The Pacific (Asia) Association of Quantity Surveyors

Motivational Factors & Benefits of Green Building Developments

Final Report

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Contents

1. Background

Sustainability is an inevitable trend. However, the number of green developments is still limited worldwide. Previous studies have attributed this to the influence of various factors, such as regional policies, green building assessment processes, integrative project management, individuals' perception on upfront costs, and so on (e.g., Chan et al., 2009; Bartlett and Howard, 2000). However, it is uncertain which factors are more critical in motivating or hindering sustainable developments. More importantly, in addition to the above mentioned business rationale and related social concerns, the performance and tangible benefits of green buildings are also uncertain. Hence, to foster sustainable development worldwide, there is an urging need to investigate the influencing factors, performance and tangible benefits related to green buildings in the AEC (Architectural, Engineering and Construction) sector. As such, the study aims to investigate the factors, performance and benefits of green buildings worldwide. To achieve this aim, the objectives of the study include:

- to identify the motivational and hindrance factors affecting green building developments; and
- to investigate performance and benefits of green building developments.

2. Systematic Literature Review

Based on the extensive literature review, factors affecting green building developments can be categorized into two main groups, namely industrial- and project-level factors.

2.1 Influencing Factors

2.1.1 Industrial-level factors

Sustainability Climate

Though facing criticisms for years, the linear supply chain approach is still dominating the AEC industry. Under this approach, clients are the key in initiating any innovation or changes (Manley, 2006). Although there are certain levels of awareness and interests in green developments in the construction sector (Abidin, 2010; Abidin and Powmya, 2014), various studies have indicated that the current social awareness and perception are insufficient for fostering sustainable developments in the industry (e.g., Liu and He, 2011 William and Dair, 2007; Zhang, 2014). Clients' leadership and demand for green are also found to be inadequate (Griffin, 2010; Zhang, 2014). In general, sustainable developments are perceived as more expensive, requiring workers with higher-level competencies, and higher technological know-how (e.g., Simpeh, 2015). These risk perceptions hinder AEC firms from developing sustainably (Du Plessis et al., 2002).

Sustainability Policies

Governments around the world have launched various green policies to encourage sustainable developments in the AEC sector. However, success of these policies depends on four key factors.

Firstly, a comprehensive policy package is essential in fostering full-cycle sustainability. For instance, the sustainable policy in Australia has been criticized for putting too much emphasis on energy efficiency, while lacking consistent focus on systematic green construction (Yang and Yang, 2015). Secondly, complexity of codes and regulations may also affect developers' decision-making for sustainability. For instance, previous studies revealed that developers have encountered difficulties in estimating the initial costs of a green building project, due to the complex codes and regulations (e.g., Hwang and Tan, 2012). Thirdly, fiscal incentives to promote green buildings, such as taxes benefits, rebates and discount on application fee, can also be critical (Olubumi, 2014). In view of the high initial cost and long payback period of sustainable developments (Li, Yang, He and Zhao, 2014), fiscal incentives have been considered as inadequate in motivating developers to invest in sustainable developments (Olubunmi, 2014). Fourthly, non-fiscal incentives for green buildings, such as technical assistance, expedited permitting, business planning assistance, market assistance, etc., have also been commented as inadequate (Olanipekun et al., 2016; Olanipekun et al., 2017).

Green Building Assessment Processes & Methods

In recent decades, various schemes are developed for green building assessment and certification worldwide. Commonly adopted green building assessment systems include LEED (Leadership in Energy and Environmental Design), BEAM (Building Environmental Assessment Method), BREEAM (BRE Environmental Assessment Method), GBCA (Green building council of Australia Green Star), Green Mark Scheme, DGNB (The German Sustainable Building Council) system, CASBEE (Comprehensive Assessment System for Building Environment Efficiency), and so on (Zuo and Zhao, 2014). Their common focuses are on energy efficiency, indoor environment quality, and environmental impacts (Zhang, 2018).

Although these assessment schemes have different objectives and assessment scopes, they are similar in terms of assessment framework. Using a score-based rating system, different points are assigned to different checklist elements. The sum of the total element score indicates the sustainability level of a building (Retzlaff, 2008). However, developed based on different regional situations and needs, element weighting differs across schemes. For instance, the weight of water is 10% in assessment scheme adopted in Northern Territory; while it is 15% in assessment scheme adopted in Queensland (Zuo and Zhao, 2014). There is uncertainty about which, or any, of these scheme(s) can accurately reflect how sustainable a building project is (Suzer, 2014).

On the other hand, some of the green building assessment processes have been commented as too rigorous and too time-demanding, which act as barriers for developers to join the schemes (Chan, Qian and Lam, 2009; Hes, 2007). For instance, LEED is one of the most popular green building assessment schemes in the world. However, it has been commented as too complex, challenging and time consuming (Ding, 2007).

2.1.2 Project-level Factors

Project Management in Green Building Developments

Project sustainability starts with managing or engineering stakeholders' values and a principled approach to manage green performance throughout the project lifecycle. Previous studies have indicated that early incorporation of sustainability issues in value management can reduce capital costs of a green project (Bartlett and Howard, 2000). When comparing with conventional projects, green building projects demand more new knowledge from multi-disciplinary project parties, more project meetings are thus required to foster knowledge exchange and advanced problem solving (Hwang and Ng, 2013). Communication and collaboration have been identified as key successful factors in green building developments (Rohracher, 2001; Zhang, 2014). In addition, previous studies have indicated that the approval process for green feature is generally longer (Hwang and Ng, 2013). This puts an additional burden on time management in green building projects.

Green Knowledge and Information

Knowledge and information in green designs, building systems, construction methods, products, and so on, are the keys to successful green developments. However, previous studies have indicated that there is still a lack of knowledge and information regarding green products, building systems, and cost data in the AEC sector (e.g., Hwang and Tan, 2012). Professional education and training on sustainable development have also been criticized as insufficient in the sector (Ying Liu, Pheng Low, and He, 2012; Yang and Yang, 2015). Due to the lack of green knowledge, firms are conservative in adopting green products, technologies or methods; and they tend to encounter more difficulties in green projects (Zhang, 2014). As such, there is a strong need of demonstration projects to promote and showcase any efficient green technologies and construction methods in the sector (Chan et al, 2009; Potbhare et al., 2009). On the other hand, cost data, including both capital and operation costs, are the key to motivate developers to invest in sustainability. Therefore, it is suggested that different cost estimation methods should be applied to fully understand the economic benefits of green buildings (Nguyen et al., 2017).

Perceived Risks

Due to the various factors mentioned above, green projects are considered to have higher risks in terms of project cost, time and quality. For instance, the project may fail to get a green certification and/or fail in achieving a higher return after investment is made (Nguyen et al., 2017; Yang and Yang, 2015). Due to the higher complexity in green building projects, delay may occur due to prolonged certification and permission processes (Simpeh, 2005), and more alterations and variations may arise during the construction stage (Hwang and Ng, 2013). These risk perceptions hinder AEC firms from attaining sustainability (Du Plessis et al., 2002).

2.2 Outcomes of Green Building Developments

2.2.1 Tangible Outcomes

Even though the concept of "green costs more" has been prevailing in the AEC sector in the past decades (e.g., Bartlett and Howard, 2000), previous studies indicate that green buildings can result in higher rents and asset values (e.g., Eichholtz, Kok and Quigley, 2013; Wiley, Benefield and Johnson, 2010). In fact, a large amount of buildings, commercial buildings in particular, in metropolitan cities like Hong Kong are owned and managed by developers and occupied by tenants. For these properties, rental rate acts as an important economic factor affecting developers' decision-making for sustainability. Previous studies have found that green buildings can attract more anchor tenants and international tenants (Smit and Toit, 2015), while commercial tenants are more willing to pay higher rent for green buildings (Eichholtz, Kok and Quigley, 2013). Meanwhile, in view of the lower operational costs, commercial tenants in green buildings are found to be more loyal (Smit and Toit, 2015). The higher economic return may motivate developers to invest in green building developments.

2.2.2 Intangible Outcomes

Along with the increasing social awareness towards sustainability, more and more AEC firms see a huge market potential for green developments. For instance, integrating green ideas into construction projects has found to help generate free publicity and media coverage opportunities for AEC firms (Smit and Toit, 2015), which can enhance a company's brand equities (Abidin and Powmya, 2014; Smit and Toit, 2015). Meanwhile, previous studies have also indicated that green experience can help firms in taking a leading position in the AEC market (e.g., in the Chinese AEC market, Jung, Sui and Xi, 2012). In general, creation of a green company image through investments in green buildings can result in more future project opportunities (Abidin and Powmya, 2014; Nurul and Abidin, 2013). In addition to market positioning at firm-level, green building design and construction have also been found to have different impacts on project-level outcomes, such as environmental sustainability, like energy and water consumption (e.g., Oates and Sullivan, 2011), and social sustainability, like health and safety (Rajendran et al., 2009).

3. Survey Design

Based on the above literature review, key factors influencing green developments are identified. The survey is then designed to measure all these factors, using well-validated measurement instruments as indicated in Table 1 (refer to Appendix for the full survey). A 5-point likert measurement scale is adopted, in which respondents are invited to indicate their degree of agreement to each statement by 'strongly disagree', 'disagree', 'neutral', 'agree', and 'strongly agree'.

Table 1 Survey Design Framework

Factors	Key References
Industrial Factors	
Sustainability climate	Griffin et al., 2010, Zhang, 2014
Sustainability policies	Yang and Yang, 2015
Green building assessment processes and methods	Abidin and Powmya, 2014, Hwang and Tan, 2012, Shen et al., 2017
Project Factors	
Project management	Chan et al., 2009, Griffin et al., 2010, Hwang and Ng, 2013, Jung, Sui, and Xi, 2012, Yang and Yang, 2015, Zhang, 2014, Zhang et al., 2012
Green knowledge and information	Chan et al., 2009, Hwang and Ng, 2013, Hwang and Tan, 2012, Potbhare et al., 2009, Simpeh and Smallwood, 2015, Yang and Yang, 2015, Zhang, 2014, Zhang et al, 2012
Perceived Risks	Hwang and Ng, 2013, Simpeh, 2015, Yang and Yang, 2015, Zhao et al., 2016
Outcomes /Benefits	
Marketing benefits	Abidin and Powmya, 2014, Jung, Sui, and Xi, 2012, Nurul and Abidin, 2013, Smit and Toit, 2015
Project benefits	Smit and Toit, 2015
Changes in time, cost and income	-

4. Sample

A purposive sampling method is adopted, in which only AEC professionals who have been involved in green project(s) in the previous two years are invited to complete the survey. Invitations are mainly sent with the support of the Pacific (Asia) Association of Quantity Surveyors (PAQS) and the Hong Kong Institute of Surveyors (HKIS), and through the personal network of the project team members. In total, 62 responses are received. The followings show the preliminary demographic information of the respondents. The majority of the respondents are from developers (34%), followed by contractors (16%), green building consultant (15%), QS consultant (10%), and design firm (6%) (refer to Figure 1). Meanwhile, respondents are from different professional disciplines, including quantity surveying (18%), project management (18%), building surveying (13%), building services engineering (13%), structural engineering (5%), and general practice surveying (3%) (refer to Figure 2). More than 60% of the green projects are located in Mainland China (refer to Figure 3). There are 44% of public projects, 37% of private projects, and 19% of semi-public projects (refer to Figure 4). Green Star is the most highly adopted green building assessment scheme (24%), followed by BEAM Plus (20%), LEED (17%), and BREEAM (14%) (refer to Figure 5).

Figure 1 Respondents' Organization

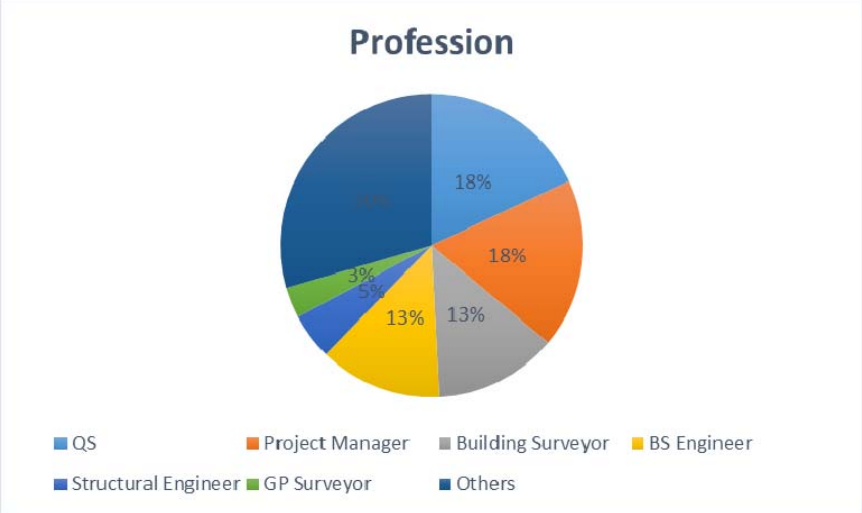

Figure 2 Respondents' Professional Disciplines

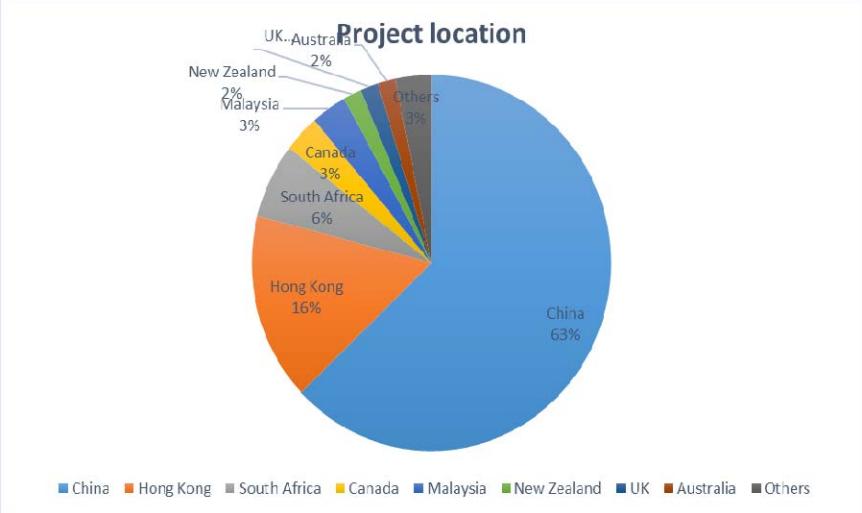

Figure 3 Project Location

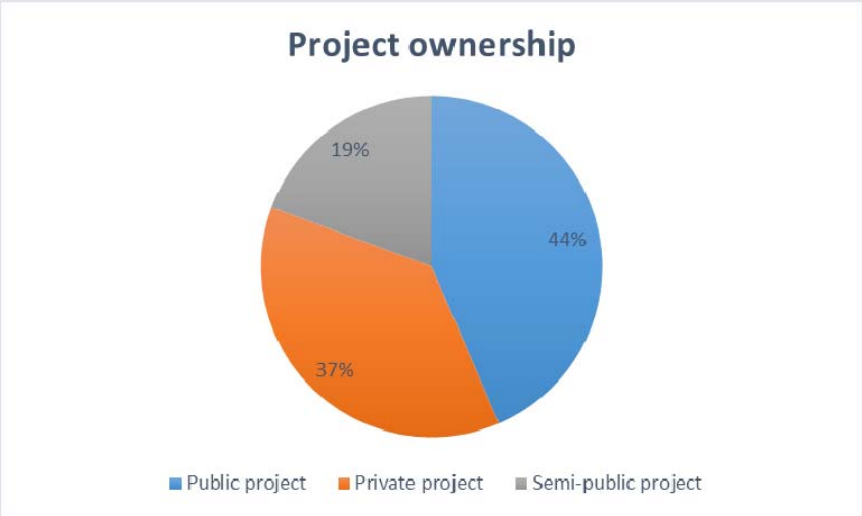

Figure 4 Project Ownership

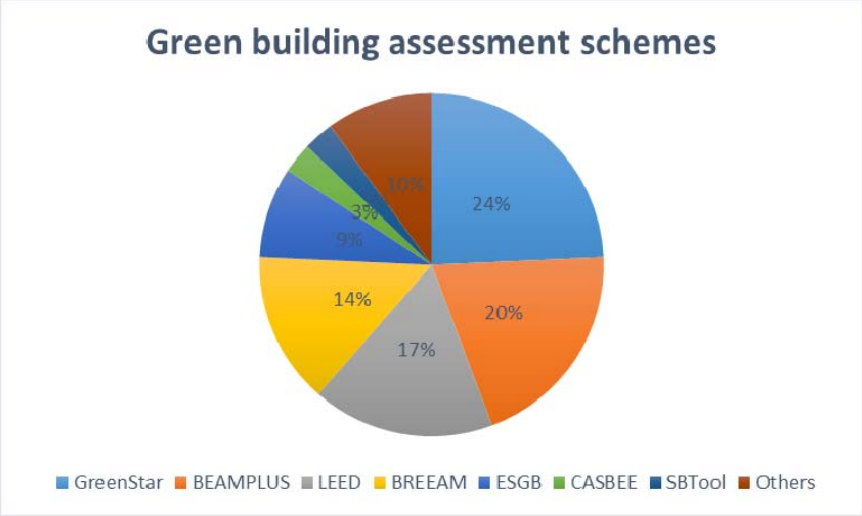

Figure 5 Green Building Assessment Schemes

5. Findings

5.1 Factors affecting Green Building Projects

5.1.1 Industrial-level Factors

There are three groups of industrial factors categorized in the study, namely sustainability climate, sustainability policy and green building assessment (refer to Figures 6-8). Respondents were invited to rate their degree of agreement towards statements related to these areas using a 5-point Likert scale in the survey, in which 1 refers to strongly disagree, 3 refers to neutral, and 5 refers to strongly agree.

As shown in Figure 6, mean scores of all of the three items related to sustainability climate are above 3, while the two items related to "insufficient consumers' demands for green" and 'lack of

atmosphere to pursue green' receive the highest score ($\bar{x}$ = 3.51 out of 5 for both of the items; SD = 0.994 and 1.043 respectively).

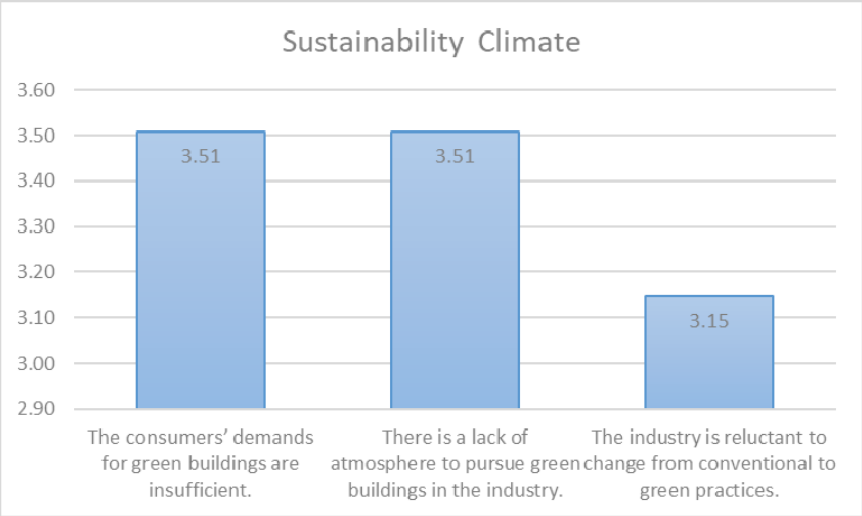

Figure 6 Sustainability climate in the industry

With reference to Figure 7, mean scores of all of the four items related to sustainability policy are above 3. The two items related to 'insufficient fiscal and non-fiscal incentives from the government' receive the highest score ($\bar{x}$ = 3.92 out of 5 and 3.80 out of 5; SD = 0.822 and 0.997 respectively).

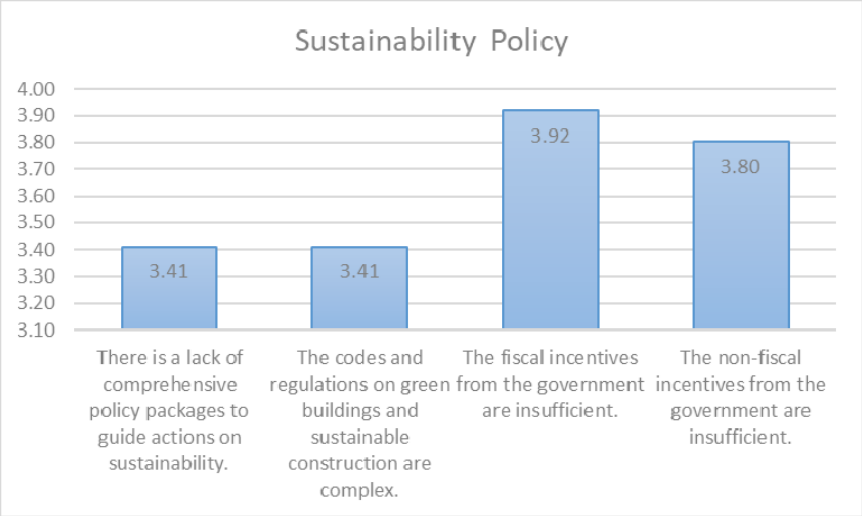

Figure 7 Sustainability Policy

As shown in Figure 8, mean scores of all of the four items related to green building assessment schemes and methods are above 3. The item related to 'green building assessment method being time-consuming' receive the highest score ($\bar{x}$ = 3.41 out of 5; SD = 1.131).

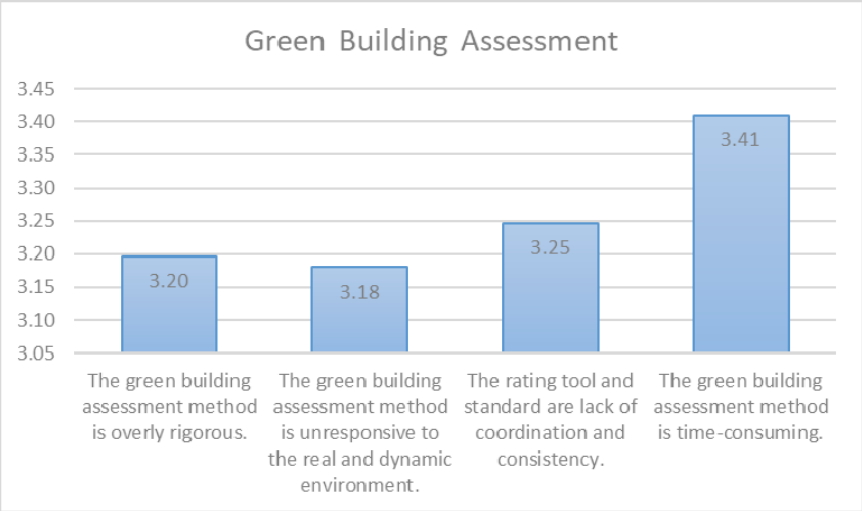

Figure 8 Green Building Assessments

5.1.2 Project-level Factors

There are four groups of project-level factors categorized in this study, namely good project management practice, hindering project management practice, lack of knowledge, and perceived risks (refer to Figures 9-12). Similar to the industrial section, respondents were invited to rate their degree of agreement towards the related statements using a 5-point Likert scale, in which 1 refers to strongly disagree, 3 refers to neutral, and 5 refers to strongly agree.

As shown in Figure 9, mean scores of all of the four items related to good project management practices in green projects are above 3, while the two items related to 'clear green goal setting at project inception' ($\bar{x}$ = 3.97 out of 5; SD = 0.706) and 'proactive value management for green design' receive the highest scores ($\bar{x}$ = 3.84 out of 5; SD = 0.820).

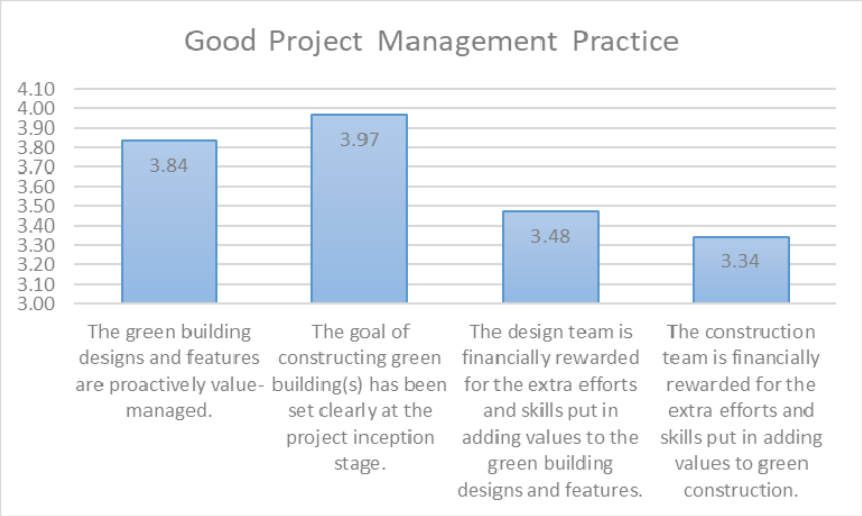

Figure 9 Good Project Management Practice

As shown in Figure 10, mean scores of all of the 5 items related to hindering project management practices in green projects are above 3, while the three highest-score items include 'more meetings required for green projects' ($\bar{x}$ = 3.87 out of 5; SD = 0.922), 'lengthy approval process for new green technologies and recycled materials' ($\bar{x}$ = 3.74 out of 5; SD = 0.929) and 'lack of communication and collaboration between stakeholders' ($\bar{x}$ = 3.69 out of 5; SD = 1.057).

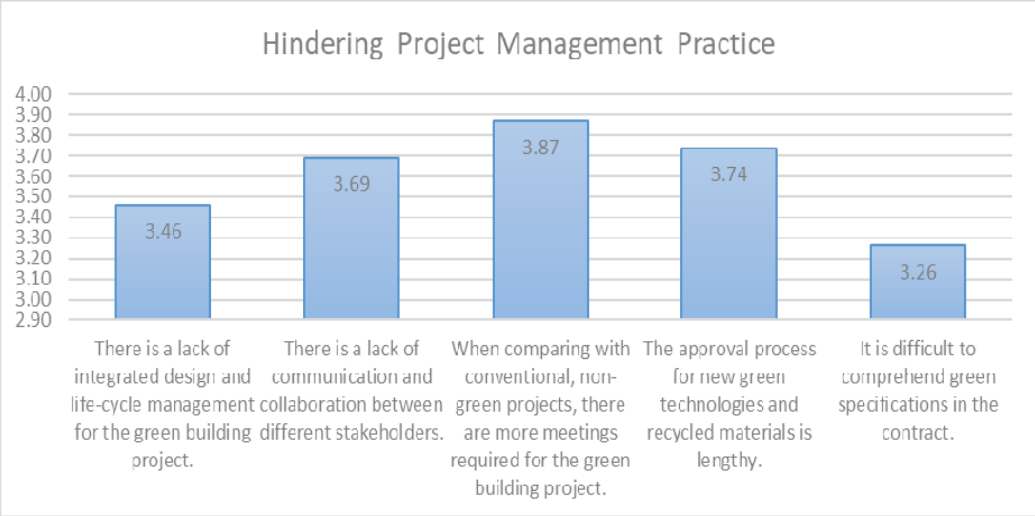

Figure 10 Hindering Project Management Practice

As illustrated in Figure 11, mean scores of all of the 6 items related to lack of green knowledge, data, and information are above 3, while the item related to 'different methods of cost estimation' scores the highest ($\bar{x}$ = 3.98 out of 5; SD = 0.695), followed by 'lack of green demonstration projects' ($\bar{x}$ = 3.37 out of 5; SD = 1.012) and 'inadequate cost-benefit analysis of green buildings' ($\bar{x}$ = 3.61 out of 5; SD = 1.005).

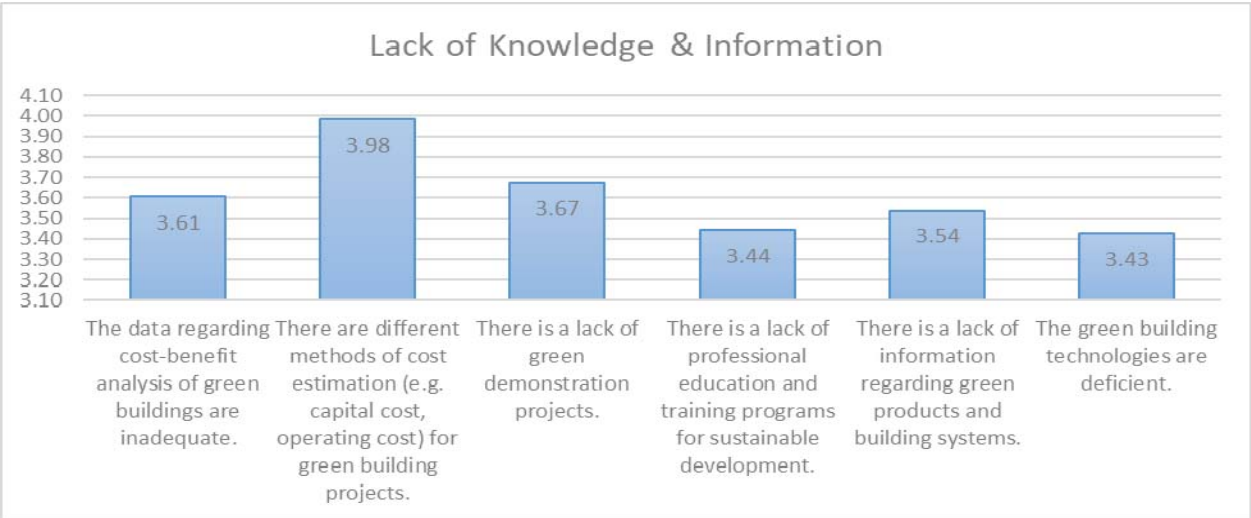

Figure 11 Lack of Knowledge & Information

As illustrated in Figure 12, mean scores of all of the 5 items related to perceived risks in green projects are above 3, while the item related to 'technical difficulties in green design' receives the highest score ($\bar{x}$ = 3.67 out of 5; SD = 1.012), followed by 'technical difficulties in green construction' ($\bar{x}$ = 3.66 out of 5; SD = 0.998) and 'higher project investment risks' ($\bar{x}$ = 3.56 out of 5; SD = 1.041).

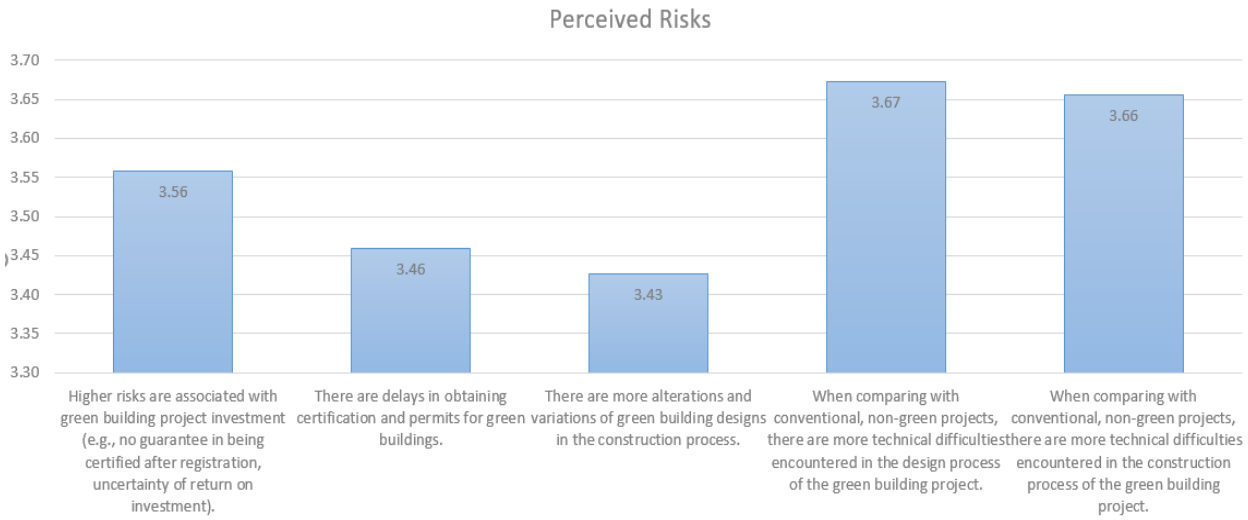

Figure 12 Perceived Risks

Overall, the three ***fostering*** items score the highest are 'clear green goal setting at project inception' ($\bar{x}$ = 3.97 out of 5; SD = 0.706), 'proactive value management for green design' ($\bar{x}$ = 3.84 out of 5; SD = 0.820), and 'financial rewards for the extra effort put by design team' ($\bar{x}$ = 3.48 out of 5; SD = 1.010), while the three ***hindering*** items score the highest are 'different cost estimation methods' ($\bar{x}$ = 3.98 out of 5; SD = 0.695), 'insufficient fiscal incentives from government' ($\bar{x}$ = 3.92 out of 5; SD = 0.822), and 'more meetings required for green projects' ($\bar{x}$ = 3.87 out of 5; SD = 0.922).

5.2 Tangible and Intangible Outcomes of Green Building Projects

5.2.1 Tangible Outcomes

In this section, tangible project outcomes in terms of cost, income and time are analyzed (refer to Figures 13-15). Respondents were invited to compare their green building projects with conventional ones, and indicate whether there was an 'increase', 'decrease' or 'no change' in the cost, income and time dimensions.

As shown in Figure 13, when comparing their green building projects with conventional ones, nearly 68% of the respondents experienced an increase in construction cost, followed by 27.4% of them experienced no change, and 3.2% of them experienced a decrease. For life cycle cost,

there is no big difference on the percentage of the respondents who experienced a decrease (29%), increase (33.9%) or no change (35.5).

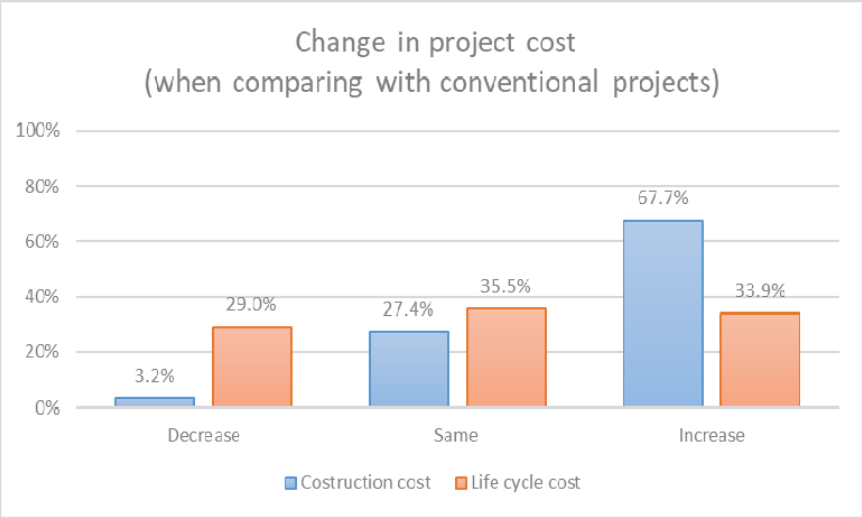

Figure 13 Change in Project Cost (when comparing with conventional projects)

As illustrated in Figure 14, when comparing with conventional projects, more than half of the respondents experienced an increase in selling price (53%), rental price (56.5%), and premium in market valuation (54.8%) in their green projects. While there are not many respondents who have experienced a decrease in these three income levels (<3.5), around 40% of the respondents experienced no change.

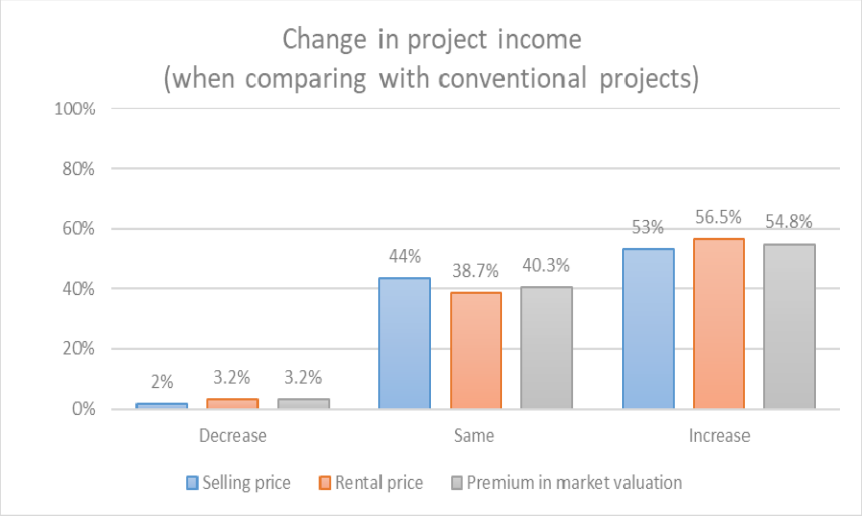

Figure 14 Change in Project Income (when comparing with conventional projects)

With reference to Figure 15, when comparing with conventional projects, more than half of the respondents experienced an increase in design time (53.2%) in their green projects, followed by

no change (41.9%) and a decrease (3.2%). In terms of construction time, half of the respondents experienced no change (50%), followed by an increase (45.2%) and a decrease (3.2%). For payback period, the majority of the respondents experienced no change (40.3%), followed by an increase (38.7%) and a decrease (19.4%).

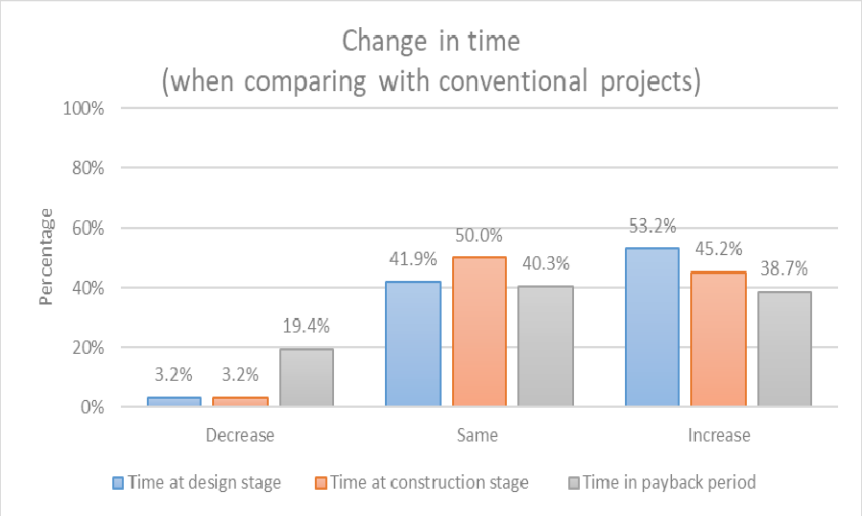

Figure 15 Change in Time (when comparing with conventional projects)

The magnitude of change in the above cost, income and time dimensions are illustrated in Figure 16. On average, when comparing with conventional projects, the construction cost, life cycle cost, design time, construction time and payback period of green projects are found to have increased by 11.8%, 0.9%, 8.0%, 4.5% and 3.3% respectively. However, the selling price, rental price and market premium of these green projects have also increased by 4.4%, 4.6% and 6.0%.

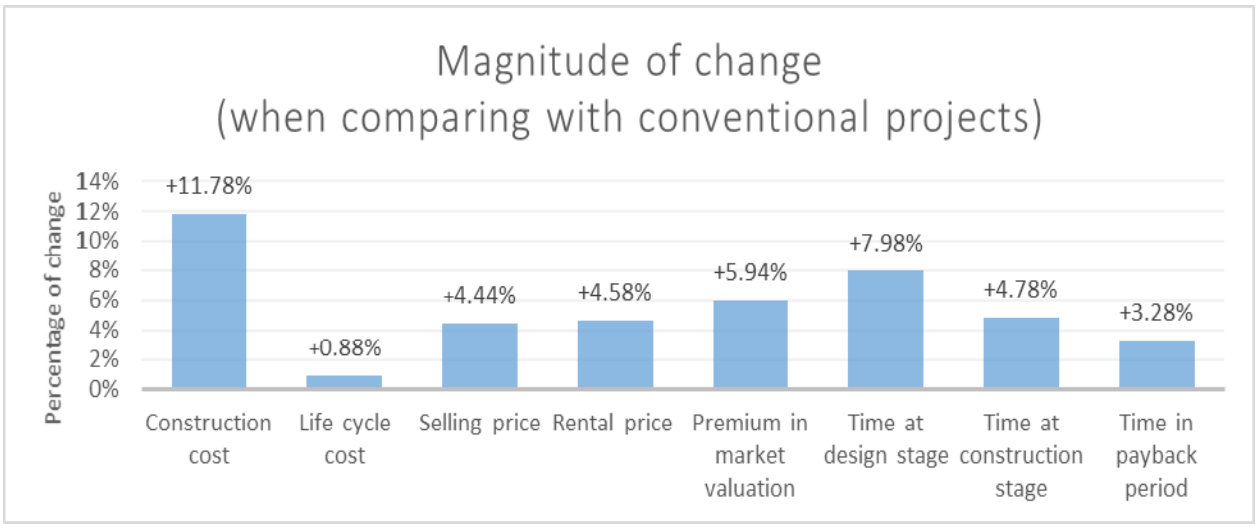

Figure 16 Magnitude of Change

5.2.2 Intangible Outcomes

There are two types of intangible benefits identified, namely perceived marketing benefits and perceived project benefits (refer to Figures 17-18). Respondents were invited to rate their degree of agreement towards statements related to these areas using a 5-point Likert scale in the survey, in which 1 refers to strongly disagree, 3 refers to neutral, and 5 refers to strongly agree.

As shown in Figure 17, mean scores of all of the three items related to perceived marketing benefits are above 3, while the highest score item is 'more opportunities for future projects' ($\bar{x}$ = 4.08 out of 5; SD = 0.759), followed by 'free publicity and media coverage' ($\bar{x}$ = 4.03 out of 5; SD = 0.816) and 'leading position in the industry' ($\bar{x}$ = 3.89 out of 5; SD = 0.819).

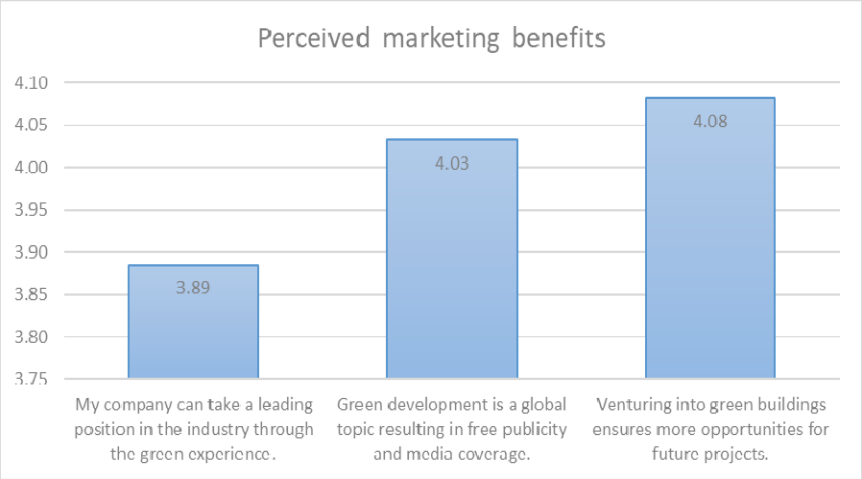

Figure 17 Perceived Marketing Benefits

With reference to Figure 18, mean scores of all of the four items related to perceived project benefits are above 3, while the highest score item is 'environmental sustainability' ($\bar{x}$ = 3.98 out of 5; SD = 0.785), followed by 'social impacts' ($\bar{x}$ = 3.95 out of 5; SD = 0.884) and 'project schedule' ($\bar{x}$ = 3.84 out of 5; SD = 0.637).

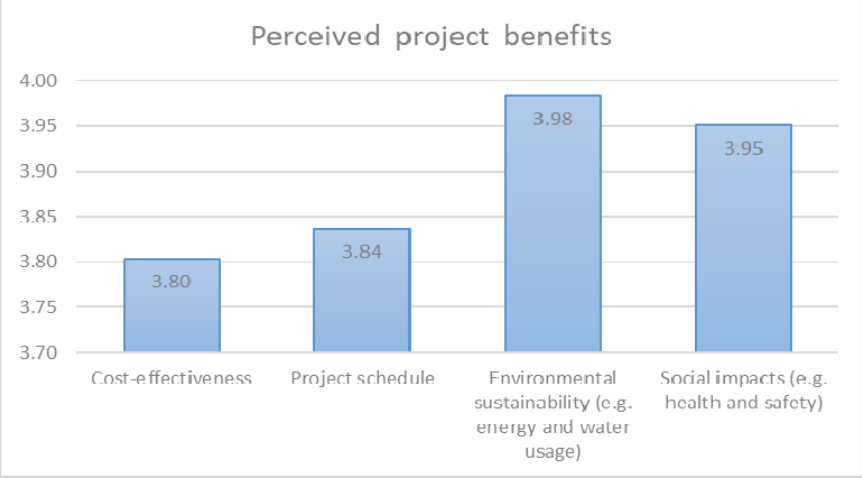

Figure 18 Perceived Project Benefits

5.3 Regression Modelling for the Predicting Effects of Project- and Industrial-level Factors on Project Outcomes

To further investigate the predicting effects of project-level factors and industrial-level factors on project outcomes, multiple regression modelling was conducted. First of all, all project-level factors are inputted into the model as independent variables, and cost performance is put as dependent variable. As shown in Model 1 (refer to Table 2), 'extra financial rewards to construction team' is found to predict project cost performance significantly ($p<0.01$). The model explains 16.6 percent of variance to cost performance. The process is then repeated, with all project-level factors being inputted as independent variables and with time performance, environmental sustainability performance, social sustainability performance and marketing benefits being inputted as dependent variable in different models (refer to Models 2-5 in Table 2).

As shown in Model 2, 'extra financial rewards to design team' is found to predict project time performance significantly ($p<0.01$). The model explains 12.7 percent of variance to time performance. For Model 3, 'extra financial rewards to construction team', 'proactive value management' and 'clear green goal setting in project inception' are found to predict environmental sustainability performance significantly ($p<0.01$). The model explains 46.9 percent of variance to time performance. Then, for Model 4, 'extra financial rewards to construction team' and 'clear green goal setting in project inception' are found to predict social sustainability performance significantly ($p<0.05$). The model explains 22.7 percent of variance to time performance. Then, Model 5 indicates that 'clear green goal setting in project inception' and 'deficient green building technologies' predict marketing benefits of a company significantly ($p<0.01$). The model explains 38.5 percent of variance to time performance.

Table 2 Regression modelling for the predicting effects of project-level factors on green project outcomes

Model	Dependent variables	Independent variables	Beta		t	Sig.	R	R^2	Sig. (ANOVA)
			UnSTD	S.E.					
1	Cost Performance	(Constant)	2.761	.319	8.659	.000	.408	.166	.001
		Extra financial rewards to construction team	.312	.091	3.430	.001			
2	Time Performance	(Constant)	3.055	.278	11.007	.000	.356	.127	.005
		Extra financial rewards to design team	.225	.077	2.928	.005			
3	Environmental Sustainability Performance	(Constant)	2.452	.494	4.966	.000	.685	.469	.000
		Extra financial rewards to construction team	.407	.079	5.120	.000			
		Proactive value management	-.411	.104	-3.960	.000			
		Clear green goal setting in project inception	.441	.115	3.847	.000			
4	Social Sustainability Performance	(Constant)	1.678	.605	2.773	.007	.476	.227	.001
		Extra financial rewards to construction team	.259	.100	2.586	.012			
		Clear green goal setting in project inception	.355	.151	2.357	.022			

Table 2 Regression modelling for the predicting effects of project-level factors on green project outcomes (con't)

Model	Dependent variables	Independent variables	Beta		t	Sig.	R	R^2	Sig. (ANOVA)
			UnSTD	S.E.					
5	Perceived marketing benefits	(Constant)	4.044	1.338	3.022	.004	.620	.385	.000
		Clear green goal setting in project inception	1.537	.292	5.263	.000			
		Deficient green building technologies	.543	.201	2.696	.009			

Then, regression modelling is applied to investigate the predicting effects of industrial-level factors on green project outcomes. Similarly, all industrial-level factors are inputted as independent variables, while different outcome factors are put as dependent variable in each model (refer to Models 6-8 in Table 3). As shown in Model 6, 'lack of comprehensive policy packages' is found to predict project cost performance significantly ($p<0.01$). The model explains 11.5 percent of variance to cost performance. Then, Model 7 reveals that 'lack of comprehensive policy packages' predicts time performance significantly ($p<0.05$). The model explains 6.7 percent of variance to time performance. Lastly, Model 8 shows that 'insufficient fiscal incentives from government' predicts perceived marketing benefits significantly ($p<0.01$). The model explains 13.7 percent of variance to perceived marketing benefits.

Table 3 Regression modelling for the predicting effects of industrial-level factors on green project outcomes

Model	Dependent variables	Independent variables	Beta		t	Sig.	R	R^2	Sig. (ANOVA)
			UnSTD	S.E.					
6	Cost Performance	(Constant)	2.884	0.346	8.329	.000	.339	.115	.007
		Lack of comprehensive policy packages to guide sustainability actions	.270	0.097	2.770	.007			
7	Time Performance	(Constant)	3.287	.279	11.792	.000	.258	.067	.044
		Lack of comprehensive policy packages to guide sustainability actions	.161	.078	2.054	.044			
8	Perceived marketing benefits	(Constant)	11.296	1.588	7.113	.000	.370	.137	.003
		Insufficient fiscal incentives from government	1.213	.397	3.057	.003			

The predicting effects of both project-level and industrial-level factors on green building project outcomes are summarized and illustrated in Figure 19 as shown below.

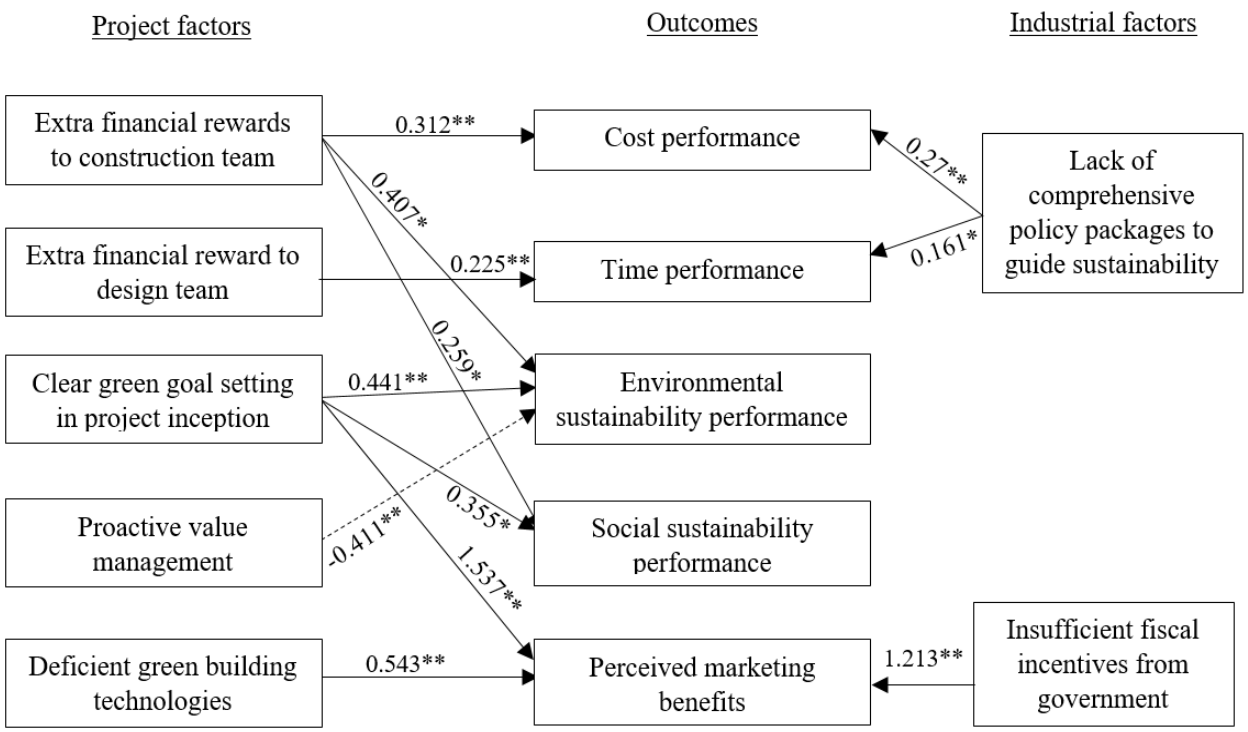

Figure 19 Statistical model showing the predicting effects of project- and industrial-level factors on perceived green project outcomes

Note: - ⟶ Positive predicting effect as revealed in regression analysis (refer to Tables 2-3)
- - -▶ Negative predicting effect as revealed in regression analysis (refer to Table 2)

6. Limitations

It is acknowledged that the sample size of this study is limited and the majority of projects are located in Mainland China. A larger sample size collected from more evenly distributed regions would enhance the reliability and representativeness of the study results. However, it should be noted that the survey respondents in this study are all AEC professionals who have primary experience in green projects and thereby are able to provide reliable data to the study. Meanwhile, a good balance between public and non-public projects, and between respondents from different types of firms are achieved. Lastly, the measurement scales adopted in this study were identified from an extensive literature review, in which they have been validated in previous studies. Therefore, despite the limitations, the evidences collected in this study provides a reliable platform for investigating the influencing factors and outcomes of green building projects.

This study adopts a quantitative approach, i.e., questionnaire survey, which aims to establish 'what' the general phenomenon, in terms of influencing factors, performance and benefits of

green projects, are. To further develop in-depth understandings of 'how' and 'why' such phenomenon happened, qualitative approaches, such as case study and focus group interviews, are proposed for further studies. Cross validation can then be done by comparing the results of both qualitative and qualitative studies.

7. Closing Remarks

Even though green projects are found to incur higher cost and longer time, when comparing with conventional ones, they can result in higher selling price (+4.44%), rental price (+4.58%) and premium in market valuation (+5.94%). In addition to these tangible benefits, green projects are also found to contribute to better market positioning of a company. For instance, company with green experience can take a leading position in the industry, they can also ensure more opportunities for future projects; and green development projects can result in free publicity and media coverage for a company as well. Furthermore, besides enhancing time- and cost-efficiencies, green projects can also result in better project performance in terms of environmental and social sustainability. In fact, these intangible benefits can indirectly enhance tangible benefits of a firm in the long run.

Building on previous studies investigating various factors affecting sustainable developments around the world, this study identified 3 industrial-level factors, namely sustainability climate, sustainability policy, and green building assessment methods, and 4 project-level factors, namely good project management practice, hindering project management practice, lack of knowledge and information, and perceived risks. To provide empirical support on their roles on green project outcomes, i.e., fostering vs. hindering; this study takes a step further to adopt regression modeling for investigating the predicting effects of these factors on the outcomes in terms of project cost, project time, environmental sustainability, social sustainability and marketing benefits. Based on the findings of the regression analyses (refer to Figure 19), the following recommendations are made to enhance outcomes and benefits of green projects:

- Provide financial rewards to the construction team for their extra efforts and skills put in adding values to green construction (→ enhance performances in cost, environmental sustainability & social sustainability)
- Provide financial rewards to the design team for their extra efforts and skills put in adding values to green building designs and features (→ enhance time performance)
- Set the goal for green design and construction clearly at the project inception stage (→ enhance environmental sustainability, social sustainability, and marketing benefits)
- Include a clear goal for environmental sustainability in proactive value management (→ enhance environmental sustainability performance)
- Be early adopter /pioneer in the industry, i.e., go for sustainability even when green technologies are still deficient and when there is still insufficient fiscal incentives from the government (→ enhance company's marketing benefits)

- Prevent overly rigorous policy packages to guide actions on sustainability (→ enhance project performance in terms of cost and time)

8. Acknowledgement

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9. References

Abidin, N. Z. (2010). Investigating the Awareness and Application of Sustainable Construction Concept by Malaysian Developers. *Habitat International*, *34*4), 421-426. doi: 10.1016/j.habitatint.2009.11.011.

Abidin, N. Z., & Powmya, A. (2014). Perceptions on Motivating Factors and Future Prospects of Green Construction in Oman. *Journal of Sustainable Development*, *7*5). doi: 10.5539/jsd.v7n5p231.

Bartlett, E., & Howard, N. (2000). Informing the Decision Makers on The Cost and Value of Green Building. *Building Research and Information*, 285-6), 315-324.

Bordass, W., (2000) Cost and value: fact and fiction, *Building Research and Information,* 285-6), Taylor & Francis Ltd. London, 338-352.

Chan, E. H., Qian, Q. K., & Lam, P. T. (2009). The market for green building in developed Asian cities—the perspectives of building designers. *Energy Policy*, 378), 3061-3070.

Cole, R.J., (2000). Editorial: Cost and Value in Building Green. *Building research and information*, 28 5/6), 304–309.

Ding, G. (2008). Sustainable Construction—The Role of Environmental Assessment Tools. *Journal of Environmental Management*, *86*3), 451-464. doi: 10.1016/j.jenvman.2006.12.025.

Dodge Data & Analytics. (2016). *World Green Building Trends 2016* [Ebook]. Dodge Data and Analytics. Retrieved from https://www.worldgbc.org/sites/default/files/World%20Green%20Building%20Trends%202016%20SmartMarket%20Report%20FINAL-2.pdf.

Du Plessis, C. (2007). A Strategic Framework for Sustainable Construction in Developing Countries. *Construction Management and Economics*, *25*1), 67-76.

Eichholtz, P., Kok, N., & Quigley, J. (2013). The Economics of Green Building. *Review of Economics and Statistics*, *95*1), 50-63. doi: 10.1162/rest_a_00291.

Gov.HK (2018). Green Buildings. Retrieved from https://www.gov.hk/en/residents/environment/sustainable/buildings.htm.

Griffin, C. T., Knowles, C., Theodropoulos, C., & Allen, J. H. (2010). Barriers to the implementation of sustainable structural materials in green buildings. ICSA 2010-1st International Conference on Structures & Architecture, Guimaraes, Portugal. CRC Press.

Hes, D. (2007). Effectiveness of Green Building Rating Tools: A Review of Performance. *International Journal of Environmental, Cultural, Economic and Social Sustainability*, 34), 143-152.

Hill, R.C. & Bowen, P.A. (1997). Sustainable Construction: Principles and a Framework for Attainment. *Construction Management and Economics,* 15, 223-239.

Hwang, B. G., & Tan, J. S. (2012). Green building project management: obstacles and solutions for sustainable development. *Sustainable Development*, 205), 335-349.

Hwang, B. G., & Ng, W. J. (2013). Are Project Managers Ready for Green Construction?-Challenges, Knowledge Areas, and Skills. *Smart and Sustainable Built Environments*, 2013): 25.

IPCC. 2015). Climate Change (2014: Synthesis Report. Retrieved from http://www.ipcc.ch/report/ar5/syr/.

IPCC. (2018). Global Warming of 1.5 °C. Retrieved from http://www.ipcc.ch/report/sr15/.

Isa, M., Rahman, M. M. G. M. A., Sipan, I., & Hwa, T. K. (2013). Factors affecting green office building investment in Malaysia. *Procedia-Social and Behavioral Sciences*, 105, 138-148.

Jung, Y., Sui, P., & Xi, H. (2012). Green Practices in The Chinese Building Industry: Drivers and Impediments. *Journal of Technology Management in China*, *7*1), 50-63. doi: 10.1108/17468771211207349.

Li, Y., Yang, L., He, B., & Zhao, D. (2014). Green Building in China: Needs great promotion. *Sustainable Cities and Society*, *11*, 1-6. doi: 10.1016/j.scs.2013.10.002.

Liu, J., He X. (2011). Influence Factors on Real Estate Companies' Decision to Develop Green Building Projects. *International Economic Cooperation*, 3: 82-85.

Manley, K. (2006) The innovation competence of repeat public sector clients in the Australian construction industry, *Construction Management and Economics*, 24, 1295-1304.

Nguyen, T., Toroghi, S., & Jacobs, F. (2017). Automated Green Building Rating System for Building Designs. *Journal of Architectural Engineering*, *22*4), A4015001. doi: 10.1061/asce)ae.1943-5568.0000168.

Nurul, D. A. & Abidin, N. Z. (2013). Motivation and Expectation of Developers on Green Construction: A Conceptual View. *International Journal of Humanities and Social Sciences*, *7*4), 914-918.

Oates, D., & Sullivan, K. T. (2011). Postoccupancy energy consumption survey of Arizona's LEED new construction population. *Journal of Construction Engineering and Management*, 138(6), 742-750.

Olanipekun, A. O., Xia, B., Hon, C., & Hu, Y. (2017). Project Owners' Motivation for Delivering Green Building Projects. *Journal of Construction Engineering and Management*, 1439), 04017068.

Olanipekun, A. O., Xia, P. B., & Skitmore, M. (2016). Green Building Incentives: A Review. *Renewable and Sustainable Energy Reviews*, 59, 1611-1621.

Potbhare, V., Syal, M., & Korkmaz, S. (2009). Adoption of Green Building Guidelines in Developing Countries Based on US and India Experiences. *Journal of Green Building*, 42), 158-174.

Rajendran, S., Gambatese, J. A., & Behm, M. G. (2009). Impact of green building design and construction on worker safety and health. Journal of construction engineering and management, 135(10), 1058-1066. Retzlaff, R. C. (2008). Green Building Assessment Systems: A Framework and Comparison for Planners. *Journal of the American Planning Association*, 744), 505-519.

Pitt, M., Tucker, M., Riley, M., & Longden, J. (2009). Towards sustainable construction: promotion and best practices. *Construction Innovation*, 92), 201-224.

Rohracher, H. (2001). "Managing the technological transition to sustainable construction of buildings: a socio-technical perspective." *Technology Analysis and Strategic Management*, 131), 137-150.

Qian, Q. K., Fan, K., & Chan, E. H. (2016). Regulatory incentives for green buildings: gross floor area concessions. *Building Research and Information*, 445-6), 675-693.

Ren, Y. (2007). Obstacles and Countermeasures in Promoting Green Building. *Development Research*, *10*, 47-49.

Samari, M., Ghodrati, N., Esmaeilifar, R., Olfat, P., & Shafiei, M. W. M. (2013). The investigation of the barriers in developing green building in Malaysia. *Modern Applied Science*, 72), 1.

Shen, L., Zhang, Z., and Long, Z. (2017). Significant barriers to green procurement in real estate development. Resources, *Conservation and Recycling*, 116, 160-168.

Simpeh, E. K. (2015). Factors Influencing the Growth of Green Building in the South African Construction Industry. In Smart and Sustainable Built Environment SASBE) Conference 2015 p. 311).

Smit, A. M. & Toit, F. D. (2015). Investigating the Financial Benefits of Green Buildings. *Environmental Economics*, 63), 61-71.

Sustainable Development Commission. (2011). What is sustainable development. Retrieved from http://www.sd-commission.org.uk/pages/what-is-sustainable-development.html.

Suzer, O. (2015). A Comparative Review of Environmental Concern Prioritization: LEED vs Other Major Certification Systems. *Journal of Environmental Management*, *154*, 266-283.

Tam, V. W. Y., (2007), The Effectiveness of the Green Building Evaluation and Labelling System. *Architectural Science Review*, 504), pp.323.

Van Bueren, E. M., & Priemus, H. (2002). Institutional barriers to sustainable construction. *Environment and Planning*, 291), 75-86.

Wiley, J. A., Benefield, J. D., & Johnson, K. H. (2010). Green design and the market for commercial office space. *The Journal of Real Estate Finance and Economics*, 41(2), 228-243.

Williams, K., & Dair, C. (2007). What Is Stopping Sustainable Building in England? Barriers Experienced by Stakeholders in Delivering Sustainable Developments. *Sustainable Development*, *15*3), 135-147. doi: 10.1002/sd.308.

Yang, J., & Yang, Z. (2015). Critical Factors Affecting The Implementation of Sustainable Housing in Australia. *Journal of Housing and The Built Environment*, *30*2), 275-292. doi: 10.1007/s10901-014-9406-5.

Zhang, B., Zhang, L. (2010). Problems Encountered on Green Building Development in Tangshan City. *Energy Research and Management*, 3: 56-67.

Zhang, L., Wu, J., & Liu, H. (2018). Turning Green into Gold: A Review on the Economics of Green Buildings. *Journal of Cleaner Production*, *172*, 2234-2245. doi: 10.1016/j.jclepro.2017.11.188.

Zhang, X. (2014). Investigation of Factors Restraining the Implementation of Green Buildings in Mainland China. *Organization, Technology and Management in Construction: An International Journal*, *6*3). doi: 10.5592/otmcj.2014.3.8.

Zhang, X., Shen, L., Tam, V. W., & Lee, W. W. Y.(2012). Barriers to implement extensive green roof systems: a Hong Kong study. *Renewable and Sustainable Energy Reviews*, 161), 314-319.

Zhao, X., Hwang, B. G., & Gao, Y. (2016). A fuzzy synthetic evaluation approach for risk assessment: a case of Singapore's green projects. *Journal of Cleaner Production*, 115, 203-213.

Zuo, J., & Zhao, Z. Y. (2014). Green Building Research–Current Status and Future Agenda: A Review. *Renewable and Sustainable Energy Reviews*, *30*, 271-281.

10. Appendix – Full Survey

Motivational Factors & Benefits of Green Development Worldwide

Please answer the following questions based on a **RECENT GREEN BUILDING PROJECT** that you are participating in / have participated in within the past 2 years.

We cordially invite you to complete this self-administered questionnaire. Filling in this questionnaire takes approximately 10 minutes. All information obtained will be used for research purposes only. Participant will not be identified by name in any publications of the completed study. All data collected will be removed within 3 years after the publication of the first paper. The participation is entirely voluntary. This means that you can choose to stop at any time without negative consequences. If you have any questions about the research, please feel free to contact Ran Chen at +852 95193566 or ranchan@hku.hk. Many thanks for your time.

Part I. Background Information

1. Project location:

Please choose **only one** of the following:

- ○ Australia
- ○ Brunei
- ○ Canada
- ○ China
- ○ Fiji
- ○ Hong Kong
- ○ Japan
- ○ Malaysia
- ○ New Zealand
- ○ Singapore
- ○ South Africa
- ○ Sri Lanka
- ○ UK
- ○ US
- ○ Other

2. Project ownership:

Please choose **only one** of the following:

- ○ Public project
- ○ Private project
- ○ Semi-public project

3. Project types:

Please choose **only one** of the following:

- ○ New commercial building
- ○ Existing commercial building
- ○ New residential building
- ○ Existing residential building
- ○ Other

4. Project period:

	From	To
Year		

5. Gross Floor Area (in ㎡):

Please write your answer here:

6. Approximate total project sum:

Please write your answer here:

Currency used:

Please choose **only one** of the following:

- ○ AUD
- ○ BND
- ○ CAD
- ○ RMB
- ○ FJD
- ○ HKD
- ○ JPY
- ○ MYR
- ○ NZD
- ○ SGD
- ○ ZAR
- ○ LKR
- ○ GBP
- ○ USD
- ○ EUR
- ○ Other [ ]

7. Green building assessment system(s) adopted:

（If the assessment process is ongoing, please indicate the level that the project team aim to achieve.）

Please choose **all** that apply:

- ☐ a) BREEAM
- ☐ b) LEED
- ☐ c) BEAM Plus
- ☐ d) ESGB
- ☐ e) Green Star
- ☐ f) CASBEE
- ☐ g) SBTool
- ☐ h) Others

Please name the green building assessment system(s) adopted :
If answer (h) in question 7:

Please write your answer here:

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (a) in question 7:

Please choose **only one** of the following:

- ◯ Pass
- ◯ Good
- ◯ Very good
- ◯ Excellent
- ◯ Outstanding

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (b) in question 7:

Please choose **only one** of the following:

- ◯ Certified
- ◯ Silver
- ◯ Gold
- ◯ Platinum

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (c) in question 7:

Please choose **only one** of the following:

- ○ Bronze
- ○ Silver
- ○ Gold
- ○ Platinum

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (d) in question 7:

Please choose **only one** of the following:

- ○ 1-star
- ○ 2-star
- ○ 3-star

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (e) in question 7:

Please choose **only one** of the following:

- ○ 1-star
- ○ 2-star
- ○ 3-star

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (f) in question 7:

Please choose **only one** of the following:

- ○ Poor
- ○ Fairly poor
- ○ Good
- ○ Very good
- ○ Excellent

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (g) in question 7:

Please choose **only one** of the following:

- ○ -1
- ○ 0
- ○ 1-4
- ○ +5

8. Green building assessment result (if the assessment process is ongoing, please indicate the level the project team aims to achieve):

If answered (h) in question 7:

Please write your answer here:

9. Your organization:

Please choose **only one** of the following:

- ○ Developer
- ○ Contractor
- ○ QS Consultant
- ○ Green Building Consultant
- ○ Other

10. Profession:

Please choose **only one** of the following:

- ○ General practice surveyor
- ○ Building surveyor
- ○ Quantity surveyor
- ○ Architect
- ○ Structural engineer
- ○ Building services engineer
- ○ Project manager
- ○ Other

11. Job title:

Please write your answer here:

12. Is this your company's first sustainable project?

Please choose **only one** of the following:

- ○ Yes
- ○ No

13. Is this your first sustainable project?

Please choose **only one** of the following:

- ○ Yes
- ○ No

Part II. Motivational factors, Hindrance factors, and Benefits of Green Building Projects

Please indicate your degree of agreement with the following statements based on THE GREEN BUILDING PROJECT identified in Part I.

Business Factors

[a] Marketing Strategies

1. My company can take a leading position in the industry through the green experience.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

2. My company's brand equity can be enhanced.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

3. Green development is a global topic resulting in free publicity and media coverage.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

4. Venturing into green buildings ensures more opportunities for future projects.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

[b] Rental Income

5. Green buildings attract major anchor tenants.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

6. Green buildings attract international tenants. *

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

7. Green buildings lead to lower tenant turnover. *

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

Industry Factors

[c] Sustainability Perception

8. The consumers' demands for green buildings are insufficient.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

9. There is a lack of atmosphere to pursue green buildings in the industry.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

10. The industry is reluctant to change from conventional to green practices. *

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

[d] Sustainability Policies

11. There is a lack of comprehensive policy packages to guide actions on sustainability.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

12. The codes and regulations on green buildings and sustainable construction are complex.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

13. The fiscal incentives from the government are insufficient.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

14. The non-fiscal incentives from the government are insufficient.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

[e] Green Building Assessment Processes & Methods

(please rate the following statements based on your answer in Q7, Part I)

15. The green building assessment method is overly rigorous.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

16. The green building assessment method is unresponsive to the real and dynamic environment.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

17. The rating tool and standard are lack of coordination and consistency.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

18. The green building assessment method is time-consuming.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

Project Factors

[f] Sustainable Project Management

19. The green building designs and features are proactively value-managed.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

20. The goal of constructing green building(s) has been set clearly at the project inception stage.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

21. The design team is financially rewarded for the extra efforts and skills put in adding values to the green building designs and features.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

22. The construction team is financially rewarded for the extra efforts and skills put in adding values to green construction.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

23. There is a lack of integrated design and life-cycle management for the green building project.

Please choose the appropriate response or each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

24. There is a lack of communication and collaboration between different stake-holders.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

25. When comparing with conventional, non-green projects, there are more meetings required for the green building project.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

26. The approval process for new green technologies and recycled materials is lengthy.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

27. It is difficult to comprehend green specifications in the contract.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

[g] Green knowledge and Information

28. The data regarding cost-benefit analysis of green buildings are inadequate.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

29. There are different methods of cost estimation (e.g. capital cost, operating cost) for green building projects.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

30. There is a lack of green demonstration projects.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

31. There is a lack of professional education and training programs for sustainable development.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

32. When comparing with conventional, non-green projects, there are more technical difficulties encountered in the design process of the green building project.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

33. When comparing with conventional, non-green projects, there are more technical difficulties encountered in the construction process of the green building project.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

34. There is a lack of information regarding green products and building systems.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

35. The green building technologies are deficient.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

[h] Risks

36. Higher risks are associated with green building project investment (e.g., no guarantee in being certified after registration, uncertainty of return on investment).

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

37. There are delays in obtaining certification and permits for green buildings.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

38. There are more alterations and variations of green building designs in the construction process.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

Overall Project Outcomes

39. Overall, the performance of the green building project is satisfactory in terms of cost-effectiveness.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

40. Overall, the performance of the green building project is satisfactory in terms of the project schedule.

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

41. Overall, the performance of the green building project is satisfactory in terms of environmental sustainability (e.g. energy and water usage).

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

42. Overall, the performance of the green building project is satisfactory in terms of social impacts (e.g. health and safety).

Please choose the appropriate response for each item:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	N/A
Degree of Agreement	○	○	○	○	○	○

What percentage was/would be added or reduced to each of the following items for THE GREEN BUILDING PROJECT (as identified in Part I) when compared with conventional, non-green projects?

Please choose the appropriate response for each item:

	Increase	Same	Decrease
56. Change in construction cost	○	○	○
57. Change in life cycle cost	○	○	○
58. Change in selling price	○	○	○
59. Change in rental price	○	○	○
60. Change in premium in market valuation	○	○	○
61. Change in time at design stage	○	○	○
62. Change in time at construction stage	○	○	○
63. Change in time of payback period	○	○	○

Percentage Change (%) in construction cost

Please write your answer here:

Percentage Change (%) in life cycle cost

Please write your answer here:

Percentage Change (%) in selling price

Please write your answer here:

Percentage Change (%) in rental price

Please write your answer here:

Percentage Change (%) in premium in market valuation

Please write your answer here:

Percentage Change (%) in time at design stage

Please write your answer here:

Percentage Change (%) in time at construction stage

Please write your answer here:

Percentage Change (%) in time of payback period

Please write your answer here:

In your opinion, how can sustainable development be fostered?

Please write your answer here:

~ End of Survey ~

Thank you!