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## Identifying critical leadership styles of project managers for green building projects

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In recent years, green building construction has been earning a significant place in Singapore's construction industry. The success of a green building project is inevitably associated with the leadership of the project manager. This study attempts to identify the leadership characteristics and styles of project managers in Singaporean green building projects. Conducting a questionnaire survey with 30 project managers experienced in green construction, this study identified 13 leadership characteristics, among which 'strive for work performance and productivity' was ranked top. Additionally, the 13 characteristics were categorized into two groupings: (1) directive and task-oriented leadership and (2) relationship-oriented leadership. The results indicated that the leadership style of the project managers was more towards directive and task-oriented leadership but did not overlook their relationships with subordinates. Therefore, this study provides an understanding of leadership characteristics and styles of project managers in green building projects for both practitioners and researchers.

**Keywords:** project manager; leadership; characteristics; green building; Singapore

### Introduction

Global climate change, caused by concentrations of greenhouse gases (GHGs) (Huang et al. 2015), seems to be the most significant environmental issue for human development in recent years (Zuo et al. 2013; Wu et al. 2014a). The building and construction industry contributes to the increase of GHG emissions (Wu et al. 2014b; Zuo et al. 2015). The World Green Building Council (WorldGBC 2013) reported that buildings are responsible for one-third of GHG emissions in the world, and thus represent a major and cost-effective way to reduce GHG emissions. This has resulted in a need for green construction across the world. According to the US Green Building Council (USGBC 2007), a green building is a building that has been carefully designed, constructed, and operated to boost environmental, economic, and productivity performance, as compared to conventional buildings. To put it in simpler terms, green buildings are designed and built in such a way that they use less energy and resources than conventional buildings and attempt to minimize the impacts on the environment (Yudelson 2008). With the increasing global concern about the environment, Singapore has shifted its focus to making sustainable development a national priority (Hwang et al. 2015c), and has been recognized as a leader in advocating sustainability in the building and construction industry with its up-to-date and efficient green strategies and initiatives (WorldGBC 2013).

The construction industry has played a key role in the economy of Singapore. According to the Building and Construction Authority (BCA 2015), Singapore's construction output was about S\$37.7 billion in 2014, and was estimated to reach between \$29 billion to \$36 billion in 2015. The Singapore government has set up a target to make at least 80% of buildings green by 2030 (BCA 2009), and various efforts have been directed toward constructing new green buildings and retrofitting existing buildings (Hwang et al. 2015b). To attain the completion of more green building construction, the leadership of project managers is essential. In every construction project, a project manager usually takes charge of all matters of the project. The relationship between achieving project success and project management competencies has been confirmed in the construction industry (Ahadzie et al. 2008). Frank (2002) indicated that the project manager had direct influence over 34–47% of project success. Therefore, project managers play a vital role in project success (Turner & Müller 2005).

In the construction industry, a project manager can be deemed a leader because he/she has the authority to delegate work tasks to his/her project team and to make important decisions on site. Every project manager has his/her own style of working and this depends a great deal on his/her leadership style. In other words, different project managers have different leadership styles, and the leadership style used can affect the project performance either positively or negatively. Leadership has been recognized as one of the essential skills of project managers (Edum-Fotwe & McCaffer 2000; Odusami 2002), which is also the case for green building projects (Hwang & Ng 2013).

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The objective of this study is to identify the leadership characteristics and styles of project managers in green building projects in Singapore. Most previous studies on the leadership styles of project managers were based on traditional building and construction projects and few have been focused on green projects. As there has been a significant rise in green projects, it is important to identify appropriate leadership styles for project managers in these projects, which will help ensure the smooth progress of the projects and their success.

## Background

### *Green building projects in Singapore*

In Singapore, a building is considered green as long as it meets the requirements stipulated under the Green Mark Scheme (GMS), which was launched by the BCA in 2005. Under the GMS, developers and building owners can submit their application for Green Mark (GM) certification. Their buildings were assessed on the five key areas, namely energy efficiency, water efficiency, environmental protection, indoor environmental quality and other green features and innovations (BCA 2014b). As long as the minimum score for GM certification was attained, their buildings would be considered GM-certified.

In December 2006, the BCA formulated the first Green Building Masterplan to encourage, enable, and engage industry stakeholders to increase their efforts in environmental sustainability. As sustainable development remains a key national priority going forward, the second Green Building Masterplan and the Sustainable Development Blueprint were unveiled in 2009, and one of the key targets is to make at least 80% of buildings green by 2030 (BCA 2009). The key initiatives of the second Green Building Masterplan included getting the public sector to take the lead in achieving GM certification, encouraging the private sector to attain higher GM ratings through the provision of additional gross floor area, stepping up the development of green building technologies through more R&D and pilot projects, building industry capability through training, profiling of Singapore as a hub for green building development and imposing minimum standards (BCA 2009).

After December 2010, all new buildings should comply with a higher GM standard. This essentially translates into an additional 10% in energy savings and the minimum standard is also 28% higher than that released in 2005. To speed up the process of going green, the BCA has launched the third Green Building Masterplan, focused on building capability in the industry, engaging the tenants and occupants for closer partnership between the people, private, and public sectors, driving adjustments in consumption behaviour, as well as developing an environment that addresses the well-being of the people (BCA 2014a).

### *Leadership theories*

Robbins (2003) defined leadership as the ability to influence a group towards the achievement of goals. Leadership is different from management because the possession of a formal managerial rank in an organization does not necessarily enable a manager to lead effectively and the ability to influence may arise outside the formal structure of an organization. In general, there have been three categories of leadership theories, namely trait, behavioural, and contingency theories (Robbins & Coulter 2007).

Trait theories focus on the traits of leaders, and consider that personal qualities and characteristics differentiate leaders from non-leaders (Robbins 2003). Some studies revealed strong evidence of an identifiable set of personality and cognitive traits that are expected to characterize successful leaders. For example, Kirkpatrick and Locke (1991) summarized six key traits: drive, leadership motivation, honesty and integrity, self-confidence, cognitive ability, and knowledge of the business; and Turner (1999) identified seven traits of effective project managers: problem-solving ability, results orientation, energy and initiative, self-confidence, perspective, communication, and negotiating ability. Obviously, trait theories of leadership have some limitations. Traits appeared to predict leadership in selective situations (Robbins 2003) and trait theories involve subjective judgments in determining who is a so-called good or successful leader (Mullins 2007). Indeed, leadership is the combination of traits, skills, and behaviours that leaders use when they interact with their team members (Achua & Lussier 2013).

Behavioural theories of leadership posit that specific behaviour differentiates leaders from non-leaders (Robbins 2003). The Iowa Studies established three major leadership styles: the autocratic, the democratic, and the laissez-faire leadership styles (Lewin et al. 1939). Specifically, autocratic leaders provided clear expectations for what needed to be done, when it should be done, and how it should be done; democratic leaders offered guidance to group members, but encouraged participation of employees in decisions; and laissez-faire leaders offered little or no guidance to group members and left decision-making up to group members.

Additionally, in the Ohio State Studies, which began at Ohio State University in the late 1940s (Stogdill & Coons 1951), two major dimensions of leadership behaviour were found: (1) initiating structure and (2) consideration. Initiating structure refers to the extent to which a leader is likely to define and structure his or her role and those of subordinates in the search for goal achievement, while consideration describes the extent to which a leader is likely to have job

relationships characterized by mutual trust and respect for group members' ideas and feelings. The two dimensions are independent of each other, and can co-exist at the same time.

Moreover, the studies undertaken at the University of Michigan proposed two dimensions of leadership behaviour: (1) employee-oriented and (2) production-oriented (Likert 1961). Employee-oriented leaders, also known as person-oriented leaders, emphasized interpersonal relations and cared about the needs of their employees, while production-oriented leaders, also known as task-oriented leaders, tended to be more concerned with the accomplishment of tasks. In this theory, the two dimensions affect each other, meaning that when the leader is highly employee-oriented, he/she would be less production-oriented and vice versa (Northouse 2013).

Furthermore, Blake and Mouton (1964) proposed a managerial grid based on the styles of concern for people and concern for production. These styles represent the dimensions of consideration or employee-oriented leadership and initiating structure or employee-oriented leadership, identified from the Ohio State Studies and University of Michigan Studies. The managerial grid presents five typical leadership styles: authority-compliance, country-club, team, middle-of-the-road, and impoverished styles.

Contingency theories of leadership propose that what makes an effective leader would depend on the situation. Certain situations and certain follower types need certain leadership styles (Mills et al. 2009). One of the most popular and widely known contingency models is the situational leadership theory developed by Hersey and Blanchard (1974, 1993), who argued that the right leadership style should be contingent on the ability and willingness of the followers. Situational leadership theory consists of two parts: (1) the leadership style, which is dependent on the directive and supportive behaviour, and (2) the development level of followers. Therefore, situational leadership theory presents four leadership styles: (1) directing (low supportive behaviour, high directive behaviour, low development of followers); (2) coaching (high supportive behaviour, high directive behaviour, moderate development of followers); (3) supporting (high supportive behaviour, low directive behaviour, moderate development of followers); and (4) delegating (low supportive behaviour, low directive behaviour, high development of followers).

Another contingency theory is the path-goal theory developed by House (1971, 1996). This theory maintains that it is the leaders' job to assist followers in achieving their goals and to provide the necessary direction and/or support to ensure that their goals are compatible with overall organization objectives. House (1996) identified four leadership styles: (1) the directive leader gives specific guidance of performance to followers; (2) the supportive leader is friendly and shows concern for the needs of followers; (3) the participative leader consults with followers and considers their suggestions before making decisions; and (4) the achievement-oriented leader sets high goals and expects followers to have high-level performance. House (1996) assumed that leaders are flexible and that the same leader can practise different types of behaviour at different times in varying situations.

This study identified 16 characteristics of leadership from previous studies on leadership (Robbins & Coulter 2007; Achua & Lussier 2013; Northouse 2013). They are elaborated in the section of results and discussion.

### ***Influence of leadership on project performance and success***

In the project management area, there have been several studies that investigated the relationship between project managers' leadership style and project performance. Odusami et al. (2003) indicated a significant relationship between project managers' leadership styles and project performance in the Nigerian construction industry. This finding was consistent with that of Mustapha and Naoum (1998), who found the significant association between preferred management styles of the site managers and their level of effectiveness. The role of project managers' leadership has also attracted attention from academia. Lee-Kelley and Leong (2003) reported the influence of project managers' leadership style on their perception of project success. Turner and Müller (2005) performed a comprehensive literature review and recognized project managers' leadership as a success factor for projects. Using both quantitative and qualitative studies, Müller and Turner (2007) confirmed the influence of project managers' leadership style on project success and disclosed that different leadership styles were appropriate for different project types. In addition, conducting a questionnaire survey, Geoghegan and Dulewicz (2008) reported that the British project managers' managerial competency leadership dimensions significantly influence project success. Moreover, Ozorhon et al. (2008) advocated the transformational leadership style and reported that project managers' transformational leadership style was positively associated with subordinates' work performance in the Thai construction industry. Furthermore, in the Taiwanese construction industry, Yang et al. (2011) found that increases in project managers' leadership enhanced relationships among team members, whilst team work was positively related to project performance and success. Because the performance and success of green building projects are crucial for the implementation of the green strategies in Singapore, this study attempts to identify the critical leadership styles adopted by project managers in green building projects.

## Method and data presentation

The literature review helped obtain a better understanding of leadership styles of project managers and collect information to develop the survey questionnaire used for data collection in this study. A pilot study was conducted with three project managers experienced in green construction to validate the questionnaire. In the finalized survey questionnaire, prior to the main body, the introduction letter provided the relevant definitions and objectives of this study. The first section captured demographic data of the respondents, their companies and projects. Then, the characteristics of leadership were presented, and the respondents were asked to rate their attitudes towards the adoption of these characteristics in their green construction projects, using a five-point Likert scale (1 = strongly disagree; 3 = neutral; and 5 = strongly agree). According to the responses, it is possible to identify the leadership styles adopted by the project managers.

The population of this study was all the project managers with experience in green construction. A list of project managers certified with the Green Mark Manager (GMM) and Green Mark Professional (GMP) schemes was obtained from the BCA, and served as the sampling frame of this study. These project managers were from either developers or contractors. A total of 90 questionnaires were personally delivered, and the researcher clearly explained to the respondents that they should answer the questions based on their experience in green building projects. Finally, 30 responses were received, representing a response rate of 33%. The response rate was reasonable compared with the norm of 20–30% for most questionnaire surveys in the construction industry (Akintoye 2000; Hwang et al. 2015a). Also, statistical analysis could still be conducted as the central limit theorem holds true with a sample size greater than 30 (Ott & Longnecker 2001; Ling et al. 2009).

Although Likert scale data have been recognized as ordinal data, a number of studies advocated that Likert data could be analysed using parametric statistical methods, such as t-test (Binder 1984; Hwang et al. 2014) and factor analysis (Carifio & Perla 2008; Deng et al. 2014; Shan et al. 2015). Nunnally (1975) believed that the results from parametric methods with ordinal data were recognized as reasonably reliable, whilst other statistics studies argued that parametric methods for interval variables could be used for ordinal variables. This was because the power and flexibility obtained from parametric methods can outweigh the small biases that they may entail (Allan 1976; O'Brien 1979), and conclusions and interpretations of parametric methods might be easier and provide more information (Allen & Seaman 2007). Therefore, the one-sample t-test and exploratory factor analysis (EFA) were used to analyse the data in this study.

Table 1 shows the profile of the respondents, their companies and projects: 37% of the respondents were contractors and the remaining 63% were developers. In addition, 83% of the respondents had over five years' experience in the construction industry. Also, 60% had less than three years' experience in green construction because the GMS had only been mandatory in the construction industry since 2008, when the Building Control (Environmental Sustainability) Regulations were enacted. Furthermore, the responses were based on 44 green building projects. The majority of these projects were residential and commercial building projects, and worth less than S\$100 million.

Table 1. Profile of companies, respondents, and projects.

Characteristics			<i>N</i>	%
Companies ( <i>N</i> = 30)	Contractors		11	37
	Developers		19	63
Respondents ( <i>N</i> = 30)	Experience in green construction	≤3 years	18	60
		4–6 years	8	27
		> 6 years	4	13
	Experience in the construction industry	≤5 years	5	17
		6–10 years	18	60
		11–15 years	4	13
		16–20 years	2	7
		>20 years	1	3
Project ( <i>N</i> = 44)	Project type	Residential	20	45
		Commercial	21	48
		Mixed development	3	7
	Project size (S\$)	<20 million	5	11
		20–40 million	8	18
		40–60 million	16	36
		60–80 million	5	11
		80–100 million	2	5
		>100 million	8	18

## Results and discussion

### *Leadership characteristics in green building projects*

The data on the perception of the respondents on leadership characteristics in green projects received a Cronbach's alpha of 0.879, indicating high reliability of the data. This study adopts a one-sample t-test to check whether the respondents significantly agreed on the 16 leadership characteristics. As shown in Table 2, the results indicated that 13 characteristics with  $p$ -values below 0.05 and mean scores above 3 received significant agreement from the project managers.

C13, 'strive for work performance and productivity', was ranked top (mean = 4.37), suggesting that work performance and productivity were emphasized by project managers in green building projects. Project managers take the responsibility for achieving project objectives, and the extent to which they achieve project objectives is considered as their performance and linked to their bonuses. In some Singaporean firms, project managers have signed accountability pledges, where they formally announce their responsibility for achieving the expected project performance (Zhao et al. 2014). In addition, some efforts have been made to develop a standardized performance measurement system for projects in Singapore (Hwang et al. 2015d). Examples are the Buildable Design Appraisal System (BDAS) (BCA 2005a), and the Construction Quality Assessment System (CONQUAS) (BCA 2005b). Furthermore, it is not surprising that project managers strive for project productivity in Singapore because the BCA has come up with several initiatives, such as the Construction Productivity Roadmap (CPR) and the Constructability Appraisal System (CAS), to enhance the construction productivity.

C07, 'have high concern for work tasks', received the second position (mean = 4.13), indicating that work tasks were highlighted by project managers in green building projects. This could be due to the fact that projects are highly goal-oriented (Frame 2003). The high rank of this characteristic was also consistent with the high rank of C13 because both of them were related to project objectives. In reality, no matter whether in traditional or green building projects, project objectives are highlighted because the achievement of these objectives represents project success in most cases (Ling et al. 2009).

C06, 'direct subordinates with clear roles and goals', was ranked third (mean = 4.10), indicating that the project managers tended to direct their subordinates with clear roles and goals so that subordinates know their role in the project. In addition, with clear roles and goals, subordinates are able to understand what the project manager expects of them. Additionally, in most cases, there are various groups of people working on site in a construction project because different work activities have to be conducted (Turner 2009). Hence, it is appropriate for the project manager to direct his/her team with clear roles and goals to prevent any confusion.

C05, 'work closely with subordinates to determine what needs to be done', occupied the fourth position (mean = 4.07), which was consistent with the democratic leadership style in the University of Iowa Studies because democratic leaders would like to actively engage their subordinates, seek their participation and work with them to determine what needs to be done (Achua & Lussier 2013). In addition, green technologies tend to require complicated techniques and construction

Table 2. Leadership styles of project managers in green projects.

Code	Characteristics of leadership	Mean	Rank	$p$ -value
C01	Make all the decisions without discussing with subordinates	2.50	16	0.000*
C02	Tell subordinates clearly what to do and how to do it	4.00	6	0.000*
C03	Closely supervise the work of subordinates	4.00	6	0.000*
C04	Encourage subordinates to share their ideas and opinions	3.77	9	0.000*
C05	Work closely with subordinates to determine what needs to be done	4.07	4	0.000*
C06	Direct subordinates with clear roles and goals	4.10	3	0.000*
C07	Have high concern for work tasks	4.13	2	0.000*
C08	Be sensitive to the feelings of subordinates	3.43	13	0.001*
C09	Look out for subordinates' welfare	3.60	11	0.000*
C10	Focus on getting the job done without paying any regard to subordinates' welfare and feelings	2.57	15	0.003*
C11	Develop and maintain good relationships with subordinates	3.77	9	0.000*
C12	Encourage two-way communication	4.07	4	0.000*
C13	Strive for work performance and productivity	4.37	1	0.000*
C14	Have high concern for people	3.53	12	0.000*
C15	Empower subordinates with freedom or autonomy in making decisions	3.13	14	0.293
C16	Delegate work responsibilities to subordinates	3.93	8	0.000*

\*The one-sample t-test result is significant at the 0.05 level.



processes (Zhang et al. 2011), with which staff may not be familiar. Because of the unfamiliarity of green technologies, a project manager should work more closely with the subordinates to determine the work tasks and clarify any issues (Hwang & Ng 2013).

C12, 'encourage two-way communication', was ranked fourth as well (mean = 4.07), indicating that project managers in green building projects also highlighted two-way communication within project teams. According to the Project Management Institute (PMI 2008), project communication management has been one of the nine areas of the Project Management Body of Knowledge (PMBOK), which shows the important role of communication in projects. In green building projects, communication skills allow the project managers to disseminate information and work procedures among diverse project participants. Additionally, because of the unfamiliarity with green technologies and complexity of green building projects, project managers should communicate regularly with project participants (Hwang & Ng 2013) and clarify work tasks, reducing the likelihood of erroneous work and rework.

C02, 'tell subordinates clearly what to do and how to do it', was ranked sixth (mean = 4.00), suggesting that the surveyed project managers preferred to use the directive leadership style in path-goal theory as well as the directing style in situational leadership theory. The high mean score of this characteristic was consistent with the usual practice in construction projects. Project managers should give their subordinates clear instructions on work tasks and construction methods.

C03, 'closely supervise the work of subordinates', was also ranked sixth (mean = 4.00). Close supervision of a project manager can help ensure that a project is on the right track and that work is being carried out correctly. In Singapore, project managers usually conduct daily site walkabouts to check the work progress. Another reason for the close supervision of project managers was that not everyone in the industry had the relevant knowledge and skills, especially those relating to green technologies. The lack of close supervision from project managers would result in erroneous work and rework.

Moreover, C16, 'delegate work responsibilities to subordinates', was ranked eighth (mean = 3.93), suggesting that the surveyed project managers tended to allocate some responsibilities to the subordinates appropriate for the work. C04, 'encourage subordinates to share their ideas and opinions', was ranked ninth (mean = 3.77). This result indicated that project managers encouraged the participation of their subordinates in decision-making, consistent with the participative leadership style in path-goal theory and the democratic leadership style in the University of Iowa Studies. C11, 'develop and maintain good relationships with subordinates', also occupied the ninth position (mean = 3.77). This was in accordance with the middle-of-the-road leadership style in the managerial grid model. In the context of Singapore, project staff are usually from different countries with various national cultures (Hwang et al. 2013). Hence, cultural differences should be highlighted when project managers handle their relationships with subordinates (Low & Shi 2002).

Furthermore, both C01 and C15 were related to decision-making, with low mean scores. As some respondents revealed, in the Singapore construction industry, project managers had to make decisions all the time. In most cases, project managers did not discuss with their subordinates when making minor decisions. However, when making major decisions, they discussed these with their subordinates to garner more opinions and viewpoints.

## **Leadership characteristic groupings**

### *Exploratory factor analysis (EFA)*

EFA identifies a relatively small and manageable set of underlying factor groupings that can be used to represent the correlations among a large set of interrelated variables. EFA requires two essential stages: (1) factor extraction, which determines the initial number of groupings underlying a set of variables, and (2) factor rotation, which makes the groupings more interpretable and determines the final number of the underlying groupings (Norusis 1992). In this study, EFA was used to categorize the 13 leadership characteristics that received significant agreement from the surveyed project managers. The ratio of the sample size to the number of variables was 2.31. MacCallum et al. (1999) concluded that factor analysis can produce correct solutions, even with samples that would traditionally have been determined to be too small for meaningful factor analysis. In addition, some previous studies using the EFA technique had a ratio below 5 – e.g. 2.48 in Koksals and Arditi (2004); 3.39 in Li et al. (2005); and 1.59 in Shen and Liu (2003).

The appropriateness of the factor analysis for the factor extraction was assessed in various ways. The Kaiser–Meyer–Olkin (KMO) value was 0.745, indicating an acceptable degree of common variance among the characteristics. The value of the test statistic for Bartlett's sphericity was large (chi-square = 302.908) and the *p*-value was 0.000, suggesting that the population correlation matrix was not an identity matrix. Hence, it can be concluded that the data were appropriate for EFA.

As for factor extraction, principal component analysis was used to identify underlying grouped factors. In terms of the number of factors to be extracted, Horn's parallel analysis (Horn 1965) was adopted because this has been seen as the most accurate method to determine the number of factors to retain (Pallant 2010).

Table 3. Leadership characteristic groups.

Code	Characteristics of leadership	Grouping	
		1	2
C06	Direct subordinates with clear roles and goals	0.976	
C02	Tell subordinates clearly what to do and how to do it	0.935	
C07	Have high concern for work tasks	0.823	
C13	Strive for work performance and productivity	0.759	
C03	Closely supervise the work of subordinates	0.796	
C16	Delegate work responsibilities to subordinates	0.694	
C05	Work closely with subordinates to determine what needs to be done	0.631	
C14	Have high concern for people		0.887
C11	Develop and maintain good relationships with subordinates		0.885
C08	Be sensitive to the feelings of subordinates		0.880
C09	Look out for subordinates' welfare		0.869
C04	Encourage subordinates to shares their ideas and opinions		0.727
C12	Encourage two-way communication		0.542
Eigenvalue		6.677	2.269
Criterion value from parallel analysis *		2.337	1.929
Variance (%)		51.4	17.4
Grouping mean		4.09	3.70

Grouping 1 = Directive and task-oriented leadership;

Grouping 2 = Relationship-oriented leadership.

\* The criterion values were obtained via the computer program developed by Patil et al. (2007). The 'number of variables' = 13 (i.e. the number of leadership characteristics). Sample Size = 30.

Factor rotation can be orthogonal or oblique. In this study, the oblique rotation was applied because the orthogonality of factors is often an unrealistic assumption. In almost all areas of social science, any factor is more or less related to other factors, and arbitrarily forcing the factors to be orthogonal may bias the reality. Even if the factors are indeed uncorrelated, the orthogonality should be empirically verified and demonstrated via EFA with an oblique rotation method (Matsunaga 2010; Zhao et al. 2013). In this study, promax rotation was adopted. The promax method begins with a varimax solution and then raises the factor loadings to a stated power called kappa ( $\kappa$ ). Thus, loadings of small magnitude will approach 0 while large loadings, although reduced, are still substantial (Zhao et al. 2015).

The principal component analysis with promax rotation was performed and the result indicated two components with eigenvalues over 1. Then, the two eigenvalues were compared with the criterion values from the parallel analysis using the computer program developed by Patil et al. (2007). The number of components to retain is the number of eigenvalues that are larger than the corresponding random eigenvalues (i.e. criterion values). As Table 3 shows, the number of components from the parallel analysis is two, consistent with that from the principal component analysis. The two leadership characteristic groupings explained approximately 68.8% of the variance, higher than the guideline of 60% recommended by Malhotra (2006).

The factor loading value reflects the degree of contribution of individual variables to each underlying grouping. All the characteristics obtained the factor loadings above the threshold of 0.45 (Comrey 1973). Thus, the 13 characteristics were categorized into two groupings. Each grouping was labelled by considering the characteristics with high loadings and what they had in common.

#### *Grouping 1: Directive and task-oriented leadership*

Grouping 1 was interpreted as 'directive and task-oriented leadership'. The two characteristics with highest factor loadings were C06, 'direct subordinates with clear roles and goals', and C02, 'tell subordinates clearly what to do and how to do it'. Both are consistent with the directive leadership style in path-goal theory and the directing style in situational leadership theory. In addition, both highlight the role and goals of subordinates. Achieving the goal of each subordinate can collectively contribute to the achievement of the project task.

C07, 'have high concern for work tasks', C13, 'strive for work performance and productivity', and C03, 'closely supervise the work of subordinates', are indeed task-oriented leadership. In other words, the concern for work task, performance



and productivity indicates that leaders need to pay great attention to the final fulfilment of the project's objective. To ensure that a project is performed smoothly, project managers tend to closely supervise the work of subordinates. The close supervision of project managers can also represent their high concern for the work tasks as well as project performance and success.

To ensure project success, project managers also need to encourage the participation of their subordinates. Thus, C16, 'delegate work responsibilities to subordinates', and C05, 'work closely with subordinates to determine what needs to be done', were also included in Grouping 1. It should be noted that the participation of the subordinates does not mean that they are empowered to make decisions, as suggested by the relatively low mean score of C15, 'empower subordinates with freedom or autonomy in making decisions'.

#### *Grouping 2: Relationship-oriented leadership*

Grouping 2 was labelled as 'relationship-oriented leadership'. Four leadership characteristics (C08, C09, C11, and C14) received high factor loadings of over 0.800. C14, 'have high concern for people', received the highest factor loading. High concern for the subordinates contributes to the development of relationships within the project team. C08, 'be sensitive to the feelings of subordinates', and C09, 'look out for subordinates' welfare', can be seen as specific examples of high concern for subordinates. Thus, a good relationship between a project manager and subordinates can be gradually developed and maintained. These four leadership characteristics are in accordance with the supportive leadership style in path-goal theory.

C04, 'encourage subordinates to share their ideas and opinions', was also included in Grouping 2. This characteristic aligns with the participative leadership style in path-goal theory and the democratic leadership style in the University of Iowa Studies. Encouraged by project managers, subordinates would like to share their ideas and opinions about projects that they are engaged in. This also indicates that project managers respect the ideas and opinions of subordinates, which contributes to the relationship between project managers and subordinates. Additionally, C12, 'encourage two-way communication', was included in Grouping 2 because communication could help resolve disputes or disagreement, contributing to a good relationship.

#### *Comparison between the two groupings*

As shown in Table 3, the mean scores of Groupings 1 and 2 are 4.09 and 3.70, respectively. The mean score of a grouping was measured as the average value of all the mean scores of the leadership characteristics under this grouping.

The result suggested that the leadership style of project managers in green building projects was more towards 'directive and task-oriented leadership'. It had been only five years since the GMS became mandatory in Singapore's construction industry. Hence, it was not uncommon that many staff were still unfamiliar with green technologies and construction processes, which were usually more complicated than those of traditional projects (Zhang et al. 2011; Hwang & Ng 2013). The project managers, who were certified with the GMM and GMP schemes and were knowledgeable about green technologies and construction processes, should provide directions for their subordinates and try to avoid any erroneous work. In addition, the BCA has set up a target that at least 80% of buildings will have been certified by the GMS by 2030 (BCA 2009). Thus, the green building projects under construction should be completed successfully, which contributes to the achievement of this target. Project managers, who are accountable for their projects, should highlight the achievement of project objectives, thus being more task-oriented.

However, the project managers did not overlook their subordinates' roles. The project managers still cared about the feeling, welfare and opinions of their subordinates. When dealing with their relationships with subordinates, the project managers adopted participative and democratic leadership styles. Indeed, a harmonious relationship within a project can greatly contribute to the project's success (Chua et al. 1999).

Therefore, project managers in green building projects should be not only directive and task-oriented, but also relationship-oriented. These two leadership styles should not be separated because the relationships within a project team inevitably influence project performance and productivity, whilst the interaction between a project manager and subordinates facilitates establishing relationships.

#### **Conclusion and recommendation**

Leadership has been recognized as one of the essential skills of project managers in green building projects (Hwang & Ng 2013), and is crucial to the success of these projects. The objective of this study is to identify the leadership characteristics and styles of project managers in green building projects in Singapore. The results of the analysis indicated that 13

leadership characteristics drew significant agreement from the project managers in the Singaporean green building projects. Among these characteristics, 'strive for work performance and productivity', 'have high concern for work tasks', and 'direct subordinates with clear roles and goals' occupied the top three positions. Additionally, the 13 characteristics were categorized into two groupings via EFA: (1) directive and task-oriented leadership and (2) relationship-oriented leadership. The leadership style of the project managers was more towards directive and task-oriented leadership. However, project managers should not neglect their relationships with subordinates. In reality, the two leadership styles should be adopted together. Although the task and project performance should be highlighted, the interpersonal relationships within a project team are also worth attention because these relationships also influence project performance and productivity.

Although the objectives were achieved, there were some limitations to the conclusions that may be drawn from the results. First, as the sample size in this study was small, one should be cautious when the results are interpreted and generalized. Also, the 16 leadership characteristics from the literature review may not be exhaustive. Additionally, the single-source data are very likely to cause common method biases (Jiang & Wang 2014; Jiang & Jiang 2015), which is a common limitation of studies using questionnaire surveys. Lastly, the findings from this study were well interpreted in the context of Singapore, which may be different from the context of other countries. Nonetheless, this study still provides an understanding of leadership characteristics and styles of project managers in the Singaporean green building projects for both practitioners and researchers. In addition, it provides the theoretical rationale behind the various leadership characteristics of project managers. Thus, this study expands the existing literature relating to leadership and green building projects.

For future studies, it would be of interest to conduct in-depth case studies disclosing how project managers lead green building projects and compare their leadership styles with those of traditional projects. Also, it is recommended to identify the factors influencing the leadership styles in green building projects and investigate the theoretical rationale behind these factors using organizational behaviour theories. Lastly, motivation and learning issues associated with implementing green strategies can be explored in future studies to further nourish the existing body of knowledge for managing green construction projects.

### Disclosure statement

No potential conflict of interest was reported by the authors.

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