Project Management Strategies for Green Business Parks: Critical Success Factors, Barriers and Solutions

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ABSTRACT

Green Business Parks (GBPs) as a way of achieving more sustainable industrial and business development are getting increasing interest from both public and private sectors. However, there have been few studies identifying the project management strategies for such projects. In light of this, the objectives of this study are to: (1) identify the critical success factors (CSFs) for GBPs; (2) investigate and assess the barriers hindering the adoption of GBPs; and (3) propose feasible solutions to overcome the barriers. To achieve the objectives, 30 CSFs, 15 barriers and 21 solutions were identified from a comprehensive literature review and then a questionnaire survey and post-survey interviews were conducted. The analysis results first reported that the top three CFSs were "strong top management support", "strong financial capability" and "adequacy of design details and specifications", while "perceived higher initial capital cost", "uncertain trade-off between environmental and financial benefits" and "lack of government supports" were revealed as the top three barriers. The analysis also indicated that "better government funding" and "clients' advocation of green management goals" were most feasible solutions to improve the potential adoption of GBPs. This study not only fills the gap in the knowledge area of the project management of GBPs but also points out the right directions for the practitioners to successfully adopt GBPs and ultimately achieve more sustainable developments.

Keywords: *green business parks, critical success factors, barriers, solutions*

1. INTRODUCTION

The sustainable development of the industrial and business sectors would lead to the great and efficient reduction of global greenhouse gas (GHG) emissions since industrial and energy sectors together are responsible for a major share of GHG emissions. According to Eurostat (2016), nearly half (45.4%) of all GHG emissions in the EU in 2013 were from the activities of electricity, gas, steam and air conditioning supply (26.6%) and the activities of manufacturing sector (18.8%). Together with the increasing developments of green buildings, Green Business Park (GBP), which is a way to create sustainable industrial and business development, has attracted a great attention from public and private sectors. GBP was defined as a hybrid concept between the agglomeration of conventional industry and green buildings (Stewart, 2007). Industrial ecology, eco-industrial park (EIP), industrial ecosystem and by-product exchange are complementary terms of GBP. Numerous Green Business Parks (GBPs) have been developed all over the world. For instance, until early 2001, at least 40 communities in the US initiated eco-industrial development projects (Lowe, 2001). Singapore and China have also launched the highly-specialized business parks such as CleanTech Park (CTP) (Green Business Singapore, 2013) and Sino-Singapore Tianjin Eco-City (SSTEC) (Flynn, 2012).

However, it is also true that the implementation of this concept is still at an early stage and encounters different kinds of difficulties (Gibbs, et al., 2005). Furthermore, the current research focuses just on definitions, benefits, drivers and limitations of GBPs through some case studies, and there have been very few studies focusing on the project management framework for GBPs. As a result, this study aims to: (1) identify the critical success factors (CSFs) for GBPs; (2) investigate and assess the barriers hindering the adoption of GBPs; and (3) propose feasible solutions to overcome the barriers. This study not only fills the gap in the project management knowledge area of GBPs but also points out the right directions for the practitioners to successfully adopt GBPs and ultimately achieve more sustainable developments.

2. BACKGROUND

Green Business Park has the root in industrial ecology or industrial ecosystem (Stewart, 2007). An industrial ecosystem was defined as a system in which "the consumption of energy and material is optimized, waste generation is minimized, and the effluents of the process serve as the raw material for another process" (Frosch and Gallopoulos, 1989). The early GBPs were called eco-industrial parks (EIPs) whose functioning was described as "applied industrial ecology" (Stewart, 2007). GBP is the hybrid of green buildings and EIPs (Stewart, 2007) and emphasizes the clustering of specialized industries by providing shared infrastructure and facilities (Tudor, et al., 2007).

The developments of GBPs attempt to achieve economic, social and environmental benefits, concurrently. First, GBPs have the potential to reduce operating costs, disposal costs and increase the income from the sale of by-products. For example, Mobil which is a park in the United State sold styrene to a recycler for 50 cents a gallon whereby previously it had to pay 1.00 USD per gallon for disposal (Stewart, 2007). Moreover, GBPs lead to a more rooted business, good jobs and a cleaner environment. GBPs are also designed to relieve the environmental pressure by promoting the closing of material cycles (Heeres, et al., 2004).

Critical success factors (CSFs) help to achieve predetermined goals and are indisputably necessary for the success of projects (Chan, et al., 2004). Through an intensive literature review on CSFs for the conventional business park, EIPs and green building projects, this study identified 30 CSFs (Table 1) which have the potential to influence the success of GBPs. Through the literature review, this study also identified 15 barriers (Table 2) having the potential to impede the development of GBPs.

3. DATA COLLECTION PRESENTATION

This study carried out a questionnaire survey to solicit opinions from experts. After developing a questionnaire based on a comprehensive literature review, this study conducted a pilot survey with three construction industry experts before finalizing the questionnaire. The first part of the questionnaire included the questions meant to profile the companies and respondents. Moreover, the questionnaire presented the 30 CSFs, 15 barriers and 21 proposed solutions. The respondents were subsequently asked to assess the criticalities of CSFs, significance of barriers and usefulness of solutions with a five-point scale. Taking the rating of CSFs as an example, "1" indicates "least critical" while "5" means "most critical". Finally, post-survey interviews were conducted with four experts who were either BCA certified Green Mark Managers (GMMs) or Green Mark Professional (GMPs) to validate the survey results. In post-survey interviews, the experts were provided with the analysis results and they all confirmed that the findings were reasonable and consistent with their expectations.

This study randomly sent out 124 sets of the questionnaire to professionals who are GMMs or GMPs, and 40 completed questionnaires were finally returned. The majority of the respondents (92.5%) had more than two years' experience in green building projects. Moreover, 85% and 57.5% of respondents had the working experience in commercial projects and industrial/business park, respectively. Furthermore, 65% and 32.5% of companies had the business background in green commercial/retail projects and industrial/business park, respectively.

4. ANALYSIS RESULTS AND DISCUSSIONS

4.1 Criticalities of CSFs of GBPs

This study first analysed the criticality of each CSF by adopting methods including descriptive means and one sample t-test (confidence level = 95%; p-value = 0.05). The criticality rankings and test results are summarized in Table 1.

"Strong top management commitment and support" (C06) was ranked first (mean = 4.75) due mostly to the importance of the upper management providing the necessary support and stipulating right policies. Moreover, without adequate and timely support from the top management, the project team will be less productive in completing their duties because of the inefficient access to organizational resources (Alexandrova and Ivanova, 2012). This is even more critical for GBPs because additional workloads are needed to achieve green requirements.

"Strong financial capability" (C07) was ranked second (mean = 4.63). As a property development, a GBP should first meet the business and financial objectives. As a good example, in case of Kalundborg EIP, each business link in the system was negotiated as an independent business deal, and was established only if it was expected to be economically beneficial (Maxwell, et al., 2015). Moreover, as green developments tend to be discouraged by the perceived high initial capital costs (Houghton, et al., 2009), some financial initiatives, such as public private partnerships, can be also considered to maximize financial capability in such developments (Lowe, 2001). The strong financial capability was also emphasized by the post-survey interviewees as a key success factor for GBPs.

Factor Category	F-Code	List of Factors	Mean	p-value	Rank
External Factors	E01	Economic development strategy	4.38	0.00	12
	E02	Extensive government support (such as funding, schemes for workforce training)	4.50	0.00	7
	E03	Preferential policies, e.g. tax exemptions, technical training and standards setting	4.48	0.00	9
	E04	Strong demand from local and foreign companies and the existence of clustering companies	4.33	0.00	16
	E05	Planning guidelines for business parks to be mutually beneficial	4.23	0.00	20
Client Related Factors	C06	Strong top management commitment and support	4.75	0.00	1
	C07	Strong financial capability	4.63	0.00	2
	C08	Ability to convey project objectives and goals clearly	4.55	0.00	4
	C09	Realistic and well-planned project schedule and proper allocation of resources	4.45	0.00	10
	C10	Moderate variation orders during construction	3.68	0.00	28
	C11	Ability to arrange for autonomous management or private park ownership	3.68	0.00	29
Project Team Related Factors	PT12	Competency of project manager	4.53	0.00	6
	PT13	Ability to develop good relationship and continuous communications between teams and stakeholders	4.33	0.00	15
	PT14	Strong commitment and involvement of project team	4.38	0.00	13
	PT15	Technical competency, experience and knowledge of project teams in developments	4.48	0.00	8
	PT16	Effective risk management	4.03	0.00	24
	PT17	Pro-active management continuously evaluating park performance	4.13	0.00	23
	PT18	Competency of facilities management team's response to tenant issues during operations	4.28	0.00	19
Project Consultant Related Factors	CS19	Competency of project consultants	4.53	0.00	5
	CS20	Involvement of Green Mark Managers/Professionals	4.38	0.00	14
	CS21	Strong cooperation in solving problems	4.30	0.00	17
	CS22	Effective marketing of the business park	4.30	0.00	18
Project Contractor Related Factors	CT23	Adequacy of design details and specifications	4.60	0.00	3
	CT24	Emphasis on high-quality workmanship	4.40	0.00	11
	CT25	Skillful workers with adequate trainings in Green Projects	4.20	0.00	21
	CT26	Using advanced technology and automation for construction work	3.70	0.00	27
Project Related Factors	D27	Selection of prime location	3.75	0.00	25
	D28	Provision of enabling environment E.g. restaurants, leisure park and right infrastructure	3.55	0.01	30
	D29	Provision of park design with flexibility and allowance for future expansion	3.75	0.00	26
	D30	Design of buildings to fulfill standardization, simplicity and constructability	4.18	0.00	22

Table 1: Summary of criticality ranking of CSFs

"Adequacy of design details and specifications" (CT23) was ranked third (mean = 4.60). This result could be contributed by the requirements of additional green features and the compliance of green regulations or standards which can be achieved partially through the adequate design and specifications (Lam, et al., 2010). It is better for a contractor to have their own green design and construction team; otherwise, the cost and schedule of a green development would be affected (Samari, et al., 2013). Moreover, experts in the post-survey interviews also suggested that setting standardized design guidelines should be crucial to the success of GBPs. For instance, setting parcel design guidelines in the development of CleanTech Park in Singapore helped the owners to attain a minimum Green Mark Gold rating (Green Business Singapore, 2013).

4.2 Significance of barriers

This study analyzed the significance of the barriers by using methods explained previously, and the results are summarized in Table 2.

Barrier Category	B-Code	List of Barriers	Mean	p-value	Rank
External barriers	B01	Imperfect government regulations	3.80	0.00	4
	B02	Adjustment of functions and changing roles of parks	3.38	0.08	7
	B03	Lack of strategic location due to the scarcity of land	3.10	0.55	11
	B04	Lack of government supports such as funds and tax exemptions	3.83	0.00	3
Client related Barriers	B05	Perceived higher initial capital costs	4.40	0.00	1
	B06	Lack of potential clients' awareness and demand	3.80	0.00	5
	B07	More variance in project deliveries leading to a higher risk level	3.05	0.79	13
	B08	More variance in site practices leading to a higher risk level	2.95	0.76	14
	B09	Unequal distribution of advantages between developers and tenants	3.08	0.68	12
	B10	Uncertain trade-off between environmental and financial benefits	4.05	0.00	2
Project team barriers	B11	Lack of skilled labor in respect of green developments or GBPs	3.15	0.46	10
Consultants barriers	B12	Lack of marketing and promotion	3.20	0.34	8
Contractors barriers	B13	Lack of the effective coordination between key players	3.18	0.32	9
Project barriers	B14	Complexity in obtaining green certifications	2.70	0.08	15
	B15	Lack of proven benefits to entice potential investors	3.78	0.00	6

Table 2: Summary of significance ranking of barriers

Except "more variance in site practices leading to a higher risk level" (B08) and "complexity in obtaining green certifications" (B14), the means of the other barriers were all statistically greater than three. Among these barriers, "perceived high initial capital costs" (B05) was ranked first (mean = 4.40). Just like green building developments, the developments of GBPs were overwhelmingly discouraged by the perceived high capital costs (Hwang and Tan, 2012; Samari, et al., 2013). From a developer's perspective, sustainable developments require the city incentive and government support unless there is a sufficient demand for sustainable developments in the market (Maxwell, et al., 2015). All post-survey interviewees also agreed with this result.

"Uncertain trade-off between environmental and financial benefits" (B10) was ranked second (mean = 4.05). Currently, there are some difficulties to concretely demonstrate positive environment impacts and financial benefits. Gibbs, et al. (2005) disclosed one reason that there were relatively very few EIP sites which were engaged in measuring energy flows and exchanges. On the other hand, some intangible benefits, such as the increased productivity of staff working in green buildings, were difficult to measure and transfer to financial benefits (Reichardt, 2015). The interviewees in the post-survey highlighted that unbiased independent case studies which could clearly show the trade trade-off are urgently needed.

"Lack of government supports" (B04) received the third position (mean = 3.83). As GBPs are at the preliminary stage, governments play a vital role to promote such developments. Gibbs, et al. (2005) investigated 61 eco-industrial projects in USA and Europe and identified that over 40% of these projects had a lead partner who was local or municipal authority. Singapore has actually initiated some funding and several incentive schemes related to the energy efficiency and clean energy such as Energy Efficiency Improvement Assistance Scheme (EASe) and Grant for Energy Efficient Technologies (GREET) (Green Future Solutions, 2015). However, the industrial practitioners may not be familiar with these funding and incentive schemes since they still thought there was a lack of government supports.

4.3 Feasible solutions for overcoming barriers

This study also identified and provided a list of solutions to be able to overcome the barriers for the respondents to choose the best measures that can tackle the barriers. The frequencies (Freq.) and percentages (Per.) of the respondents who chose particular solutions for each of the barriers are tabulated in Table 3. For the sake of the length of the paper, solutions for barriers B08 and B14 were excluded because they were not statistically significant as discussed above. Moreover, except the solutions for the top three barriers (B05, B10 & B04), the solutions with Per. < 50% were also excluded from Table 3.

"Minimize variations order during construction to avoid delays by having efficient management" was suggested to overcome the high initial capital costs and the lack of potential clients' awareness and demand for GBPs (B05&B06). However, the low percentage (32.5%) indicated that it is not a useful solution. The interviewees in the post-survey commented that the high initial costs were mainly due to the difficulties in the establishment of interlink between companies, the requirements of additional green features and compliance of green regulations or standards. These could be properly maintained at the planning and design stage but not the construction stage.

As for the clients' perception of the uncertain trade-off between environmental and financial benefits (B10), 55% of respondents felt that the collaboration with research institutes and firms to study and highlight the long-term social and cost benefits can help to overcome the barrier. This solution aims to get more clients' advocation of green management goals. Furthermore, 80% of respondents felt that the government support, such as the increase in the scope of co-funding and the incentives for trainings and technologies were needed. Moreover, the government could also found some supporting structures like the training center or technology research center to educate the practitioners or the public.

Barriers	List of Solutions	Frequency	Percentage
B01	Policies and regulations for green industrial spaces to be structured in a supportive manner, such as flexible planning guidelines, tax exemptions and privileged permits with short time approval	30	75.0%
B03&B04	Government to increase the scope of co-funding and incentives for trainings and technologies	32	80.0%
B05&B06	Minimize variations orders during construction to avoid delays by having efficient management	13	32.5%
B09&B10	Relevant statutory boards to collaborate with research institutes and firms to study and highlight the long-term social & cost benefits in order to promote GBPs to the industrialists	22	55.0%
B11	Select qualified team members with specialized skill and provide proper trainings	25	62.5%
	To include at least one Green Mark Professional/ Green Mark Manager in the project	25	62.5%
	Encourage team to explore compliance requirement under specific standards together with other consultants during planning phase	27	67.5%
B12	Provide trainings for staff to understand such specialized facilities in order to manage them well during operation phase	24	60.0%
	Consultants should provide full cooperation to contractor/ client when their expertise are required	26	65.0%
	Strong communicate with the client promptly to avoid misinterpretation	25	62.5%

B13	Provide proper planning and scheduling during construction to ensure efficient allocation of resources and time to avoid cost overrun and disputes	20	50.0%
	Contractors who are specialized in green design and technologies can increase investors' interest by offering some form of indemnification for certain conditions	20	50.0%
B15	Permit authorities should work collaboratively with project teams to ensure specifications of project design are aligned with the criteria for certifications	22	55.0%

Table 3: Summary of suggested solutions for overcoming barriers

5. CONCLUSIONS AND RECOMMENDATIONS

This study aimed to identify project management strategies for Green Business Parks by investigating critical success factors, significant barriers and useful solutions. To achieve the objectives, 30 CSFs, 15 barriers and 21 solutions were identified from a comprehensive literature review. Having conducted a questionnaire survey, "strong top management support", "strong financial capability" and "adequacy of design details and specifications" were reported as the top three CSFs. Moreover, "perceived higher initial capital cost", "uncertain trade-off between environmental and financial benefits" and "lack of government regulations" were revealed as the top three barriers. The analysis also indicated that "better government funding" and "clients' advocation of green management goals" were most feasible solutions to improve the potential adoption of GBPs. This study not only fills the gap in the project management knowledge area of GBPs but also points out the right directions for the practitioners to successfully adopt GBPs and achieve more sustainable developments. Future studies could focus on the long-term social and cost benefits of GBPs increasing the clients' interest and demand of GBPs.

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