



# THE ASSOCIATION BETWEEN CLIENT QUALITIES AND DESIGN TEAM ATTRIBUTES OF GREEN BUILDING PROJECTS

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## ABSTRACT

The construction industry has become more complex due to changes in technology and the greater emphasis placed on satisfying green requirements. The design phase is the most important phase in determining the green performance of building projects. The performance of the design team is crucial. The selection of a design team should be based on a set of criteria. Therefore, a competent design teams is required to have a good understanding of environmental issues. Design teams require a range of competences such as skills of environmental assessments, initiatives and environmental background as the basis for design decisions. In addition, success of building projects greatly depends on the client's performance. The performance of clients is crucial since decisions made will influence the overall project performance. The quality of clients' representatives has potential influence on design team performance. In designing green buildings client's attributes are critical factors to high performance of building projects. The propose of this study to identify the significant associations between variables of design team attributes and client qualities. To achieve mentioned aim a questionnaire survey was conducted to collect data required. A sample of 274 respondents has been covered under the study, including architects and engineers practicing design and consultancy building sectors. Prior to analysis of data WINSTEPS software were used for Rasch modeling to determine validity and reliability of date. Descriptive analysis data includes quantitative and qualitative. The results indicate that the influence of Clients' Qualities on Design Team Attributes is extensive. Coordination ability has major influence on overall design team attributes. The higher the Client Knowledge on Green buildings the higher is the Design Team Attributes expected.

**Keywords:** construction industry, design team attributes, clients' qualities, green design performance.

## 1. INTRODUCTION

The construction industry has become more complex over the last two decades due to changes in technology and the greater emphasis placed on satisfying green requirements, this makes it difficult for the design teams to deliver all the design requirements [1]. Pheng and Chuan [2] mentioned that the achievement of high performance design depends to a large extent on project team members being capable of performing tasks together effectively.

The design process of building projects involves individuals from different background and different orientations and values. These individuals do not automatically work together. Arranging work into teams that have a mixture of complementary skills, knowledge, attitudes and other characteristics is more effective than if the members work individually.

In the construction industry, over the years, studies have paid little attention to client's performance. The performance of clients is crucial since decisions made will influence the overall project performance. The performance of clients has not been sufficiently researched. This view is echoed by Egbu and Ilozor [3] who mentioned that there is still a lack of research pertaining to the comprehension of the client's key roles.

## 2. KEY CLIENT'S QUALITIES

### 2.1. Clients' knowledge on green buildings

The client is the key person to provide information concerning the business mission and the overall aim of the project. When the client is knowledgeable in their organization's mission and their operation, he could provide the required design information to the design team [4].

A knowledgeable client in green building aspects will plan the development of the requirements parallel to the business strategies of their organization. This guarantee the client obtained the necessary information appropriately to the organization. On the other hand, unknowledgeable client in implementing different construction levels is unable to enroll into green aspects and understand what to expect and how to play their roles. In this context, Alinaitwe [5] found that more than 90% of building clients do not support training on green design aspects in their organization. That reveals the lack of knowledge and skills in client's representatives during the design process of green buildings. These findings were supported by Gaia [6] who highlighted that most clients should give more consideration to training to increase knowledge concerning green design issues.

### 2.2. Clients' experience on green buildings

Client experience plays a major role in affecting the performance of a design team [2] and on the performance of building projects [7]. Soetanto *et al.*, [8] evaluated the qualities of UK clients and found that the client's experience is one of three qualities that



significantly affect overall project performance. These findings were supported by Ahmed [9] who found that the level of client experience has a major impact on project success.

Designing green buildings is more complex than designing conventional buildings. To understand the complexity of activities during the design process is very difficult [10-12]. Due to the complexity of the design process, the effort applied to planning and control is commonly either insufficient or inappropriate [13]. Thus, more knowledge and experience are needed to cope with green design requirements.

### 2.3. Clients' commitment to green buildings

High client commitment is required especially at the early design stage in order to ensure clear identification of the client requirements Gaia [6]. Many studies have confirmed that the project performance have a direct influence on the commitment level of the client in the construction project. [4, 14-16].

The initial step in the process of achieving a green building project is to confirm the required commitment on the part of the client. Shafii and Othman [17] stated that to move towards green building, building owners and clients should be more committed to disseminating green construction. Yudelson [18] discussed the cost effectiveness of green building design and mentioned that early client commitment to green building is crucial to achieve a high performance building.

### 2.4. Client's capability of managing design process

Designing green buildings requires a set of tasks to be identified, recognized, assigned across the team arranged and integrated properly into the design team process. Ahmed (2007) mentioned that in managing the design process, the clients are required to clarify goals and objectives of the project and to coordinate efforts with design team members.

Efficient and effective management of building projects requires strong leadership skills [14]. Selecting the right individuals for a project team is essential for high-quality attributes particularly during the design phase. Ahmed [9] mentioned that the quality of both, the client's representatives and the design team influences the development of client requirements, thus, the client's representatives are required to have strong leadership skills to organize the whole project process to be systematic, efficient and effective. Coordinating and encouraging the green design process within a project team requires competent leadership.

### 2.5. Communication effectiveness with design team

Communication during the design process is an iterative in nature, which needs shared understanding and commitments from the client and other project participants involved. It is a dynamic process that continues during the early design phase of the building project and develops from general to more detailed features as it progresses. In this context, Love [19] mentioned that the utilization of

Information Communication Technologies (ICTs) is one of the most important means of improving the performance of design and construction teams.

The design process of green buildings is more complex than the design process of conventional buildings. Efficient and effective coordination, collaboration and communication among client and other project participants is required to overcome complexity and difficulty inherent within the design process of green buildings. The client's representatives are required to have management skills in order to be able to organize and coordinate the design process effectively with the design team and other project participants.

### 2.6. Commitment of client organization to provide finances for green building

Organizational commitment has a significant influence on overall employee behaviors and performance effectiveness in organizations. Lack of resources is frequently a major cause of inadequate team performance. Drawing from the literature, many researchers stated that client commitment providing finances is the key factor influencing design team attributes and overall project performance [4, 14-16].

To apply green design issues effectively requires client commitment. Most building clients believe that implementing green issues in buildings impose additional cost. Therefore, they are avoiding the incorporation of green features in design particularly if they are expensive. Uhl and Anderson [20], [21, 22] found that one of the key barriers of integrating green innovation into the building industry is lack demand from the client. [23] Confirmed that the low commitment from top management and lack of resources allocated to green issues play as major barriers to green built environments in Malaysia.

### 2.7. Maintaining active participation in green design process

The significance of team member participation to the performance of the organization has been shown in many studies. Rahmat [24] and Vandenberg *et al.*, [25] found that team participation can enhance collaboration, performance, communication, resource utilization, decision-making, team commitment, member confidence and quality. These findings were supported by Belanger and Allport [26] mentioned that perceived member involvement among teams in decision-making was positively associated with team cohesiveness, team productivity and an enhancement of team communication.

The design of green building projects is a complex process and thus, difficult to manage. Design requires effective participation and collaboration from a huge and diverse collection of individuals and organizations. Karlson *et al.* (2008) mentioned that achieving green built environments successfully requires more involvement and collaboration among design team members and client. This view was supported by Yudelson (2009) who also believes that effective involvement and



coordination among project stakeholders is one of the vital elements to enhance the performance of green design.

### 3. DESIGN TEAM ATTRIBUTES

Drawing from literature, 21 design team attributes were identified as crucial for high green design performance. These attributes were classified into two groups, namely, general attributes and green attributes. The general attributes are essential for design team in order to produce high quality design, whereas green attributes selected are essential for design team members to produce green design. General and green design team attributes selected are explained as follow:

#### 3.1. Design team experience

Sahil [27] studied factors influencing the performance of construction consultancy firms. He found one of the most significant factors is poor previous work experience. Lee and Egbu [3] recommended that multiple skills and a variety of relevant experience with various competent knowledge features of building design are needed. These findings were supported by Mac Cormack *et al.* [28] and Krishnan [29] who discovered that teams with a great experience base were performing better.

#### 3.2. Design team management

While present construction projects vary in their degrees of complexity, they all still need the competencies of various individuals to be coordinated and effectively managed as a team, [30]. Therefore, design management is becoming progressively accepted as being essential to the success of any complex construction project [1]. According to Rounce [31] many of the quality and effectiveness problems faced during the design process are due to ineffective design management. These findings were supported by Tozrtzopoulos [32] who mentioned that inadequate design management contributes considerably to inadequate design process performance. Performance management capabilities of team members are beneficial in identifying team and individual performance [33-35].

To move toward green building, one of Shafii and Othman [17] recommendations was concerned with the development of decision-making tools for the construction industry. These findings were supported by Knesl *et al.* [36] who found that the awareness of relevant experts and specialists of key decisions during design process that could influence later environmental alternatives.

Leadership style is one of the various factors that encourage teamwork [37]. According to Morgeson *et al.*, [38] team leadership is to satisfy the team's requirements and to foster team effectiveness. Since construction work in general requires team efforts, leadership must have a great influence on construction work performance [39]. Mathieu *et al.*, [40] stated that leadership has been revealed as a significant factor in project success.

Several empirical research efforts have discovered how the function of team leadership influences team function. For instance, Kane *et al.* [41], Morgeson *et al.* [38] and Klein and Kozlowski [42] investigated team

leaders who perform task functions needed for team performance. Newton [1] and Girard and Robin [12] believe that the design team leader should maintain and promote the team through effective leadership and team selection.

#### 3.3. Effective communication and conflicts management

Hes [43] and Emmitt and Gorse [44] mentioned that the combination of an increasing design process fragmentation, the insatiable requirement for comprehensive information and an increasing client expectation level has lead to greater stress on the necessity and requirement for effective communication. A number of studies have investigated communication effectiveness. According to Otter and Emmitt [45], and Forsyth [46] mentioned that effective communication between teams is dependent on all of the team members willingness, actions and reactions, paying attention and sharing to develop their competencies for effective communication utilization.

Conflict resolution is very crucial to team effectiveness. Throughout team interactions, it is occasionally difficult to keep positive interpersonal relationships since individuals have different plans, principles, attitudes and interpersonal communication manners, which can cause interpersonal stress and reduce team effectiveness [47]. Kirkman *et al.*, [48] mentioned that a failure of communication among project participants can cause misunderstandings and conflicts that may affect project performance if not realized and resolved at an early stage. Competencies require members of the team to be capable to understand and promote desirable conflicts but hinder undesirable conflicts (Stevens and Campion, 1999). Referring to this issue Bolton and Bolton (2009) suggested that conflicts will take place along the way and quick conflict management is needed to get the team back on track and to keep relationships among the team at a very professional level and to prevent personal conflicts that influence team performance.

#### 3.4. Clarity of roles

The delivery of a green performance project requires early formation of the project team, the major project team members must be recognized from the beginning of the project, the roles and responsibilities of design professionals must be clearly described and classified to ensure that the green initiatives that they are responsible for are developed, refined and applied from the beginning of the project. If roles and responsibilities are not assigned, green initiatives might potentially be mistaken or cut out (Danielle, 2007).

The delivery of green performance also requires an increased collaboration among a variety of project stakeholders at the design stage [36]. Rohracher [49] found that at this stage 'green' building should be introduced as an innovative way to fabricate things, new technologies and new structures. He emphasized on the relationship between design team members through more



cooperative collaboration to achieve green building projects. These findings were supported by Shafii and Othman [17] who also suggested that achieving green development demands collaboration between sectors, organizations and effective participation of all project stakeholders.

### 3.5. Design team knowledge on green building

Without sufficient knowledge about design and construction of green buildings, design teams would be struggling to implement environmental design criteria and other green design requirements. Megat [23] found that the key barriers of applying green building features are team knowledge and understanding of green rating systems. These findings were supported by Karlson *et al.* [50] who also found that design teams need to be aware regarding the principles of green design requirements and measures. Therefore, more education about the green design process is required.

However, Shari *et al.* [51] argued that the Malaysian building industry players have “insignificant” knowledge on sustainability in general as well as on Green Building Rating Systems (GBRS) in specific. This observation is echoed by Shafii and Othman [52] who identified the key barriers to promoting sustainability in Malaysia. The study discovered that the key barriers fell under the knowledge-related factor, which included lacking experience or knowledge, lacking education and training in green design and construction.

For the construction industry to shift green design, Shafii and Othman [52] recommended that education and training must include green development concepts and to make it well known and acknowledged by all people. Isabel and Cyril [53] mentioned that there is a need for further training amongst the various design teams. Providing education and training to building project stakeholders might change green building perceptions as well as provide the knowledge required to integrate green building technology into a project (Sandra, 2005).

To achieve green buildings, design teams should be knowledgeable about environmental issues during their professional training, [54]. Lee and Egbu [55] recommended that the designer should be multi-skilled with several competent knowledge areas in all of the different features of building design. Therefore, designers should be able to translate green design aspects into designs required to be equipped with the knowledge and tools [56]. Complemented by management skills and knowledge to meet all of the green design challenges, [57].

### 3.6. Design team skills on green building

The skills and abilities of team members have a major influence on overall team performance [58]. Therefore, the skills and characters of every single team member have to be observed and to be considered because it may affect the final performance output of a team, [40, 59, 60]. These findings were supported by Daghfous [61]

and Chow and Ng [62] who also stated that skills are important core capability dimensions.

Recently, the criteria for selecting design team members has been widened to include their skills on design team process [63, 64]. The skills of the team members are found to be a critical factor, [65]. A good design team must have the appropriate design skills and ability to interpret the clients’ requirements, [66]. Green design requires a variety of skills and perspectives to demonstrate how final designs will comply with green performance requirements.

### 3.7. Conscientiousness on green

Conscientiousness also includes hardworking, persevering and achievement oriented. The lack of these traits might lead to a negative impact on individuals and overall team performance [67]. Peeters *et al.* [68] expected this positive result of the elevation of conscientiousness at the team level as well. This expectation was supported by Robertson *et al.* [69] and DeDreu and VanVianen [70] as they demonstrated that a higher level of conscientiousness within a team leads to better team performance.

There are three measures of conscientiousness on green design, i.e., attention to green design and construction details, speed in producing green design drawings and the ability to overcome green design difficulties. During the design process of building projects the design teams have to pay special attention to green elements design and construction details in order to achieve buildability [71]. Molleman *et al.* [72] expected that similarity in conscientiousness will lead to speed the process, while, dissimilarity in conscientiousness might lead to a clash and reduce the team’s effectiveness.

### 3.8. Commitment on green

DeShon and Landis [73] defined goal commitment as the degree to which an individual or team believes the goal to be significant and is established to achieve it by increasing effort over time, and is unwilling to discard or lower the goal confronted with delay or negative feedback. In addition, Aube and Rousseau [74] added that establishing a goal at the team level indicates that the members of the team ought to achieve it collectively. Therefore, it could be argued that to produce green design, every member of the design team must believe in green design and willing to increase their efforts.

Rousseau [74] considered that the commitment as a determinant of job performance. This view is echoed by Meyer *et al.* [75] who found that effective commitment is positively correlated with job performance. From this statement, it could be understood that effective commitment to green design is positively correlated to green design performance.

## 4. METHOD AND MATERIALS

### 4.1. Methodology





The study is part of Ph.D. research a triangulation technique was implemented, which combined quantitative and qualitative data collection approaches. The research was performed throughout three main stages, the first stage was a comprehensive literature review validated in a preliminary questionnaire survey. Data collection involving semi-structured interviews was the second stage. The main aim of this stage was to upgrade and refine the research problem and proposed theoretical framework. The last stage involved the final questionnaire survey, in which data was collected for statistical analysis purposes. Prior of this survey preliminary questionnaire was posted. Four research variables were verified.

To investigate key characteristics of building projects influence green design performance, in final questionnaire survey, the questionnaire was divided into two parts. The first part requires respondents to provide their personal particulars, whereas, the second part focuses on uncovering the key characteristics of building projects.

A survey package consisting of the detailed questionnaire was posted to professionals in various architectural consultancy firms as well as engineering consultancy firms, selected by the lists of architects and engineers provided from their organizations. The population for this study became key design team players for architects and engineers. Only architects registered in PAM and Engineers registered in AECM are selected as the research context. The target population includes architects and Engineers working in design consultancy located in Malaysia. A total of 274 survey questionnaire

were distributed, 102 valid replies were received, which represents a response rate of 37.1%.

WINSTEPS software was used for Rasch Modeling of the Principal Performance Measures to examine data validity and reliability was analyzed. SPSS version 19, software was used to analyses data collected. The technique of descriptive statistics was used to describe and make sense of the data. The descriptive statistics included the frequency and mean for studied variables.

#### 4.2. Validity and reliability

Prior to analysis, functioning of the 5-point Likert scale was examined according to the criteria by Linacre (2006). More than 10 observations are found in each category. Table shows the rating scale category function data for design team attributes and client qualities suggesting no category disordering. Beside, both the observed average measures and category measure are characterized by criterion of monotonic advance. The Outfit MNSQ values, which are close to infit MNSQ values, for each category are all close to 1.00 and less than 2.00, suggesting that each label was providing measurement information rather than noise in the data. The threshold estimates increase with the category label, indicating that the response categories were used in expected and intended manner. The total variance explained by the measures are (63.9%, 64.9) which exceeded 60% suggesting that each item was explained by more than 60% of measures. These evidences suggested that the rating scale categories are effectively satisfactory for design team variable and client qualities.

**Table-1.** Key reliability and validity parameters of items.

Total variance in observations		Category measures		Threshold estimates	
DT	CQ	DT	CQ	DT	CQ
-1.74	-3.52	-2.99	-4.75	-	-
-0.87	-1.93	-1.37	-2.5	-1.65	-3.58
-0.13	-0.33	-0.08	-0.04	-0.80	-1.38
0.6	1.01	1.33	2.5	.52	1.29
1.28	2.6	3.19	4.83	1.93	3.66
Rasch principal components analysis (RPCA)					
		DT	CQ		
Total variance in observations		58.2%	20%		
variance explained by measures		63.9%	64.9%		
Unexplained variance in 2 <sup>nd</sup> contrast		4.7%	7.8%		

Reliability and Separation Index: As can be seen from Table-2, reliability of all variables item difficulty measure was very high (0.96, 0.98). This suggested that the ordering of item difficulty was highly replicable with other comparable sample from similar population. The item separation index was very high which are

considerably higher than the minimum desired 2.00. The Adj-Sd was at accepted estimate. The item measure RSME measure was (0.12, 0.16) which considered very well. Taken together, these statistics indicate good separation between items and item measures.

**Table-2.** Reliability and separation index.

	Model RMSE	Mean	Adj-Sd	Separation	Reliability
<b>Behavior measures</b>					
DT	0.27	0.11	1.04	3.35	.94
CQ	0.66	0.17	1.6	2.11	.85
<b>Item measures</b>					
DT	0.12	0.14	0.63	4.95	.96
CQ	0.16	0.49	1.18	7.04	.98

#### 4.3. Dimensionality test of variables

For the project characteristics with five-category response model as can be seen in Table-3, all items had acceptable outfit MNSQ statistics between 0.78 and 1.45 the lowest outfit was 0.75 whereas the highest was 1.49 suggesting that it was not redundant items with considering high values may represent a lack of homogeneity with other items in the subscale. All items

had high to very high PTMEA correlations (0.26 - 0.62) which exceeded .20 as critical value for the correlation. Positive sign of correlation values identified that the items are systematically correlated in the same direction, measuring the same latent variable calling "project characteristics", therefore, all items had good discrimination.

**Table-3.** Item statistics: misfit order and item correlations.

Variables	MNSQ				PTMEA	
	outfit		Infit		Lowest	Highest
	Lowest	Highest	Lowest	Highest		
Design Team	0.71	1.53	0.70	1.63	0.24	0.62
Clients' qualities	0.69	1.30	0.70	1.37	0.66	0.76

## 5. RESULTS AND DISCUSSIONS

The hypothesis of this study that was tested is whether Client's Qualities variables affect the Design Team Attributes during design process of building projects. The null ( $H_0$ ) and alternative ( $H_1$ ) hypotheses for the test are:

**H<sub>0</sub>:** The Client's Qualities variables do not influence the Design Team Attributes of building projects.

**H<sub>1</sub>:** The Client's Qualities variables influence the Design Team Attributes of building projects.

Spearman's rank correlation technique was used in the correlation test to establish whether a significant relationship existed between the Clients' Qualities variables and the Design Team Attributes variables. The null hypothesis was rejected at 5 percent significance level.

### 5.1. The association between client general qualities and design team attributes

Table-4 shows that, as expected, generally more positive correlations are detected in the correlation test. This indicates that Clients' General Qualities influence the Design Team Attributes of building projects. Therefore, in general, it can be concluded that the association between the Clients' General Qualities and Design Team Attributes is extensive. These results show that as Clients' General Qualities of building projects improves as the Design

Team Attributes improve and vice-versa. The significant correlations are discussed below.

#### 5.1.1. The influence of the ability to coordinate design process on the design team general attributes

Table-4 shows that 16 out of 21 significant correlations were detected between the Ability of Client to Coordinate Design Process and Design Team General Attributes variables. Thus the influence of the Ability to Coordinate Design Process on Design Team Attributes is extensive.

This result is expected since increasing complexities in construction industry require more coordination among design teams involved during design process. Khaidzir [76] stated that clients have to place greater emphasis on the coordination and management with design teams. Girard and Robin [12] found that to improve design performance clients required efficient coordination with design teams during design process. Ahmed (2007) mentioned that in managing the design process, the clients are required to clarify goals and objectives of the project and to coordinate efforts with design team members. With this view is supported by Yudelson (2009) who also believes that effective coordination among project stakeholders is one of the vital elements to enhance the performance of green design.

**Tables-4.** The association between client's qualities and design team attributes.

		Clients' general qualities variables		
		CQ5	CQ6	CQ7
<b>Design team attributes variables</b>				
<b>Design team - general attributes</b>				
1	Experience in construction industry	.365**	.423**	.453**
2	Experience in similar type and size of project	0.016	0.136	0.189
3	Leadership effectiveness	.214*	.383**	.457**
4	Decision - making effectiveness	.201*	.247*	.396**
5	Effectiveness of controlling and monitoring design development	.213*	.238*	.390**
6	Effectiveness of controlling and monitoring to produce economic design	.305**	.308**	.395**
7	Communication effectiveness	.369**	.259**	.376**
8	Effectiveness of managing conflicts	0.157	.207*	.335**
9	Clarity of design team roles	.237*	.359**	.462**
<b>Design team -green attributes</b>				
10	Knowledge relevant to green design	.211*	.365**	.473**
11	Knowledge of green design assessment tools	.240*	.257**	.402**
12	Skills of using design programs	.381**	.318**	.306**
13	Interpret client needs into efficient green design	.381**	.385**	.446**
14	Attention to green design and construction details	.263**	.327**	.432**
15	Speed in producing green design drawings	.229*	.261**	.278**
16	Ability in overcoming green design difficulties	.289**	.320**	.463**
17	Offering suggestion to improve green design	.239*	.269**	.388**
18	Interest in the green design assignments	0.091	0.137	0.193
19	Commitment level of the architect to produce green design	.263**	.397**	.395**
20	Commitment level of M and E engineers to implement green energy	0.174	.240*	.262**
21	Commitment of Q.S to select green materials	0.124	0.154	.278**

**Key:** CQ5: Ability to coordinate design process; CQ6: communication effectiveness; CQ7: client involvement

The results imply that client coordination ability has major influence on overall design team attributes. The client should employ an experienced project team which is capable of coordinating the design process. The experience of client on managing the design process can facilitate the design team motion. The client should identify roles clearly among project team members to obtain effective coordination among the project team. The clients' needs also to establish suitable communication devices among project teams to ensure all information required is distributed to design team members.

#### 5.1.2. The influence of client communication skills on design team general attributes

Table-5 shows that 18 out of 21 significant correlations were detected between Client Communication Skills during the design process and Design Team General

Attributes variables. The results reveal that the Communication Effectiveness degree of the client in design process is significant correlated with Design Team General Attribute's variables. The influence on Design Team General Attributes is extensive.

This result is expected since the Communication Effectiveness during the design process enhances design performance. [77] Stated that the nature of the design process requires effective communication to allocate all the requirements and to ensure deep consideration of all possible crucial issues in order to improve design outcome. This view is echoed by Danielle [78] who recommended the adoption of a design charrette as a regular mechanism to promote efficient communication and collaboration.

The results imply that the importance of client's communication effectiveness with the design team to



improve design team general attributes. Therefore, the client should set a clear communication approach that ensures the client project team can share and exchange all design information required. To ensure an effective communication between the client and design team, the client should also arrange for design charrette at the early stage of design which involves discussion of the effective communication devices which could be adopted to encourage efficient communication and collaboration among the project team.

### 5.1.3. The influence of the client involvement on design team general attributes

Table-4 shows that 19 out of 21 significant correlations were detected between Client Involvement during design process and Design Team General Attribute's variables. Thus the influence of the Clients' Involvement on the Design Team General Attributes is extensive.

This result is supports Karlson *et al.* [50] and Yudelson [18] who observed that one of the effective approaches for green design is a Green Charrette, which among others stressed the importance of clients' involvement in order to create a high-performance work setting. Wenjian [79] argued that clients and design team members should be involved and work together in order to develop an integrated design team, which will result in better design performance.

The results imply that the importance of Client Involvement the during design process on Design Team General Attributes. In order to be able to involve effectively, the clients must be knowledgeable and skilled on green design and committed to green buildings. Knowledgeable clients will encourage the design team to integrate green features. Clients should employ Green Charrette Concept to encourage greater involvement and collaboration with design team.

### 5.2. The association between clients' green qualities and design team attributes

Table-5 shows that, as expected, generally more positive correlations are detected in the correlation test.

This indicates that Clients' Green Qualities influence the Design Team Attributes of building projects. Therefore, in general, it can be concluded that the association between the Clients' Green Qualities and Design Team Attributes is extensive. These results show that as Clients' Green Qualities of building projects improves as the Design Team Attributes improve and vice-versa. The significant correlations are discussed below:

#### 5.2.1. The Influence of client's green knowledge on the design team attributes

Table-5 shows that 20 positive significant correlations out of 21 expected between Client's Green Knowledge and Design Team Attributes variables. The Client's Green Knowledge affects equally both the General and Green Attributes of design team. Thus it can be concluded that the effects of Client's Green Knowledge on the Design Team Attributes is extensive.

This result is expected since the degree of Client Knowledge on Green is needed to establish client requirements and to enhance Green Design Performance [4]. In this context, Alinaitwe [5] found that lack of training on green design aspects in client organization is the key factor for drawback of green design performance. These findings were supported by Gaia [6] who highlighted that most clients should give more consideration for training to increase knowledge concerning green design issues.

The results imply that the higher the Client Knowledge on Green buildings the higher is the Design Team Attributes expected. Therefore, the client must acquire green knowledge because that will encourage design team members to employ green features in their design. Knowledgeable client will articulate clearly green elements in project brief and will be identified as client requirements. And knowledgeable clients in green buildings can understand better of green design requirements such as additional time and cost required. Design teams throughout dealing with knowledgeable client can be promoted to integrate green design elements and they will find taking decisions during design process are fast.



**Table-5.** The association between client's qualities and design team attributes.

		Clients' green qualities variables			
		CQ1	CQ2	CQ3	CQ4
<b>Design team attributes variables</b>					
<b>Design team -general attributes</b>					
1	Experience in construction industry	.213*	0.098	0.157	0.151
2	Experience in similar type and size of project	0.183	0.18	0.109	0.17
3	Leadership effectiveness	.268**	0.175	.237*	.339**
4	Decision -making effectiveness	.262**	.223*	0.087	0.16
5	Effectiveness of controlling and monitoring design development	.277**	.229*	0.092	.205*
6	Effectiveness of controlling and monitoring to produce economic design	.377**	.312**	0.112	0.188
7	Communication effectiveness	.448**	.286**	.224*	.284**
8	Effectiveness of managing conflicts	.254*	0.161	0.177	.242*
9	Clarity of Design Team Roles	.238*	0.133	.362**	.334**
<b>Design team - green attributes</b>					
10	Knowledge relevant to green design	.524**	.301**	.440**	.378**
11	Knowledge of green design assessment tools	.415**	.312**	.471**	.360**
12	Skills of using design programs	.267**	.210*	0.08	0.078
13	Interpret client needs into efficient green design	.401**	.279**	.480**	.317**
14	Attention to green design and construction details	.393**	.234*	.322**	.405**
15	Speed in Producing Green Design Drawings	.477**	.381**	.379**	.419**
16	Ability in overcoming green design difficulties	.503**	.325**	.509**	.490**
17	Offering suggestion to improve green design	.431**	.282**	.470**	.504**
18	Interest in the green design assignments	.404**	.318**	.331**	.384**
19	Commitment level of the architect to produce green design	.350**	0.173	.421**	.369**
20	commitment level of M and E engineers to implement green energy	.348**	.294**	.335**	.296**
21	Commitment of Q.S to select green materials	.340**	.276**	.303**	.362**

Key: CQ1: Green Knowledge; CQ2: Green Experience; CQ3: Organization Commitment; CQ4: Commitment to finance Green

### 5.2.2. The influence of client experience on the design team attributes

Table-5 shows that 15 positive significant correlations out of 21 expected between Clients' Experiences to Green Design Performance. Thus the effect of Clients' Experience on the Design Team Attributes is extensive, especially on the Green Attributes.

This result is expected since the client's experience could enhance design performance. Ling [7] and Pheng and Chuan [2] stated that client experience plays a major role in affecting the performance of a design team and on the performance of building projects. Soetanto *et al.* [8] found that past experience of the clients is the vital attribute that significantly affect overall project performance. These findings were supported by Ahmed [9] who found that the level of client experience has a

major impact on project success. Thus, more experienced clients are needed to cope with green design requirements.

The result implies that an inexperienced client must employ experienced representatives to help him manage the design process. An experienced client of his representatives will improve the attributes of the design team members. An experienced client will provide an effective leadership that would enhance design team attributes during a design process, which in turn will be more likely to integrate green features in their designs. Experienced clients understand how to articulate green features and identify it in a project brief.



### 5.2.3. The Influence of client commitment to green building on the design team attributes

Table-5 shows that 14 positive significant correlations between Client Commitment to green buildings and Design Team Attributes variables. Thus the influence of Clients' Commitment on Design Team Attributes is extensive.

These results support the literature on the importance of Client's Commitment. High client commitment is required especially at the early design stage in order to ensure clear identification of the client requirements. Gaia [6] and Wan Abdullah and Ramly [80] said that overall project outcomes greatly depend on the commitment level and involvement effectiveness of client during project implementation. In the design process, the initial step is to confirm the required commitment on the part of the client. Shafii and Othman [17] stated that to move towards green building, building owners and clients should be more committed to achieve green buildings.

The results imply that the commitment of the client to implement green design is vital to encourage the design team to integrate green elements into their designs. The clients should work cooperatively with the design team to ensure all green design features are integrated into the design. Compulsory green building indices imposed by government will enhance the commitment level of both client and design teams in building projects.

### 5.2.4. The influence of client commitment to finance green building on the design team attributes

Table-5 shows that 15 positive significant correlations between Client Commitment to Finance Green Buildings and Green Design Performance variables. However, only 3 significant correlations were related to General Attributes. In contrast, all except one Green Attributes variables are significantly correlated. Therefore, the influence of Clients' Commitment to Finance Green buildings on the Green Design performance is extensive.

The result is expected since sufficient project funds should be allocated from the outset by the client. Barrett and Stanley [4], CABE [14], Green Purchasing Network [15] and Yu, *et al.* [16] stated that providing finances to the project is the key indicator of client commitment. Ahmed [9] stressed that funds allocated by the client for the project is the key restriction that outlines the parameter of the project such as the client's requirements being balanced with resources available. These results are confirmed by Megat [23] who found that the low commitment and lack of funds allocated to green issues act as major barriers to green built environments in Malaysia.

The results imply clients with less commitment degree of finance green design will influence the commitment level of the design team to integrate green design elements because integrating green elements requires more time and efforts than design ordinary building. On the other hand, committed clients to finance green building will encourage the design team members to interpret client needs into their designs and to pay more

attention to design details and improve the speed in producing designs. Therefore, client must increase their commitment level to finance green design to enhance design team attributes in achieving high green design performance.

## 6. CONCLUSIONS

In conclusion, the correlation test results indicate that the influence of Clients' Qualities on Design Team Attributes is extensive. Sufficient project funds should be allocated from the outset by the client with consideration of additional cost of implementing green design elements. Managing Design process of green buildings requires more knowledgeable, skilled and experienced design team leader. Client commitment to green is the key factor influencing design team attributes. Committed clients will insist to include green elements into their project requirements. On the other hand, un committed clients will refuse any additional cost of integrating green design elements in their projects.

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