Key Internal and External Factors Influencing Design Team Performance in Green Buildings

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***Abstract*—**With the increase inherent technologies and parties involved during the design process of green buildings, Green Design Process (GDP) becomes more complex motion. The selection of a competent Design Team (DT) is essential to overcome the complexity for high performance green design. Certain attributes of the design team are required. The overall objective of this research is to provide the green design team with key attributes that design team should have to be used to improve their design performance of buildings. Furthermore, Internal and external factors influencing these attributes, specifically, Governance system, client quality and Project Nature to be investigated. Design team attributes variables were identified based on literature within the domain of green design team responsibilities. By conducting a questionnaire survey this study identified the common design team attributes and their relative importance to design green buildings. A sample of 277 respondents has been covered under the study, including architects and engineers practicing design and consultancy in Malaysia. Analysis data includes descriptive and quantitative analysis by using SSPS software version 16 was carried out. A correlation and regression models was established to explore the relationship between identified factors. The results showed that the design team needs to comply with certain knowledge and skills that necessary to overcome complexity of the green design process. On the other hand, Clients should consider green design need additional time. Moreover, Governance system and client quality have major influence on design team attributes. An effective approach such as training courses to design team to increase their competency in order to improve green design performance.

***Keywords*—**design process, design team attributes, green design, performance.

I. Introduction

A green building is an environmentally sustainable building, designed, constructed and operated to minimize the total environmental impacts[1].The majority of papers and books that discuss 'green' buildings commence by describing the impacts of buildings on the surroundings [2].The largest part of cited figures are that the built environment and the construction industry are responsible for about 30 % of the world's energy consumption 40 % of resource consumption, [3], and generate waste between 10 % to 40% of the world's[4].

Green building techniques create a building healthier, comfortable, durable as well as affordable to sustain compared to a normal one. This is accomplished by integrating project phases from design stage till construction stage practices that make the most effective use of resources, the local environment attributes, and green building practices and innovations.

Design Green Building (DGB) aims to reduce buildings impact on the environment. Typically, green buildings have high complexity and uncertainty [5]. At the conceptual design phase major environmental impacts of a building are determined [6]. Design stage is a vital area to influence project performance, design phase is one of the highest effecting part on green performance of the buildings outcomes, in addition, most of decisions made throughout conceptual design have the highest influence on project performance and have the least correlated cost [7]. Therefore, it is crucial that environmental design tools be applied at this stage in order that the environmental suggestions of different iterations of design may be monitored gradually[8]. Practice shows that green buildings set too much emphasis on good intention s at the design phase [1]. Therefore, Good quality design team must have the proper design capability and ability to interpret the clients' requirements. These attributes are essential because unless the design is right, a acceptable building can never be created [9] Attention has recently been drawn to the inevitability to include sustainability criteria in team selection methods. However, while frameworks exist for assessing technical performance of design teams, measuring green performance have been complex [10]. This highlights the importance of the design stage, and hence the performance of the design teams should be carefully examined.

The aim of this paper is to identify key design team attributes in order to improve green design performance. Also, the study highlights the key external and internal factors that have high impact on design team performance to ward design green buildings.

II. Complexity Of Green Design Process

The primary purpose of Green design is a bigger compatibility between the artificial and the natural environments without compromising the functional needs of the buildings and their particular costs [11]. Mainly design is an innovative process of solving problems [12]. Design is not easy to define and impractical to describe in any meaningful model. It is a technique of doing things, of integrating complicated and different information into an artifact whether drawn or construct [7], [13].Design is an essentially further complex process than construction and fundamentally a human activity and awareness the activities carried out by design team is very complicated [14],[15]. The design process is the series of procedures that must be carried out to rally design aims matching to a product definition in a specific context[14]. Therefore, the different design phases, is effected by the tools and the individual and physical resources available[16].

Various researchers have tried to model and identify the process of design but, they have not succeeded in describe how it works[7]. The relations of all of the various steps and decisions required to create a high quality design are very complex. [17].

Due to growing complexity of buildings processes, rapid changes of user requirements and market environment, objectives of sustainable development and demands for closer delivery schedules methods to manage building projects from design stage to use are of greater significance [11].The design team believe that designing green buildings and construction projects, is complex because there are so many environmental design criteria that require to be measured, with some of conflicting interest with other design requirements. design green building is very complex and design team find difficulties in implementing Environmental Management System EMS because the design team members lake of knowledge on how to create and implement it [18]. Green buildings have high complexities and uncertainties in such projects and hence the heightened need for cooperation, creative thinking, as well as technological and managerial innovations [5]. The green design process requires research and experimentation and a enthusiasm on the part of the design team to self-consciously question the design process at every stage [19].

III. Design Team Composition And Selection

A team is defined as "a small number of people with complementary skills who are committed to a common purpose, performance goals, and approach for which they are mutually accountable" [20]. The composition of a team can be described by diverse players. Initially a team member can be determined by the demographic data bases like age, gender, nationality or divided by other attributes like the cognitive skills, knowledge, attitude, experience, culture and socialization [21].

The organization's ability to win projects and carry in business will increase with building a project team that has greater number of experts required. The shipment of an greatest mix of a project team that has necessary skills and competences matched unto the client's project needs, will direct to client fulfillment of the project [22]. Associations are gradually more implementing teamwork and other group work preparations become more interested in team performance [23].

Selecting the 'perfect' team is considered necessary to the success of any construction project [10].The attributes of every single team member have to be determined and to be considered. The explicit composition of possible teams might have huge impact on the organizational structure of teams, the decision making process, and the dynamic of a team influence the final performance productivity of a team [21]. One of the first steps in a building construction project is the selection of optimal members of the architect-engineers team. The importance of the design stage, and emphasized on the performance of the design team at the design stage should be carefully scrutinized.[24],[25]. The perfect selection of a design team composition should take place before a project is begun, and this will enhance the probability of the team's success [26]. Selection criteria summarized and grouped under similar characteristics proposed by deferent organizations which are: Firms' background: reputation; technical competence / qualification; Experience with similar project. Past performance: - Cost control; Quality of work; Time control. Capacity to accomplish the work: - Present workload; Availability of qualified personnel; Professional qualification/experience. Project approach: - Approaches to time schedule; Approaches to quality; Design approach/methodology **[27].** Good design team selection practice contributes to increase efficiency and productivity [28].The High-quality design team must have the appropriate design capability and ability to interpret the clients' needs [9]. These attributes are essential because unless the design is right, a acceptable building can never be produced [29]**.** The whole design of buildings nowadays requires the participation of a team of people with a range of related experience.

A multiple regression performance prediction model was developed by [9] to assist designer/builders in predicting design team potential performance level . The model lists a number of important attributes which potential design team should be evaluated on. Upon inputting the rating of the design team members on each attribute, the model calculates a performance score. He divided design team attributes into two groups hard: knowledge, skills, and experience and soft that include consciousness, commitment, initiatives, social skills, and communication **[9].** Understanding how individuals perform complex cognitive activities, such as architectural and engineering design has been the raison d'etre of design methods research for the past four decades. The performance of design team is therefore significant because any decision made at the inception of the project will influence project success. For design team and technical service companies, the reputations, experience and skills of staff are their main assets [30].In design green buildings, a careful selection process which ensures that each member of the professional design team has demonstrated experience on design green building[10],[31].

IV. Green Design Team Performance

The major strategies to reach a green building include: reduced energy consumption, water conservation, recycling waste. Well designed green buildings will save money, increase comfort and create healthier environments for people to live and work, using improved indoor air quality, natural daylight, and thermal comfort [1]. To improve the quality of the built environment along with the processes of its procurement design, construction, and management there is need to understanding how individual perform complex cognitive activities [32].

Gradually, organizations are more applying teamwork and other group work arrangements. Therefore, organizations become further paying attention in team performance than in individual performance [33]. The performance of design team is important because any decision made at the inception of the project will affect project performance [34].The performance is a multi-dimensional conception. On the most basic level, distinguish between task and contextual performance [35].Performance can be shows from two angles, task performance and contextual performance [33].

Task performance present the competency level of staff in performance a variety of tasks and responsibilities that

essential in fixed jobs and work roles [36]. Whereas task performance defined as individual‘s proficiency with the person performs activities which improve directly or indirectly “technical core” of the organization [33]. Task performance in itself is multi-dimensional.for instance [37].Recently, researchers focus on the precise aspects of task performance such as innovation and customer-oriented behavior [38].

Contextual performance refers to activities that support organizational social and psychological environment. In order to improve work procedures throughout staff behaviors and their initiatives[33] contextual performance is not only one set of regular behaviors, but is in itself a multidimensional concept [39]. Behaviors which aim essentially at the soft functioning of the organization as it is at the present moment, and proactive behaviors which seek at changing and improving work procedures and organizational processes[33].

The distinguish between task and contextual performance, task performance refers to an individual’s proficiency with which he or she performs activities which contribute to the organization’s ‘technical core’. Contextual performance refers to activities which do not contribute to the technical core but which support the organizational, social, and psychological environment in which organizational goals are pursued [35]. both task performance and contextual performance can be distinguished at the conceptual level and separated empirically [40],[41].

In addition, task and contextual performance factors such as job dedication and interpersonal facilitation contributed individually to overall performance in managerial jobs [42]. Furthermore, other individual variables can predict contextual performance, not just task performance. While, task performance can be predicted by abilities and skills while contextual performance and related factors can be predicted by personality [43].On the other hand, specific contextual performance aspects such as personal initiative have been shown to be predicted both by ability and motivational factors [44].The differentiation between task performance and contextual performance lead to three basic assumptions, that are firstly, task performance activities vary between jobs while activities of contextual performance are to some extent similar across jobs; secondly, task performance is correlated to ability, whereas contextual performance is correlated to personality and motivation; finally , task performance is more arranged and constitutes in-role behavior, while contextual performance is more discretionary and extra-role [43].

In construction projects, Task performance and contextual performance are significant factors influencing design team performance. The task requirement is accepted as a crucial factor in performance; on the other hand, specifically in a setting with a need for active team performance, this task achievement is strongly linked to a people requirement. This people factor effectiveness has been shown to be a predictable function when considering occupation, organization and personality traits [33]. In addition, Design teams have to demonstrate how their design fulfills with the performance requirements and as a result required a transparent environmental design process. In various teamwork situations in which tasks are disjunctive and in which members are mutually dependent on one another, the combination of individual performances into team performance is much more complex [45].

V. Design Team Attributes

On any project, an individual, team or group should meet certain criteria in order to be successful. High-quality design team is competent to understand problems early and less expected to make errors in decision. The rationale behind the utilize of teams is that the mixture of the individual skills, knowledge and attitudes of individuals will contribute in improved mission achievement [53].Being the creator of brief development, design team members’ knowledge or the lack of it can be a value source or a risk source to the project. By selecting a suitable design team, the chance of handing over a project on time and within budget may well increase [54].

Knowledge is something that exist in people’s minds and is one of the most significant resources to an association [48], it is crucial for project team to be knowledgeable [49].One of the key barriers stated by associations is the lack of green design knowledge that internal and external decision-makers exhibit during the construction process [50].As well as lack of education is often quoted as a major barrier to implementing green design [51].

Skills and Knowledge refers to the techniques specifically to the organization as well as the scientific understanding. These skills can be public, industry-specific, or organization-specific. While public skills can be gained from journals and public sources while industry specific skills can be gained from consultants, organization-specific skills are generally unstated, hence less adaptable and imitated by competitors. These skills are specific to the organization and people who own them [52].

Due to the tendency of change in building industry toward sustainability. Capable green design team should therefore be knowledgeable about environmental issues and features of buildings impact[2].Design team for that reason requires being equipped with the knowledge and tools to be capable to translate into design, the increasingly stringent environmental performance goals of clients, and create buildings that meet these new objectives[55].There are four parts of core capability are: skills and knowledge, physical systems, Managerial systems, Values and Norms [52].

The team might not perform effectively if any of the following factors or associated variables are incoherent, the basic attributes of a good team consist of clear identification of objectives, clarity of roles, common feeling, motivation, commitment and collaborative attitude as well as the team members build up confidence, trust, and commitment among the team [56]. In general, some of the knowledge has vital influence on the design process is of unstated character. Clear knowledge can be articulated and is thus accessible to others while unstated knowledge cannot be articulated [57].

The acquisition of suitable skills, knowledge and competencies through appropriate education and training are very important [50].The construction industry now needs larger ‘knowledge workers’ than in the past [58].Designing buildings and construction projects that are green, is complex because there are various environmental design criteria that require to be considered, with some of differing interest with

other design requirements [18]. Design team requires being equipped with the knowledge and tools to be capable to translate into design, the increasingly strict environmental performance objectives of clients, and generate buildings that rally these new objectives [2].

The importance of consultant engineers to be a competent and responsible toward success of a construction project, because they could bring genuine and everlasting values to the client through innovative, functional, safe, environmental-friendly design [59].The architect should be multi-skilled with some competent knowledge in all of the different aspects of building design. The whole design of buildings today needs the involvement of a team of people with a range of appropriate experience. It is the architect's responsibility to design the building structure and to co-ordinate the inputs of the specialist design team [50].

Design team must be capable to identify life-cycle environmental influences that a building they are designing is expected to have. Furthermore, they must be capable to decide whether the measures taken to improve the environmental benefit of their building will rally the expectations of their client and society [2]. Design team experience and skills could be considered as main asset of the design firm, as well the knowledge is a vital resource of competitive advantage [30]. To achieve environmental building, designers ought to be educated about environmental issues at some stage in their professional training [60]. Design Teams must have the ability to recommend innovative and alternative design solutions to enhance the quality standard, and reduce the project period and cost [61]. Experience and knowledge, it would seem that individuals from similar work backgrounds and knowledge bases would form more successful teams [53].

The successful team characterized by following strengths that were: 1).Competent leadership and skilled team members;2). Team members offering to help one another when needed;3) Willingness to work out differences in an honest and healthy way;4) Well-organized meetings;5) Clear overall team purpose;6) Sufficient material resource. On the other hand the following weaknesses were: 1) Commonly found in the responses;2) Unclear understanding of team performance;3) Poor communication system with individuals outside the team;4) Current focus is on too many activities, which inhibits effectiveness; 5) Unable to fully participate in all aspects of teamwork; 6) Responsibilities posed distractions.;7) Lack of organizational support of the team and its mission. ; 8) Few rewards for performing well on a team. The high quality team is attributed to a combination of aspect comprising leadership, team assessment, empowerment, skills, feedback, team coordination, mission clarity, and rewards [62].

Even various researchers have discussed the attributes and characteristics of teams in organizations [63[,[64]. There is a need for identifying factors affecting design team attributes to improve in order to design team performance.

VI. Key Project Factors Influencing Green Design Team Attributes

Characteristics of the project have long been ignored in the literature as being key success factors whereas they represent one of the essential dimensions of project performance [66]. Project factors comprised size, complexity, function and the procurement of the projects, in addition, these characteristics influence by type of client [65].

The key attributes influencing project success are the project characteristics, client's financial stability, duties and responsibility and project feasibility [67]. The number of activities and the familiarity of the design team with the type of project being undertaken are critical. The performance can be greatly influenced by the uniqueness of the activities [66]. The type of project is expected to be a important factor influencing the weights of evaluation criteria, because different project categories place different needs on the design team [27].

The influence of the experience of project manager's on the project's success or failure was examined. It was concluded that the previous experience of project managers has lowest influence on the performance of project, while the size of the earlier managed project does affect the performance of managers. Project size and value, the project activities uniqueness, the project network density, life cycle of the project and the project outcome urgency were identified as key projects characteristics [66].

A. Design Assessment Tools:

Environmental performance assessments defined as procedures that determine to what extent a building may affect the environment, so that the building design or operation can be changed to reduce harm and improve amenity [55]. There are a several ways of determining the influence of design decisions on the environmental impact of a building. These consist of consulting experts, using detailed modeling tools to forecast the actual building performance over a range of environmental criteria, using building material specific check-lists, or performance assessment tools. The implement of environmental design tools helps design team comprehensively study design alternatives, and then create buildings that are: 1). comfortable, in terms of thermal, visual, acoustical and air quality features 2). Economical in their use of energy and other resources; and 3). Gentle overall to the environment, in terms of decreased air pollution, avoiding use of ozone- depleting refrigerants, emissions of solid and liquid waste and damage to biodiversity [55].

Some tools are designed to forecast the environmental suggestions of design decisions as the design is being developed [55],[2]. Design teams implement a several tools that can help them to integrate sustainability into design. Design teams, can undertake building information modeling using computer simulation software. These programs let the space or building to be modeled in three dimensions with elected building materials. Performance-based tool that design team implement to benchmark the building performance and to identify where sustainability initiatives may be integrated into the design to enhance performance. Additionally, tools

such as life cycle assessment and triple bottom line (TBL) assessment can be implemented to find out the level of sustainability of a product, material or building.

Environmental performance assessments are measures that determine to what degree a building may impact the environment, so that the building design or operation can be altered to decrease harm and improve amenity [2]**.** Environmental performance assessments rely on tools for the assessment of the environmental performance of buildings and a design process that significantly accommodates life-cycle environmental thinking. Using tools during design also give a systematic and transparent description of the decisions that lead to environmental design solutions. it help design team during design process toward achieving green design by three features, firstly enhancing the effectiveness of the design team. Secondly, design team can learn more about the impact of buildings on environment through introducing environmental assessment tools. Lastly, client environmental performance goals will be determined through introducing systematic assessment of design option [55],[2]. Environmental assessment of building design varies in range and purpose, depending on the design phase at which it is applied, the time frame required for assessments to be carried out, the knowledge level of the design team, information availability, and financial resources availability. Designers therefore requires being equipped with the knowledge and tools to be capable to translate into design [55].

B. Green Design time frame:

The time phrase of project cycle is one of the crucial elements of the conceptual model for green construction. Different stages of building projects require different skills to optimize the performance. Implementing suitable environmental tools to support green performance of environment in the right stage of building projects is very important [68]. Design teams frequently fail to finish their tasks on time [69].

It is perceived that integrating green building technology adds to a project's timeframe, thus projects with time constraints will keep away from its implementation. In general, pressures to speed up project delivery override desire to apply green design [51]. Extra fees and time required to introduce innovation into the design are offset by the prevention of fines, accidents and delays, while getting a higher return on investment. Time and effort are only required while the design team incorporate the new knowledge it needs into their praxis, after which it becomes another item to be measured in the design process [7]. One of the building profession's major problems in reacting to the green development is lack of resources [18].There are many fee plans considered on factors that contribute to developing an environment that will foster teamwork.[70]

VII. KEY CLIENT FACTORS INFLUENCING GREEN DESIGN TEAM ATTRIBUTES

Even though there is increasing awareness of green building issues in the Southeast Asia region, it is still in its early stages. The awareness on green building issues in the design and Construction is still low and developing countries like Malaysia have only just start to address the challenges of green buildings [71].The essential in the process of achieving a successful built development project is to confirm the necessary commitment on the part of the client. Client commitment, competency and direction are mainly essential in the early stages to inform strategic thinking [7]. The clients ought to be knowledgeable in their organization mission and their business [72]. The missing of the knowledge and experiences in implementing the construction project levels the clients with no clue on what to expect and how to play their roles and responsibilities.

Three features of client performance to be greatly influenced which are: (1). The capability of client's representatives; (2). Client's past performance and experience; (3). The financial soundness and reputation of the client. [73].Even the present clients more organized they were less committed and lack of focused during briefing as they perceived that the task is belong to the design team [74]. The 94% of designers agree that they would increase their use of green design solutions if sustainability was part of a client's corporate mission [7].

The initial step in the process of reaching a successful built development project is to confirm the necessary commitment on the Client part. The majority of clients still does not know the benefits of green building and are not interested in spending a little bit more to save future maintenance costs. [18]The main barriers to incorporate 'green' innovation into the building industry is the lack of demand from the clients .All clients must give consideration to undertaking in depth training on green design issues and must expect design teams to have undergone or commit to training.

VIII.KEY GOVERNANCE SYSTEM FACTORS INFLUENCING DESIGN TEAM ATTRIBUTES

The variety of construction industry activities lead to gab between effective policies and environmental problems. The lack of directions from high-level leadership is considered as one of the most critical barrier to implement green design, this leads to a lack of mandatory green design standards and control mechanisms. The lack of practical understanding of sustainability has hampered the effective enforcement of legislation for green construction. [68],[75]. There is a relationship between different governance systems and climate change outcomes in terms of the institutional framework, policies developed, capabilities developed to innovate and speed of adaptation [76]. Also there is currently limited policy and standards to guide green practitioners and no fiscal incentives for green building [77].

The process of driving green buildings in Southeast Asia region is slow. There are barriers in green design development in the Southeast Asia region which include: Procurement issues and Regulatory barriers. A number of these measures have been adopted by the Malaysian government including policies, regulations and programs. However, they are still insufficient to mitigate the environmental problems [49].

The development of green building in Malaysia is relatively slow; this in part, may due to the lack of incentives and

regulatory procedures to guide green building construction. [71]. In addition most current incentive programs are aimed at the developer, not at the design team and contractors. Each group, particularly those on the design team, can influence the way the building and landscape is designed and constructed. However, most financial incentive programs are targeted at the developer, thereby providing little incentive to those carrying out the study to build more sustainably [7].

A high performance design can be secured if the client is committed and has the skills, adequate budget, and interest on whole life costs, integrated team includes a quality designer. A crucial issue in considering green building design is to know that significant attention is necessary throughout the procurement and design process if the appropriate results are to be achieved.

IX. Methodology And Data Collection

To capture the professional's perception, a questionnaire survey was conducted. The questionnaire was divided into two parts. The first part requires respondents to provide their personal particulars including their job title, experience, number of construction projects involved, type of buildings designed by his/her firm followed by type of procurement, type of building and size of the projects they have been carried out, whereas, the second part focuses on uncovering the expectation of experts on key design team attributes, project factors, governance system factors, and client attributes.

A survey package consisting of the questionnaire, post card, pen , stamped envelope and a covering letter explaining the objectives of the study was posted to professionals in various architectural consultancy firms as well as engineering consultancy firms, selected by the list of architects downloaded from the Malaysian Institute of Architects (PAM) website, whereas list of engineers provided from their organization directory of Association of Consulting Engineers Malaysia(AECM) .The population for this study became key design team players for architects registered with the PAM and Engineers registered with ACEM practicing consultancy services.

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. Projects handled after January 1, 2003 were included in this study. This date was chosen because it was assumed that respondent who chooses projects handled before than this date may not have had all project details to complete the questionnaire. A total of 1180 survey questionnaire were distributed 278 valid replies were received, which represents a response rate of 24%. SPSS virsion16 were 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. Many variables were examined to determine the influence degree of external variables on design team attributes. Correlations, multiple liner regression were used.

X.THEORETICAL FRAMEWORK:

The study investigated internal and external factors influencing design team attributes to improve design team performance of green buildings. The proposed model variables are based on the previous studies has discussed on the literature review of the field of the study adapted from [9] to evaluate architects and engineers performance.

Job performance theory state that job performance should be measured from two perspectives; task performance [78] and contextual performance [35].The Task performance is the Proficiency and skill in job specific tasks and differentiates one job from another [41]. The criteria for measuring it are consist of cognitive ability, job knowledge, task proficiency, and job experience[79], whereas the Contextual performance occur because people work in an organizational setting instead of by themselves and therefore require to communicate with one another, coordinate activities, follow instructions, and seldom go beyond their job descriptions [35]. The criteria of measuring it are consisting of conscientiousness, initiative, social skills, control, and commitment. [35].

As shown in figure 1 the conceptual model of this study is part of the main study model. It has three independent factors, the first is project factors (PF) as internal factor with sub factors named as design timeframe (P1), design fees (P2), and design assessment tools (P3). The second independent variable is government system (GS) with sub factors named as regulations and policies (G1), fiscal and incentive (G2), and type of procurement (G3), whereas, the third independent variable is Client`s Attributes (CA) with sub factors named as Knowledge of client (C1), client commitment (C2). The GS and CA identified as an external factor that may have an influence on the design team in green building. However, the dependent is an output variable Design Team Attributes (DTA) is consist of three measurements first is task performance (TP) has three elements named as design team Knowledge (TP1), skill (TP2) and Experience (TP3) on design green building, Second is contextual performance (CP) also has three elements named as design team initiatives (CP1), commitment (CP2), and reputation (CP3) on design green buildings.

The study has two hypotheses, first is there positive influence between the project factors and design team attributes. Second is there positive influence between the External factors and design team attributes

XI. RESULT

This section will present the result of collected data analyzed start with the Characteristics of respondents and description of the factors mean and std. Division. The techniques of correlation matrix and multiple liner regression has used.

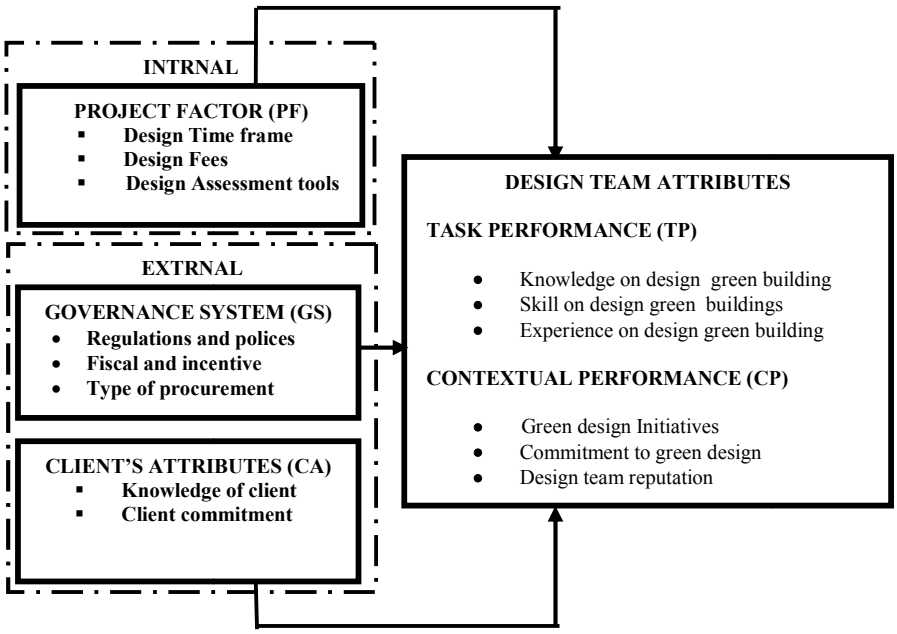

Fig. 1 Conceptual model of effective design team

A. Characteristics of respondents

In the first part of the fieldwork A total of "1180" survey questionnaire were distributed "277" valid replies were received from Architects and Engineers professionals registered with PAM and AECM organizations, which represents a response rate of "24%" of all questionnaires sent. Intended for "41%" of the respondents were architects followed by "40%" mechanical and electrical engineers while structure and civil engineers were only "19 %" of the total respondents. The fact that they were senior personnel rendered further validity to the survey results and their firms represented almost quarter of the design firms practicing in Malaysia. As shown in fig.2 all of respondents had more than five years of relevant experience and "80 %" of respondents had over fifteen years and lowest percentage was "13.4%" had over ten years of experience practicing in construction industry. Among the "227" respondents, the percentage of respondents who had involved in the construction projects was "89.1%". These proportions illustrate that the respondents were very experienced .Moreover; the respondents were credible and capable of answering the questionnaire and their views noteworthy. This study is exploratory in nature and is mostly quantitative with limited qualitative analysis.

B. Key design team attributes

The significance level for this study was set at "0.01" in accordance with the conventional risk level [80]. The results of the statistical test of the mean, which are summarized in Table I, showed that designers generally agree with the factors that affect design attributes, except for design team reputation, design time frame, and fees of the design green buildings. However, Fig.3 shows that totally disagree "21.3%" and "25.6%" disagree with the sufficient time was given by the client for green design. Moreover, approximately "55%" of respondents were agreeing with statement of insufficient design fees was given by the client.

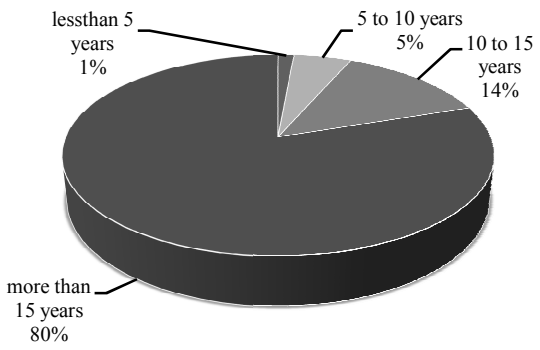

Fig. 2 Years of involvement in construction industry

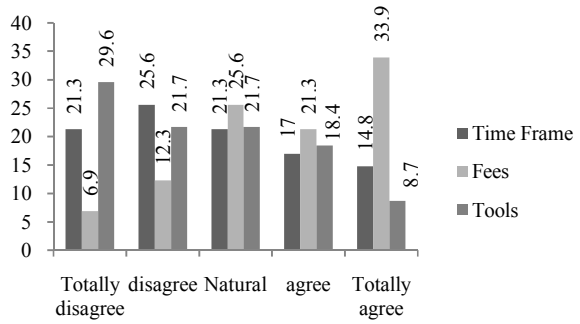

Fig. 3 Mean of Project Factors

C. Correlation Matrix

Correlation coefficient is a measure of the strength of any linear association between a pair of random variables [81]. It measures how closely a change in one variable is tied to the change in another variable and vice versa. Unlike linear regression, random variables are treated symmetrically, where the correlation between X1 and X_2 is the same as the correlation between X_2 and X_1. The correlation relationship is measured on a scale of 21-11, where "0" represents no correlation or no linear relationship between the scores, "21" is for perfect negative correlation and "11" is for perfect positive correlation. The correlation coefficient matrix obtained by the (2-tailed) Pearson's correlation analysis is shown in Table III The observation shown that most of the independent variables are correlated with the dependent variable.

TABLE I
The Mean And Std. Of The Variables

	TP1	TP2	TP3	CP1	CP2	CP3	G1	G2	G3	C1	C2	P1	P2	P3
Mean	4.72	4.21	4.19	4.18	4.51	3.48	4.41	4.27	3.44	4.47	4.66	2.55	2.78	3.63
Std. Dev.	0.613	0.905	0.82	1.042	0.725	1.212	0.899	0.922	1.097	0.764	0.698	1.317	1.353	1.255

TP1= Design team Knowledge, TP2= Design Team Skills, TP3=Design Team Experience, CP1=Design Team Green Initiatives, CP2 = Design Team commitment, CP3 = Design Team Reputation, C1=Client Knowledge, C2 =Client Commitment, P1= Design Time Frame, P2 = Design Fee, P3= Design Assessment Tools.

Based on the correlation outcome, most of the factors have significant positive correlations with each other at ($p<0.01$), highest value green design initiatives against design team reputation "0.612",whereas, the lowest value is Regulations and Polices against design assessment tools "0.003".The significance of some correlations was only at $p<0.05$, i.e., fiscal and incentives against type of procurement with value of "0.149", design assessment tools against green design fees with value of "0.133". Whereas, Table II shows positive correlation at ($p<0.01$) for the main factors tested and the highest value governance system against client attributes "0.334" followed by design team attributes against client attributed. Whereas, the lowest value client attributes against project factors "0.011".

TABLE II
CORRELATION MATRIX OF THE FACTORS CONTRIBUTING THE DESIGN TEAM OF GREEN BUILDING

	DTA	GS	CA	PF
DTA	1			
GS	.254**	1		
CA	.313**	.344**	1	
PF	.171**	0.057	0.011	1

**. Correlation is significant at the 0.01 level (2-tailed).

TABLE III
CORRELATION MATRIX OF THE SUB FACTORS CONTRIBUTING THE DESIGN TEAM OF GREEN BUILDING

	TP1	TP2	TP3	CP1	CP2	CP3	G1	G2	G3	C1	C2	P1	P2	P3
TP1	1.000													
TP2	.373**	1.000												
TP3	.382**	.297**	1.000											
CP1	.222**	.463**	.276**	1.000										
CP2	.513**	.296**	.406**	.504**	1.000									
CP3	.318**	.466**	.324**	.612**	.372**	1.000								
G1	.182**	.103	.078	.074	.130*	.053	1.000							
G2	.031	.184**	.203**	.393**	.223**	.307**	.263**	1.000						
G3	-.064	.129*	.113	.007	-.010	.099	.123*	.149*	1.000					
C1	.224**	.142*	.173**	.179**	.332**	.120*	.221**	.273**	.098	1.000				
C2	.039	.212**	.111	.366**	.294**	.218**	.122*	.477**	.025	.410**	1.000			
P1	.046	.098	.072	.069	.092	.269**	-.048	.074	.102	.066	-.015	1.000		
P2	.080	.162**	.162**	.010	.038	.133*	-.049	-.069	.119*	.052	-.056	.561**	1.000	
P3	.060	.049	-.036	-.062	.058	-.025	-.003	.033	.030	.006	-.029	-.083	-.056	1.000

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

TP1= Design team Knowledge, TP2= Design Team Skills, TP3=Design Team Experience, CP1=Design Team Green Initiatives, CP2 = Design Team commitment, CP3 = Design Team Reputation, C1=Client Knowledge, C2 =Client Commitment, P1= Design Time Frame, P2 = Design Fee, P3= Design Assessment Tools.

D.Multiple liner regression analysis

The predictive power of the model is judged through the statistical measurement coefficient of determination (R^2), which is a measure of the goodness of fit for the model. R^2 is used to measure the strength of the correlation when more than two variables are being analyzed. The R^2 gives the proportion of the variance of Y, which is explained by the independent variables, reflecting the overall accuracy of the predictions. However, when the number of independent variables is introduced into the model, R^2 also increases. A better estimate of the model goodness of fit is adjusted R^2. Unlike R^2, it does not inevitably increase as the number of included explanatory/independent variables increases.

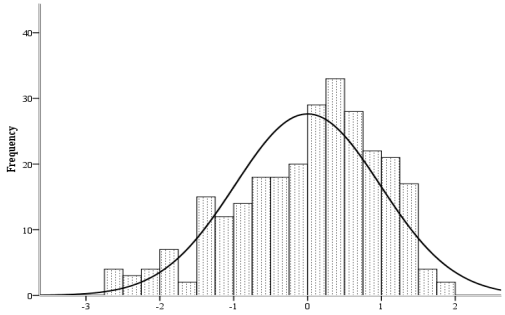

Fig. 4 Histogram of Design Team Attributes (DTA)

The optimum regression model to be selected should be the one that fits the data the best and yields the most accurate prediction of a design team attributes.

Regression analysis of the Design Team Attributes (DTA) with Project Factors (PF), Government System (GS), and Client's Attributes (CA) has positively influenced Design Team with a coefficient of determination R^2 of "0.23". This indicates that "23%" of the Design Team was explained collectively by project factors, government system, and client's attributes as shown in Table IV, The F-and t-tests were used to assess the goodness-of-fit of the models and their individual parameters, respectively. A probability of less than "0.05" is generally considered the highest to indicate a significant difference [82].

TABLE IV
ANOVA TEST

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	29.639	8	3.705	9.72	.000a
	Residual	100.652	264	0.381		
	Total	130.291	272			

a. Predictors: (Constant), P3, G1, P2, C2, G3, C1, G2, P1

b. Dependent Variable: DTA

TABLE V
DESIGN TEAM ATTRIBUTES MODEL SUMMARY

							Change Statistics			
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin-Watson
1	.477a	0.227	0.204	0.61746	0.227	9.717	8	264	0	1.95

a. Predictors: (Constant), P3, G1, P2, C2, G3, C1, G2, P1

b. Dependent Variable: DTA

Hypotheses 1, 2, and 3: The Government System (GS) , Client's Attributes (CA), and Project Factors (PF) had Significant positive effects on Design Team Attributes (DTA), as expected with ***F*** test is "9.72" and significance level of $\boldsymbol{P} \leq 0.001$. The general multiple liner regression model equation (Y) is consists of predictors (X's), regression coefficients that estimate from the data (B's) and including the Errors (E):

$$Y = \beta 0+\beta 1*\chi 1+\beta 2*\chi 2+\ldots.\beta n*\chi n+\varepsilon$$

$$DTA=1.678+0.029*G1+0.173*G2+0.012*G3+0.041*C1+ 0.215*C2+0.105?*P1+0.011*P2+0.017*P3 \quad (1)$$

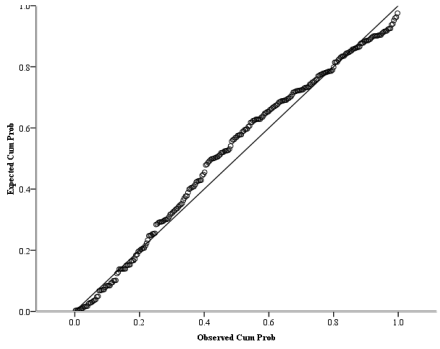

Fig.5 Normal P-P plot of Regression Standardized Residual of Design Team Attributes (DTA)

XII. Discussion

The project factors have high influence on the design team attributes. These factors related to type and the size of the project. Different building types required different design knowledge and skills. Instance, design commercial buildings may need more focus on energy consumption and Indoor air quality, whereas requirements of train station building are different.,

The size of the project has a high impact on the design team attributes. The design process is a complex in nature. Green design process is more complex. The size of the project and variety of functional spaces plays major role in rising complexity of the design process. On the other hand, small projects may increase the total cost of implementing green design features and extending the payback period.

The result of the statistical test of the mean, which are summarized in Table 2, showed that designers generally agree with the factors that affect design attributes, except for design time frame and fees of the design green buildings. However, figure.2 It shows that "46.9%" of respondents generally disagree with the sufficient time was given by the client for green design.

Much debate on green buildings cost more than ordinary buildings, green building cost less in term of the project life cycle. The additional cost located at design and construction stages. Therefore, the largely green features will be applied at design and construction stage. In the study "55.2%" of respondents were agreeing with the statement of insufficient design fees was given by the client design fees. Clients should consider green design process complexity require additional activities and simulations to achieve high performance green building. Farther more, clients must locate adequate budget for green design.

Design process is a complex activity in nature, the complexity raised more with new building technologies, that leads more specialization required among design team members. Therefore, design team members need to educate theme self with environmental knowledge and develop their technical skills to comply with a Green design process. Variety of environmental assessment tools is available in the world, the most known environmental tools used for design assessment are LEED, BREAM, SB tool, Green Mark. Malaysia launched Green Building Index (GBI) at 2009, for voluntaries. Clients, contractors and design firms need to certify from GBI organization. Therefore, design team needs to meet design assessment criteria to be certified. "53.3%" of respondents disagree with design assessment tools were easy to implement. Design team should enroll in training courses to improve their skills.

Design green building is not easy motion. Design team characteristics have major influence on green design performance. One of the key barriers of design green buildings is the lack of green design knowledge that internal and external decision-makers exhibit throughout the building phases. This includes project managers, architects, engineers, developers, contractors, other various construction professionals, and internal agency staff. Generally, there is a lack of understanding of what green building is, what its benefits are, how it is measured, and how it is implemented. In particular, stakeholders need to be educated on such things as the process of implementing green design concepts; products and systems of green building, related cost benefits, and Information resources. In addition, two particular gaps must be considered beyond the general lack of knowledge; firstly, the lack of GBI qualified professionals. Secondly, lack of knowledge and skills on Life cycle assessment. Attached with the lack of green building knowledge is the perception by design firms that there is a lack of data about the benefits, durability, and payback of green design features and green products.

Offering education and training on green building to project stakeholders involved in the design process including developers, project managers, architects, engineers, consultants, suppliers and contractors might change green building perceptions as well as give the knowledge required to include green building technology into a project. Particular training required to include GBI official recognition courses and LCA training for relevant professionals.

Governance system plays major role toward implementing green building features. There is a relationship between different governance systems green building outcomes in terms of the institutional framework, policies developed, capabilities developed to innovate and speed of adaptation. The gaps between effective policies and design green buildings resulting from a lack of practical understanding of green building in Malaysia has hampered the effective enforcement of legislation. Some public policies include education and training required to help ensure that both agency representatives and design teams understand how to implement green design policies and procedures effectively.

One of the most key obstacles to green design implementation is the lack of directives from high-level leadership. High-level leaders include the Government, Executive Directors, General Managers, and Policy Makers. Currently, no executive orders or policies exist that require conditions influenced

building projects to establish sound green building/green design. The lack of support from the high-level decision- makers led to a lack of compulsory green design standards and control mechanisms. As a result, when and if green design initiatives are created, they are usually voluntary and not enforceable.

Generally, knowledgeable client on green building could encourage design team to implement green design features efficiently by including environmental requirements in the brief. Moreover, knowledgeable client on green building will help the design team to communicate and make-decisions faster. Respondents believed client commitment is the key factor for design team to implement green design elements. Therefore, to increase client‘s commitment more focus on client awareness required. As government is the first owner, maybe ought to implement green feature in their building.

Due to the recently green design introduced most of the design team members not knowledgeable on green design requirements. Even Green Building Index (GBI) has been introduced the design team still infancy on green design. Moreover, training courses required for green design skill such as design assessment tools, simulation programs and technical software. More collaboration among sectors and organizations and the participation of all stakeholders and individuals are required to achieve green design.

XIII. CONCLUSION

There is a lot to know about the design green building, still much study to be done both in Malaysia and internationally on methodologies and green design development and in design team Attributes. For an effective involvement design team leader should clarify roles within the team and encourage design team members for more participation. Offering education and training on green building to project stakeholders involved in the design process including developers, project managers, architects, engineers, consultants, suppliers and contractors might change green building perceptions as well as give the knowledge required to include green building technology into a project. Particular training required to include GBI official recognition courses and LCA training for relevant professionals.

The core of this study is to identify key design team attributes in order to improve performance level of design green buildings by using task performance and contextual performance theories. The key attributes of task performance theory are green design knowledge, green design skill and the experience on design green buildings. The attributes of contextual performance theory are commitment to green design, initiatives on green design. For an effective contribution of design team attributes to green design performance need effective management approach to insure high participation and efficient communication among the design team members.

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