question that needs to be addressed is whether the increased tempo in sustainable real estate development is itself ''sustainable.'' In other words, the consumer's acceptance and patronage of sustainable real estate development is fundamental to its success and thus, demands more thorough studies to ensure that resources are efficiently deployed, rather than misused, in sustainable real estate development.

This is underscored by the fact that although some progress has been made, and people laud the virtues of sustainable development, rhetoric on sustainability has not often been backed with action. This is true of Singapore (and other parts of the world) where, despite the government's efforts to push the green agenda, the private sector appears to be relatively slow in warming up to the green revolution. Thus, this paper is motivated by the fact that sustainability and thus, sustainable real estate development, is a survival imperative for mankind. The sustainability (i.e., success) of sustainable real estate development could make a significant contribution towards the fight against global warming to promote the continued survival of mankind. This makes it worthwhile to investigate the ways and means of making sustainable real estate development ''sustainable.''

Secondly, Singapore has become an important financial center in Southeast Asia. Prospective multi-national companies for the Singapore market may like to know the market's perception of green buildings. Thirdly, Singapore is a cosmopolitan city. Thus, any insight into green building based on a study in Singapore may have a cosmopolitan flavor to appeal to a wide audience. The paper therefore explores the market's perception of the benefits of green buildings and the impact of these benefits on commercial building occupier's willingness to occupy and/or invest in green buildings; and the factors that are militating against mass development of green buildings in Singapore.

The rest of the paper proceeds as follows. The next section provides a brief review of the relevant extant literature. This is followed by data sourcing and management after which the results of the data analysis are presented and discussed. The last section is devoted to concluding remarks. It is found that environmental and unquantifiable benefits, though lauded by the market, are less important in influencing occupiers' decision-making. Price, reliability, and effectiveness of green features, as well as apathy towards environmental issues, slow the acceptance of green buildings in Singapore. Benefits that will directly impact the business' economic performance have a significant influence on commercial building occupiers' willingness to invest in, and occupy, green buildings. Profitability, rather than mere environmental concern, is the main priority.

Literature Review

Porter (2000) aptly remarks that sustainable development is a two-word phrase with a thousand meanings. According to Porter (2000:1), sustainable development ''speaks of balancing economic and social forces against the environmental imperatives of resource conservation and renewal for the world of tomorrow.''

This is in consonance with the Brundtland Commission, which defines sustainable development as ''development which meets the needs of the present without compromising the ability of future generations to meet their own needs,'' (World Commission on Environment and Development, 1987). In other words, sustainable development should safeguard and perpetuate the harmonies of nature (i.e., preserve ecological balance). It would appear, however, that current definitions of sustainable development (i.e., green buildings), water down this idea of preservation of the ecological balance to ensure that the needs of future generations are not compromised.

According to the white paper on green buildings presented at the Green Building Congress 2001, a green building is one that incorporates several green features, such as:

- Use of energy-efficient and eco-friendly equipment (e.g., low energy consumption achieved by a range of techniques including the use of natural ventilation rather than air-conditioning, heat recovery systems, and the use of thermal mass, careful orientation, and low-energy lighting design).
- Use of recycled and environmentally-friendly building materials (e.g., careful specification of lower environmental impact building materials).
- Quality indoor air for human safety and comfort.
- Use of renewable energy (e.g., maximum use of natural day-lighting).
- Effective controls and building management system.
- Efficient use of water (e.g., use of gray-water recycling for landscape irrigation and WCs).
- Use of non-toxic and recycled materials.
- Effective use of existing landscapes (e.g., minimizing site impact through sensitivity to site ecology and careful landscaping).
- Adoption of cost-effective and environmentally-friendly technologies.

The emergence of worldwide rating systems such as the Building Research Establishment Environmental Assessment Method in the United Kingdom (BREEAM), Leadership in Energy and Environmental Design in the United States (LEED), and Green Globes and Green Mark in Singapore (all of which are in consonance with the white paper on green buildings) is giving impetus to sustainable real estate development. These rating systems, with virtually similar objectives, are pushing the green agenda by encouraging environmentally and socially responsible building practices, and distinguishing between sustainable real estate and conventional properties by awarding ''badges'' for buildings' different degrees of ''green.'' In effect, green buildings are aimed at reducing the negative impact of real estate development on both the environment and human health to promote the sustainability of life. However, it is doubtful whether the extant green machinery will lead to sustainability as defined by the Brundtland Commission, i.e., renewal that ensures continuity of matter, resources, populations, and cultures (Porter, 2000). In mathematical form, sustainability implies the following equation:

$$EC \leq ER, \quad (1)$$

where *EC* stands for environmental/ecological consumption/degradation and *ER* for environmental/ecological renewal. Regardless of one's stand in the definitional thicket, the extant literature on green buildings mainly revolves around the benefits of, and barriers to, sustainable development. The benefits of green buildings are categorized as economic, social, and environmental.

Economic Benefits

It is argued that ''greening'' increases property value via lower running cost and risk, gains in productivity and reduced construction cost, and financial incentives. According to Wasiluk (2007), sustainable commercial buildings have a competitive advantage over traditional commercial buildings because of their ability to attract higher profile tenants to command above-market rentals and thus, capital values. Furthermore, green buildings command a premium by virtue of the ''badge of honor,'' which is awarded by the rating systems, and the concomitant brand name, which investors use in marketing (e.g., Shiers, 2000; Holmes and Hudson, 2001; Jones Lang LaSalle, 2006; Reed and Wilkinson, 2006). These findings have been replicated by Miller, Spivey, and Florance (2008), who conclude that ENERGY STAR-rated and LEED-certified office buildings in the U.S. have a competitive advantage over their non-rated counterparts.

In addition, energy efficiency and good indoor environmental quality in green buildings translate into lower operating cost and thus, higher net operating income, capital value, and productivity relative to conventional buildings (Roper and Beard, 2006). According to the Leadership Roundtable moderated by Cannon and Vyas (2008), McCabe argues that green buildings inherently have lower risk of exposure to volatility in price and resource availability, which should logically result in lower capitalization and discount rates.

Energy efficiency resulting from ''greening'' is certainly a welcome benefit to both real estate investors and tenants. However, its impact on property value needs to be carefully studied and documented to substantiate the claim as, according to Jevons Paradox, the more efficient we become in using a given resource, the more we consume of that resource (Bezdek in Leadership Roundtable moderated by Cannon and Vyas, 2008). This supposition is supported by the fact that there has been a dramatic increase in energy efficiency in the U.S. over the past 30 to 40 years but energy consumption per capita over the period far outstripped the efficiency of use (Rubin and Tal, 2007). For example, air conditioning efficiency in the U.S. has risen by 17% since 1990, while the number of air conditioning units in the residential sector has increased by 36% (Rubin and Tal, 2007). What has happened in the residential sector in relation to energy efficiency vis-à-vis energy usage could resonate in the commercial real estate sector as well. As noted by Rubin (2007), the legacy of energy efficiency improvements is ever greater energy consumption. This implies that energy efficiency may not necessarily lead

to a reduction in operating expenses to increase net income and capital value if all other things are held constant.

Furthermore, Shiers (2000) and Robinson (2005) state that savings in running cost [which may be lower than projected (see Cannon and Vyas, 2008)] are often of little interest to many tenants as many of them adopt a financial ''short term'' view of their business, rather than focusing on long-term savings or investment opportunities. Investors tend to be more concerned with the business activities of the tenants in the buildings rather than the effect of the building on the environment. Tenants tend to view their office occupation costs as being dominated by salaries, rent, and rates, while service charges are deemed to be negligible in comparison to these major items. The insignificance of service charges, as a proportion of overall business cost, casts doubt on occupiers' willingness to pay a premium rent for green buildings.

Another economic benefit that has been attributed to green real estate is reduction in construction cost. Lucuik, Trusty, Larsson, and Charette (2005) state that savings from the elimination of unnecessary systems, or the downsizing of systems through better design, offsets the increased costs resulting from implementing more advanced systems. Construction costs savings can arise from a low-impact approach to the use of the site and taking advantage of a site's natural features such as daylight, shading, and landscape (Hydes and Creech, 2000). Optimization of building layouts, simple and efficient planning of buildings due to requirements and constraints of natural ventilation systems, and more careful specification practices also contribute to cost savings in construction (Shiers, 2000). Whether these cost savings make green buildings less costly and/or less expensive than conventional buildings is debatable.

According to Shiers (2000), there are inherent problems in making meaningful comparisons on a like-for-like basis with regards to the construction cost and performance of buildings of different ages, design, and functional characteristics. A 2004 study by Davis Langdon found that the cost of constructing a sustainable building tends to match or only slightly exceed those of comparable non-green buildings. Taking into account a range of construction factors including climate, location, market conditions, and local standards, the study found that for many of the green projects, pursuing LEED certification had little or no budgetary impact. In addition, Roper and Beard (2006) state that some green buildings may indeed be less expensive than their conventional counterparts but may be significantly different in both concept and in terms of detail in design. Further, the paucity of market evidence, sales data, and lease transactions of sustainable buildings have left many in the industry wondering whether sustainable buildings are feasible (Lutzkendorf and Lorenz, 2005a & b). All these may imply that the economic benefits attributable to green buildings could be exaggerated.

Financial Incentives

Another economic advantage that green buildings enjoy is financial incentives and tax concessions. Often, the economic-price model does not adequately value social and ecological attributes in the decision-making process (Chua, 2007). Thus, few

developers in the private market would adopt green technologies. Governments therefore have to provide incentives to induce market decision-making in accommodating and incorporating green attributes in buildings.

In Singapore, the Building and Construction Authority (BCA) has created a $20 million Green Mark Incentive Scheme for private sector developers, in an attempt to encourage private developers to build green buildings. The scheme is to provide cash incentives to developers for meeting Green Mark Gold rating or higher and to create demand in green building technologies so as to lower costs in the long run (ttp://www.bca.gov.sg). Further proposed financial incentives include boosting the availability of funds by involving banks in providing preferential loan rates for Green Mark projects. This works in Japan, where banks make 'green loans' for buildings that aim for higher environmental ratings (Cheam, 2008).

Social Benefits

A green building provides a healthier working environment. Improved indoor air quality helps to reduce the health and safety risks to occupants from Sick Building Syndrome (SBS) and Legionnaire's Disease (Shiers, 2000). Fisk (2002) estimates that improved heating, ventilating, and air conditioning (HVAC) systems, which limit the spread of contaminants and pathogens, could reduce respiratory illnesses by 9%–20%. Better indoor air quality can also reduce asthma attacks and allergies.

Health and comfort are becoming increasingly important with the growing concern about staff welfare. Through sustainability, companies can improve their competitive advantage in the recruitment and retention of talent. Paevere and Brown (2008) note that green building can be used as an employee 'benefit' to attract and retain high quality workers. Scholars also suggest that initial applicant attraction to a firm is based on perceptions of the firm's image, which is thought to be influenced by the firm's corporate social performance (Turban and Greening, 1996). For example, certain companies, such as IBM, General Motors, and Microsoft, are sending out brochures to prospective applicants promoting their companies' philanthropic and environmental programs. This implies that some firms are using social responsibility as a recruitment tool (Turban and Greening, 1996; ASHRAE, 1998; Leaman, Thomas, and Vandenberg, 2007).

Notwithstanding the use of green buildings as a recruitment ploy by some employers, factors such as improved health and productivity in green buildings may not be quantifiable and thus, are subject to a higher degree of uncertainty (Roper and Beard, 2006). Amidst the hype about sustainability, high performance, and green buildings, the meaning or definition of ''building performance'' is vague. Each of those descriptors alludes to some improved building performance over a baseline or reference, which is seldom defined in measurable or verifiable terms. As a result, accountability is seldom realized for delivering or operating buildings that meet objective, measurable criteria that are of primary importance to the building owner or tenant (Woods in Leadership Roundtable moderated by Cannon and Vyas, 2008). Moreover, tenants are not clear as to what constitutes green and thus, are rarely able to venture past the (green) trophy sticker mentality.

Environmental Benefits

Real estate contributes to the environment through resource depletion, energy consumption, air pollution, and creation of wastes that are not easily assimilated by the environment. In Singapore, commercial and industrial buildings alone have been estimated to contribute about 15% of the total carbon emission, largely from electricity consumption, half of which goes towards air conditioning (Chua, 2007).

Green buildings offer a lower level of environmental risk by helping to minimize the environmental footprint of the real estate industry on the environment. The rational use of natural resources and appropriate management of the building stock will contribute to saving scarce resources, reduce energy consumption, and improve environmental quality (Roper and Beard, 2006). However, reduction in energy consumption due to green buildings may be difficult to achieve, given the Javons Paradox, which has been shown to be true in the U.S. (see Rubin and Tal, 2007). Thus, the expected improved environmental quality resulting from green buildings via energy efficiency and its corollary reduction in the greenhouse gas effect may not materialize. Furthermore, the reliability of renewable energy sources to provide sufficient energy to mitigate the reliance on fossil fuel (the source of the greenhouse effect) has been questioned (Cannon and Vyas, 2008).

The foregoing discourse shows that notwithstanding the hype about the benefits of green real estate, there are questions and barriers (e.g., lack of faith in the green system to deliver the touted benefits, unquantifiable benefits, etc.), which impede the development of green buildings in the market. Moreover, the vast majority of consumers proxied by 93% of respondents to a survey conducted by Jones Lang LaSalle and CoreNet Global (2007) feel that sustainable solutions are patchy or limited. Thus, given the prospects of green real estate vis-à-vis the challenges that militate against its widespread adoption, it is anybody's guess whether sustainable real estate development is sustainable in Singapore.

Data Sourcing and Management

The study is based on primary data collected through a survey (see the Appendix) of 400 commercial building occupiers in Singapore. The sample size is a function of the method of analysis (factor analysis) used for the study. As a general rule, there must be at least five times as many observations (respondents) as there are variables to be analyzed, with the more acceptable range being a ten-to-one ratio (Hair, Anderson, Black, and Tatham, 1998). Since there are 29 benefits (variables)—extracted from the extant literature—in the questionnaire, a ten-to-one ratio gives a more acceptable sample size of 290. This makes the sample size of 400 sufficiently large enough for statistical inferences to be made.

The survey, which was randomly administered, was conducted in Jurong East, Raffles Place, Woodland, Harbour Front, and Tampines to ensure as wide a representation of commercial building occupiers as possible. The questionnaire comprises four sections. Section one solicits information on the respondents' perception of the benefits of green buildings. Questions in this section relate to

29 benefits (based on extant literature). The respondents were asked to rate (on a 5-point rating Likert scale, with 1 being ''Not important'' and 5 being ''Very important'') the level of importance they (as individuals) attach to each benefit. This method ensures that evaluation categories can easily be compared and response categories can be collapsed into positive and negative response groups with an intervening neutral category between the two poles.

Section two of the questionnaire seeks to ascertain the respondents' willingness to invest in and/or occupy green buildings given that the green buildings provide all the benefits that the respondents consider to be of importance. The respondents were given a 5-point rating Likert scale with 1 being ''Strongly disagree'' and 5 being ''Strongly agree'' to state their level of agreement to statements in the section. These statements are aimed at ascertaining the respondents' acceptance of green buildings.

Section three of the survey explores the potential barriers to green buildings. Once again, the respondents were asked to rate the level of significance of each barrier on a 5-point Likert scale with 1 being ''Not important'' and 5 being ''Very important.'' The last section, section four deals with the respondents' demographic profile.

The respondents' ratings for the benefits of green buildings were factor-analyzed using principal component analysis (PCA), followed by varimax rotation. These analytical tools were employed after verifying the appropriateness of the dataset for factor analysis through the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, Bartlett's test of sphericity, and the determinant of correlation matrix. A high KMO value (between 0.5 and 1.0) is considered appropriate while a KMO value below 0.5 is not appropriate for factor analysis (Kline, 1994; Malhotra, 1996). Similarly, a low Bartlett's test of sphericity value less than 0.05 and a determinant of correlation matrix value close to 0 indicate that factor analysis is appropriate (Kline, 1994; Malhotra, 1996). Thus, the figures in Exhibit 1 attest to the appropriateness of the dataset for factor analysis.

Furthermore, the widely used Cronbach's alpha as a diagnostic measure for consistency of the entire scale is adopted. The generally accepted lower limit for Cronbach's alpha to yield reliability is 0.70 (Hair, Anderson, Black, and Tatham, 1998). The correlation between the respondents' willingness to invest in and/or occupy green buildings and the ''important'' variables is evaluated via bi-variate correlation.

Exhibit 1 | Results of KMO and Barlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		0.734
Bartlett's Test of Sphericity	Approx. chi-square	6,090.199
	df	406
	Sig.	0.000

Results

Relevant Demographic Details of Respondents

Most of the respondents, of which 58% and 42% are male and female respectively, hold a diploma (37%), first degree (41%), and a master's/doctorate degree (7%). The remaining 15% comprises Institute of Technical Education (ITE) certificate holders (11%) and people with up to secondary education (5%). The relatively high proportion of male respondents reflects the labor force participation rate of males and females in Singapore. Furthermore, about 85% of the respondents are between age 21 and 49 inclusive, with age group 30–39 accounting for 43.3% of all the respondents. Moreover, 58% of the respondents hold executive and managerial/professional positions (see Exhibit 2).

Benefits of Green Buildings

The results of the survey relating to the benefits of green building are presented in Exhibit 3. Out of 29 variables (i.e., benefits), 27 are reported in Exhibit 3; the variables ''Accelerates jurisdictional approval'' and ''Reduced societal costs of landfill creation and maintenance'' had insignificant factor loadings and thus, were sifted out of subsequent analysis. The latent root criterion suggests an eight-factor solution, which accounts for 69.92% of the variance within the original variables in Exhibit 3.

The four highest ranking factors (benefits), each of which accounts for more than 10% of the variance, are environmental, productivity gains, improved internal conditions, and cost savings in descending order (see Exhibit 3). Environmental factors, which comprise five variables (Exhibit 3, Factor 1), account for 11.40% of the variance. The results clearly attest to the respondents' acknowledgement of environmental benefits of green buildings. Green buildings use more

Exhibit 2 | Occupation of Respondents

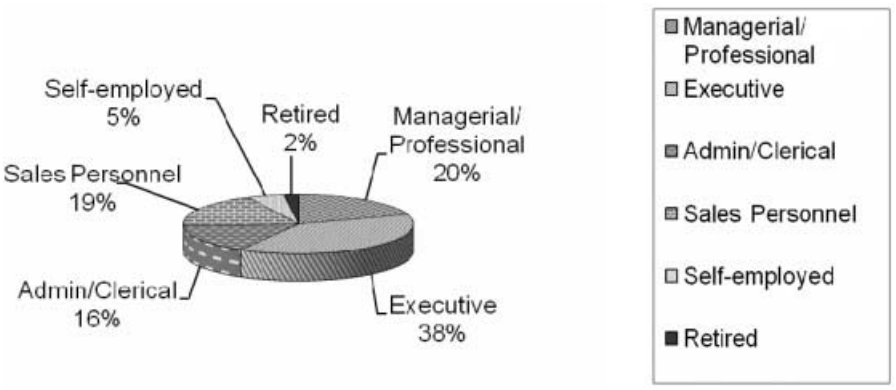

Exhibit 3 | Benefits of Green Buildings

	Component							
Factor	1	2	3	4	5	6	7	8
Factor 1: Environmental (Cronbach alpha: 0.85)								
Sustainability	0.824							
Less pollution	0.788							
Fight global warming	0.807							
Waste minimization	0.815							
Minimized site impact	0.745							
Variance (%)	11.396							
Factor 2: Productivity Gains (Cronbach alpha: 0.86)								
Reduced absenteeism		0.756						
Reduced health and safety risks		0.833						
Less claims made on health costs		0.847						
Boosts creativity		0.748						
Higher morale		0.710						
Variance (%)		11.248						
Factor 3: Improved Internal Conditions (Cronbach alpha: 0.90)								
Improved indoor air quality			0.886					
Less complaints on comfort-related problems			0.883					
User satisfaction			0.866					
Users have more control over their environment			0.839					
Variance (%)			11.103					
Factor 4: Cost Savings (Cronbach alpha: 0.88)								
Water conservation				0.842				
Energy efficiency				0.881				
Lower services maintenance costs				0.822				
Secure grants				0.784				
Variance (%)				10.770				
Factor 5: Higher Building Value (Cronbach alpha: 0.84)								
Secure higher rents					0.845			
Faster tenants lease-up					0.868			
Valuation premiums					0.737			
Variance (%)					8.037			
Factor 6: Lower Risks (Cronbach alpha: 0.75)								
Lower risk of exposure to volatility in prices						0.790		
Lower risk of exposure to resource availability						0.877		
Reduced liability risks						0.729		
Variance (%)						7.249		
Factor 7: Branding (Cronbach alpha: 0.82)								
Better market distinction							0.885	
Higher prestige							0.920	
Variance (%)							6.073	
Factor 8: Workforce Turnover (Cronbach alpha: 0.85)								
Lower workforce turnover								0.706
Variance (%)								4.039
Total variance (%)								69.915

environmental-friendly materials; generate less waste and pollution, thereby reducing the carbon footprint caused by the property sector. This is crucial not only to Singapore but to all major world cities where commercial buildings consume large amounts of electricity due to massive air-conditioning and/or heating. In consonance with governmental efforts in promoting sustainable development to combat climate change, green buildings promise to offer environmental benefits that are well-aligned with governmental agendas to go green.

The next most important benefits of green buildings are productivity gains (11.25% of the variance). The variables in this factor include ''reduced absenteeism,'' ''reduced health and safety risks,'' and ''less claims made on health costs.'' These items can be costly enough to affect the profit margins of business in commercial buildings. Notwithstanding the relative importance of productivity gains as a benefit, it is questionable whether all, or a statistically significant proportion of, such gains are solely attributable to green buildings. This should positively influence respondents' decisions to invest in, or occupy, green commercial buildings if the benefits are deemed to be attributable to green features.

Improved internal conditions (Factor 3) account for 11.10% of the variance. This could be attributed to the fact that commercial building occupiers value comfort and well-being and that employers are also increasingly concerned about staff welfare. Better indoor air quality helps to reduce the susceptibility of office buildings to diseases such as Sick Building Syndrome (SBS) and Legionnaire's Disease. Providing a comfortable and pleasant internal working environment can be a key differentiator (Paevere and Brown, 2008) when recruiting talent, particularly in an increasingly challenging labor market. Hence, creating healthier and more user-oriented working conditions becomes an important factor.

The next benefits of importance are cost savings (10.77% of variance) and higher building value (8.04% of variance). Respondents favor the potential of green buildings to offer cost advantages, particularly in terms of operating costs relating to ''water conservation,'' ''energy efficiency,'' and ''Lower services maintenance costs.'' This is not surprising as the heavy reliance on air-conditioning, vis-à-vis a relatively high electricity tariff, and the levying of water conservation tax (30% of water bill) could mean that ''energy efficiency'' and ''water conservation'' could lead to substantial savings in utility bills (and thus, operating expenses) to increase the profits of businesses operating in green commercial real estate, as well as the net operating income and capital values of green commercial buildings.

The variables under Factor 5, ''higher building value,'' are ''faster tenants lease-up,'' ''secure higher rentals,'' and ''valuation premiums.'' Improved tenant attraction and retention is pivotal to lowering vacancy rates in buildings. This reduces the time and cost for securing new tenants to increase property value as ''space-time'' implies that time is ''value'' for real estate. Similarly, ''secure higher rentals'' and ''valuation premiums'' increase, all other things being equal, the market value of the building. The underlying implication of both Factors 4 and 5 is that the respondents are aware that green buildings are not merely an

environmentally responsible alternative, but could be a smart, financially responsible business strategy to increase economic bottom line.

The remaining benefits are: lower risks (7.25% of variance), higher marketability (6.07% of variance) and workforce turnover (4.04%).

On the whole, the robustness of seven of the identified factors, Factors 1–7, is attested by the Cronbach's alphas, which range from 0.75 (Factor 6: lower risk) to 0.90 (Factor 3: improved internal condition). Therefore, we test the impact of each benefit on the willingness of the respondents to invest in and/or occupy green commercial buildings.

Respondents' Willingness to Invest In and/or Occupy Green Buildings

The effects of green benefits on respondents' willingness to invest in and/or occupy green buildings is tested through correlation analysis of the relationship between the variables under each factor and respondents' willingness to invest in and/or occupy green commercial buildings. The null hypothesis (at the 0.05 level of significance) is that green benefits have significant impact on the willingness of respondents to invest in and/or occupy green commercial buildings.

The results presented in Exhibits 4–10 reveal that only two of the green benefits have statistical significant effect (at the 0.05 level of significance) on the respondents' willingness to invest in and/or occupy green commercial buildings. It appears paradoxical that the three highest ranking green benefits—environmental, productivity gains, and improved internal conditions—generally have no significant impact on the respondents' willingness to invest in and/or occupy green commercial buildings (Exhibits 4–8). This implies that although

Exhibit 4 | Environmental Benefits & Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest in Green Building
Sustainability	Pearson Correlation	−0.052	−0.077
	Sig. (2-tailed)	0.301	0.123
Less pollution	Pearson Correlation	−0.002	−0.085
	Sig. (2-tailed)	0.966	0.090
Fight global warming	Pearson Correlation	0.023	0.041
	Sig. (2-tailed)	0.649	0.412
Waste minimization	Pearson Correlation	−0.011	−0.013
	Sig. (2 tailed)	0.822	0.790
Minimized site impact	Pearson Correlation	−0.035	0.031
	Sig. (2-tailed)	0.480	0.534

Exhibit 5 | Productivity Gains & Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Reduced absenteeism	Pearson Correlation	0.132	0.113
	Sig. (2-tailed)	0.008	0.024
Reduced health and safety risks	Pearson Correlation	0.085	0.091
	Sig. (2-tailed)	0.076	0.130
Less claims made on health costs	Pearson Correlation	0.090	0.096
	Sig. (2-tailed)	0.071	0.055
Boosts creativity	Pearson Correlation	−0.012	0.017
	Sig. (2-tailed)	0.818	0.731
Higher morale	Pearson Correlation	0.087	0.093
	Sig. (2-tailed)	0.082	0.063

Exhibit 6 | Improved Internal Conditions and Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Improved indoor air quality	Pearson Correlation	0.003	−0.017
	Sig. (2-tailed)	0.946	0.731
Less complaints on comfort-related problems	Pearson Correlation	0.064	0.016
	Sig. (2-tailed)	0.200	0.743
User satisfaction	Pearson Correlation	0.040	0.041
	Sig. (2-tailed)	0.427	0.415
Users have more control over their environment	Pearson Correlation	0.039	0.024
	Sig. (2-tailed)	0.431	0.626

Exhibit 7 | Lower Risk and Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Lower risk of exposure to volatility in prices	Pearson Correlation	0.020	0.022
	Sig. (2-tailed)	0.696	0.666
Lower risk of exposure to resource availability	Pearson Correlation	0.146	0.141
	Sig. (2-tailed)	0.003	0.005
Reduced liability risks	Pearson Correlation	0.036	0.015
	Sig. (2-tailed)	0.472	0.763

Exhibit 8 | Higher Marketability and Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Better market distinction	Pearson Correlation	−0.015	−0.072
	Sig. (2-tailed)	0.771	0.153
Higher prestige	Pearson Correlation	−0.036	−0.091
	Sig. (2-tailed)	0.478	0.069

Exhibit 9 | Cost Savings and Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Water conservation	Pearson Correlation	0.445	0.547
	Sig. (2-tailed)	0.000	0.000
Energy efficiency	Pearson Correlation	0.673	0.691
	Sig. (2-tailed)	0.000	0.000
Lower services maintenance costs	Pearson Correlation	0.498	0.521
	Sig. (2-tailed)	0.000	0.000
Secure grants	Pearson Correlation	0.441	0.437
	Sig. (2-tailed)	0.000	0.000

Exhibit 10 | Higher Building Value & Willingness to Use Green Buildings

		I Would Occupy Green Building	I Would Invest In Green Building
Secure higher rents	Pearson Correlation	0.445	0.547
	Sig. (2-tailed)	0.000	0.000
Faster tenants lease-up	Pearson Correlation	0.673	0.691
	Sig. (2-tailed)	0.000	0.000
Valuation premiums	Pearson Correlation	0.498	0.521
	Sig. (2-tailed)	0.000	0.000

people laud the environmental benefits of green commercial buildings, these benefits do not hold enough inducement to make them invest in and/or occupy such buildings. Environmental benefits avail to all—a public good that no self-centered, profit-motivated individual is willing to pay for.

The only variable under productivity gains that is of statistical significance (at the 0.05 level) is ''reduced absenteeism.'' This factor (productivity gain) is virtually

of no statistical significance at the 0.05 level. The factor generally becomes of marginal statistical significance only when the level of significance is raised to 0.1. This could be attributed to the fact that people are skeptical of the effectiveness of green features in providing productivity gains. The complexity of human health and performance issues, the large range of human reactions to indoor environmental quality changes, and the large range of ways that improvements can show up make it difficult to attribute productivity gains solely to green buildings.

The statistical insignificance of ''improved internal conditions,'' though inconsistent with previous studies, may be understandable in the Singapore context as the impression that green buildings equate to more use of day lighting and less use of air-conditioning could cause respondents to fear that green buildings may lead to uncomfortable internal conditions. Similarly, the statistical insignificance of marketability is contrary to previous studies. However, the finding shows that the respondents are not easily swayed by ''branding'' and that a ''green'' rating may not be having the desired impact on commercial building users' decision-making.

Significant Green Benefits

The two benefits that are of statistical significance are: cost savings (Factor 4) and higher building value (Factor 5)—see Exhibits 9 and 10. It is worth noting that all the variables (i.e., green benefits) under both factors are statistically significant at the 0.05 level. In other words, both factors induce respondents to be willing to invest in and/or occupy green commercial buildings. It seems obvious from the above discourse that the only green benefits that hold sway on commercial building users in Singapore, and perhaps the world at large, are those benefits that are discernibly translatable into dollars and cents.

Potential Barriers to Green Buildings

Exhibit 11 reveals that the main barriers to the acceptance of green commercial buildings are price (mean rating 4.14), lack of interest (mean rating 3.79), lack of faith in effectiveness of green features (mean rating 3.97), reliability of using renewable energy sources (mean rating 3.83), and uncertain returns (mean rating 3.41). About 90% of the respondents consider price to be a great deterrent from choosing green building over conventional buildings. The respondents think that green buildings are more expensive than conventional ones. They are not willing to pay a premium for green features with no verifiable tangible benefits. Similarly, 72% of the respondents indicated a ''lack of interest'' as the overriding consideration for not choosing green buildings.

Furthermore, a large majority of the respondents (83%) do not have faith in the effectiveness of green features. Moreover, 74.8% and 54.8% of the respondents are concerned about the reliability of using renewable energy sources, and uncertain returns respectively. These may be due to the fact that there are no

Exhibit 11 | Potential Barriers to Success of Green Buildings

Likert Scale	1	2	3	4	5	Total
Price (Mean = 4.14)						
Frequency	0	0	41	261	98	400
Percentage	0.0	0.0	10.3	65.3	24.5	100
Lower than Expected Savings from Green Features (Mean = 3.08)						
Frequency	4	138	93	151	14	400
Percentage	1.0	34.5	23.3	37.8	3.5	100
Lack of Interest (Mean = 3.79)						
Frequency	2	36	74	222	66	400
Percentage	0.5	9.0	18.5	55.5	16.5	100
Lack of Faith in Effectiveness of Green Features (Mean = 3.97)						
Frequency	3	12	53	260	72	400
Percentage	0.8	3.0	13.3	65.0	18.0	100
Unwillingness to Change (Mean = 3.30)						
Frequency	14	74	106	191	15	400
Percentage	3.5	18.5	26.5	47.8	3.8	100
Limited Options (Mean = 3.01)						
Frequency	9	87	198	102	4	400
Percentage	2.3	21.8	49.5	25.5	1.0	100
Reliability of Renewable Energy Sources (Mean = 3.83)						
Frequency	2	23	76	238	61	400
Percentage	0.5	5.8	19.0	59.5	15.3	100
Uncertain Returns (Mean = 3.41)						
Frequency	4	70	107	195	24	400
Percentage	1.0	17.5	26.8	48.8	6.0	100

Note: The Likert scale is 1 (Not important) ...5 (Very important).

proven records on the effectiveness of green features. This may change over time if green features prove their effectiveness.

The respondents also specified other barriers that they believe to be important factors in holding them back from choosing green buildings. One factor is the unquantifiable nature of the benefits such as improved workers' productivity and user satisfaction. Such benefits are often perceived rather than measured and therefore subject to a much higher degree of uncertainty. Furthermore, some respondents highlighted that factors such as location and accessibility are still their primary consideration and whether the building has green features is of secondary concern.

Policy Implications: Is Sustainable Real Estate Development Sustainable?

A world that acknowledges and very much appreciates the virtues of green buildings is not swayed by these virtues to invest in and/or occupy green buildings. Even the highest ranking benefit of green buildings (environmental benefit) does not in any way induce ''consumers'' of commercial buildings to go green. The only two green benefits that statistically significantly tilt the will of ''consumers'' towards investment in and/or occupation of green buildings are ''cost savings'' and ''higher building value.'' Thus, only green benefits that can be quickly and verifiably translated into ''cash'' are of significance to decision-makers. The philosophy appears to be: ''the benefits must be in cash now or never as businesses are under pressure to perform (in terms of profit) now. Economics reign supreme in the business world. Medium to long term benefits are important but businesses must survive in the short term to enjoy the medium to long-term benefits.

Thus, the emphasis on quantifiable, verifiable monetary benefits of sustainable real estate development in the short term is understandable. This implies that all the hullabaloo about sustainable development would be just music to the ear unless the economic benefits are realizable in the short term too. People want to talk about it, get excited about it but are reluctant to ''commit'' to it. The short-term view of business (in terms of performance as measured by profitability) may seriously undermine sustainability of sustainable development unless it is satisfactorily addressed.

One way to tackle this issue may be for governments to offer tax and/or financial incentives over a period of about two to five years (instead of just one-off financial incentives, which have been found to be ineffective in endearing green buildings to consumers) to encourage people to invest in, and/or occupy green buildings. Such incentives could bolster the ''bottom line'' of business to make green buildings appealing to investors given customers' general unwillingness to pay premium rent for green features, the benefits of which are yet to be proven.

Furthermore, the most effective way to ensure the sustainability of sustainable real estate is to demonstrate, beyond reasonable doubt, that green benefits equate to monetary returns, not only in the medium to long term, but now. For example, actual cost savings from green buildings (Factor 4), which can be realized both now and in the future, and which have statistical influence on people's willingness to invest in/occupy green buildings should be collated and made known to consumers. This is very crucial as ''lack of interest'' and ''lack of faith in the effectiveness of green features'' to deliver the touted benefits are among the barriers to the acceptance and thus success of sustainable real estate development. The fact that ''price'' emerged as the barrier that is most prejudicial to the acceptance of green buildings implies that quantifiable, realizable economic benefits are the key to the sustainability of sustainable real estate development. Moreover, the perception that green buildings are more expensive than conventional buildings, vis-à-vis unquantifiable and uncertain green benefits,

underscores the need to turn green advocacy into economic advocacy. Competitive pricing of green buildings relative to conventional buildings could endear sustainable real estate to consumers.

According to the respondents, location and accessibility are their primary consideration in the choice of commercial buildings—green features are of secondary importance. This may imply that location and ''green features'' could be a winning combination. Thus, the way to promote sustainable real estate may be to provide green features (with government subsidies via tax and/or financial incentives) in existing commercial buildings in prime locations. In addition, it is necessary that all new undeveloped commercial sites in good locations (in particular but not exclusively) be developed as green commercial enclaves. To achieve this, it may be necessary for governments to make it mandatory for all new real estate developments to be ''green'' as sustainability is a survival imperative for mankind; and thus, should not be left solely to the whims and fancies of individuals.

Conclusion

The paper explores the market's perception of the benefits of green buildings and the impact of these benefits on commercial building users' willingness to occupy and/or invest in green buildings. Furthermore, the paper is aimed at ascertaining the factors that are militating against mass development of green buildings in Singapore. The results show that the respondents are very much aware of the benefits of green buildings. Environmental benefits are ranked first amongst the green benefits. However, awareness and appreciation of green benefits (apart from cost savings and higher building values) virtually have no influence on respondents' choice of commercial buildings as the benefits are considered to be remote, unquantifiable, and uncertain. Green buildings are, at the moment, suffering from ''credibility'' stigma in Singapore and perhaps, the whole world. Unless the credibility gap is quickly addressed, sustainable real estate may prove to be unsustainable. This may prove suicidal for mankind. Mankind is beset with a stark choice: To make sustainability work for its own survival, or to make it fail for its extinction in the long run. Mankind has vested interest in the success of sustainable real estate and thus, sustainable advocacy as a whole. To this end, there is an urgent need to grapple with the barriers to sustainable real estate to ensure its success.

The results of the study, among other things, offer some hope that success is achievable. The implications of Factors 4 and 5 (cost savings and higher building value) being statistically significant factors in commercial buildings users' willingness to invest in/occupy green buildings is that consumers are aware that green buildings are not merely environmentally and socially responsible alternatives, but that they also could be a prudent financially responsible business strategy to increase the economic bottom line. Developers may capitalize on this sentiment to develop sustainable commercial buildings in good locations at

competitive prices relative to existing conventional buildings. Such an initiative, coupled with empirical evidence to demonstrate to consumers the effectiveness of green features to deliver competitive monetary benefits, and government's financial and/or tax incentives to developers and investors in the short term to encourage green development could be pivotal in making sustainable real estate development sustainable.

Appendix
Questionnaire Survey

Part 1: Importance of Green Building's Benefits

How important is each of the following benefits as an attribute of Green Building? *(Please rank the factors according to the level of importance: 1 for least important to 5 for most important).*

		Not important (1)	Not so important (2)	Neutral (3)	Important (4)	Very important (5)
	Factors					
	Higher Building Value					
(1)	Secure higher rents	☐	☐	☐	☐	☐
(2)	Faster tenants lease-up	☐	☐	☐	☐	☐
(3)	Valuation premiums	☐	☐	☐	☐	☐
(4)	Better market distinction	☐	☐	☐	☐	☐
(5)	Higher prestige	☐	☐	☐	☐	☐
	Cost Savings					
(6)	Water conservation	☐	☐	☐	☐	☐
(7)	Energy efficiency	☐	☐	☐	☐	☐
(8)	Lower services maintenance costs	☐	☐	☐	☐	☐
(9)	Secure grants/subsidies	☐	☐	☐	☐	☐
(10)	Accelerates jurisdictional approvals	☐	☐	☐	☐	☐
	Lower Risks					
(11)	Lower risk of exposure to volatility in prices	☐	☐	☐	☐	☐
(12)	Lower risk of exposure to resource availability	☐	☐	☐	☐	☐
(13)	Reduced liability risks	☐	☐	☐	☐	☐
	Productivity Gains					
(14)	Reduced absenteeism	☐	☐	☐	☐	☐
(15)	Reduced health and safety risks	☐	☐	☐	☐	☐
(16)	Less claims made on health costs (e.g., medical and litigation costs)	☐	☐	☐	☐	☐

		Not important (1)	Not so important (2)	Neutral (3)	Important (4)	Very important (5)
(17)	Boosts creativity	☐	☐	☐	☐	☐
(18)	Higher morale	☐	☐	☐	☐	☐
(19)	Lower workforce turnover	☐	☐	☐	☐	☐
(20)	Improved indoor air quality for staff welfare	☐	☐	☐	☐	☐
(21)	Less complaints on comfort related problems	☐	☐	☐	☐	☐
(22)	User satisfaction	☐	☐	☐	☐	☐
(23)	Users have more control over their environment	☐	☐	☐	☐	☐
	Environmental					
(24)	Sustainability (Not to jeopardize future generations' needs)	☐	☐	☐	☐	☐
(25)	Less pollution	☐	☐	☐	☐	☐
(26)	To fight global warming	☐	☐	☐	☐	☐
(27)	Waste minimization	☐	☐	☐	☐	☐
(28)	Reduced societal costs of landfill creation and maintenance	☐	☐	☐	☐	☐
(29)	Minimized site impact (e.g. Sensitivity to site ecology and careful landscaping)	☐	☐	☐	☐	☐

Part 2: Willingness to Occupy Green Buildings

If the benefits I deem to be important are provided,

		Strongly disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly agree (5)
(30)	I would be an occupier of a green building	☐	☐	☐	☐	☐
(31)	I would pay premium for green features	☐	☐	☐	☐	☐
(32)	I would recommend green buildings to others	☐	☐	☐	☐	☐
(33)	I would invest in green buildings	☐	☐	☐	☐	☐

Part 3: Potential Barriers to the Growth of Green Buildings

What are the barriers that are holding you back from choosing green buildings over conventional properties? *(Please rank the following barriers according to the level of importance: 1 for Least important to 5 for Most important).*

		Not important (1)	Not so important (2)	Neutral (3)	Important (4)	Very important (5)
(34)	Price	☐	☐	☐	☐	☐
(35)	Cost savings from green features are lower than expected	☐	☐	☐	☐	☐
(36)	Lack of interest	☐	☐	☐	☐	☐
(37)	Lack of faith in effectiveness of green features	☐	☐	☐	☐	☐
(38)	Unwillingness to change	☐	☐	☐	☐	☐
(39)	Limited options in the market	☐	☐	☐	☐	☐
(40)	Reliability of using renewable energy sources	☐	☐	☐	☐	☐
(41)	Returns are uncertain	☐	☐	☐	☐	☐
(42)	Others, please specify:	☐	☐	☐	☐	☐

Part 4: Demographic Profile

43. Gender
☐ Female
☐ Male

44. Nationality
☐ Singaporean
☐ Singapore PR
☐ Others

45. Age Group
☐ 15–20
☐ 21–29
☐ 30–39
☐ 40–49
☐ 50–59
☐ 60–69
☐ Above 70

46. Qualifications
☐ Primary level/Secondary level
☐ Diploma
☐ ITE
☐ Degree
☐ Masters/ PhD
☐ Others

47. Occupation
    - ☐ Managerial/Professional
    - ☐ Executive
    - ☐ Administrative/Clerical
    - ☐ Sales Personnel
    - ☐ Self-employed
    - ☐ Retired
    - ☐ Others: please specify: _____

48. Monthly Income
    - ☐ < S$1000
    - ☐ S$1001–S$3000
    - ☐ S$3001–S$5000
    - ☐ S$5001–S$7000
    - ☐ > S$7000

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