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Clients' Priorities in Design and Delivery of Green Projects: South African Perspective

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***Abstract*—**This study attempts to identify the client's main priority when delivering green projects. The aim is to compare whether clients' interests are similar when delivering conventional buildings as compared to green buildings. Private clients invest more in green buildings as compared to government and parastatal entities. Private clients prioritize on maximizing a return on investment and they mainly invest in energy-saving buildings that have low life cycle costs. Private clients are perceived to be more knowledgeable about the benefits of green building projects as compared to government and parastatal clients. A shortage of expertise and managerial skill leads to the low adaptation of green buildings in government and parastatal projects. Other factors that seem to prevent the adoption of green buildings are the preparedness of the supply chain within the industry and inappropriate procurement strategies adopted by clients.

***Keywords*—**Construction clients, design team, green buildings procurement.

I. Introduction

CONSTRUCTION clients play different roles in construction projects depending on the identity of the client. Clients can be categorised as state or government entities, private individuals and investors. These clients have different property needs and therefore their participation and role in construction projects will differ. The other factor that determines the role played by the client is their knowledge of construction, which may in turn make them actively involved or if they lack the required knowledge they employ agents to work on their behalf. The client's role at the design stage is to present the brief to the design team so that they can produce sketches, budgets and feasibility plans of the works. The client's other role is to determine the procurement strategy that will be used to deliver the project and also to determine the project management of the works. Active participation of clients tends to improve the performance of projects. However, overall, when state projects are compared to private projects there tends to be less performance with regards to project delivery schedules and budgets even though the state is perceived to be the highest contributor to infrastructure development.

II. Literature Review

Construction clients vary in nature and have different objectives and building needs. Reference [1] found it difficult to classify clients into specific definitions because they claim that each design brief should follow a certain procedure to meet the desired needs of the client. However, [2] classified construction clients as private individuals, governments or state clients and property investors. All these client identities have different objectives when it comes to the need to build. Yet, the crucial aspect about clients is their experience in construction which affects the level at which the client can be actively involved at design stages of the projects [2]. Client's experience was further categorised as:

- Inexperienced clients;
- Moderately experienced clients; and,
- Experienced clients.

With all these categories some clients may have knowledge of construction and therefore become actively involved in all stages of the project leading to project success, while some have no experience at all and will therefore rely on outsourcing representatives to partake in the project [3].

Reference [4] also ascertains that relatively few clients understand construction processes and issues relating to procurement methodologies and how they influence and impact on the delivery of the construction project. Because client experience varies, those with limited experience employ advisers that are equipped with the knowledge and experience required for building projects [3]. Meanwhile, [5] suggests that clients should be more participative in construction processes, thereby gaining more knowledge on how to achieve successful projects, and then using this knowledge and experience in future projects to determine procurement strategies and planning of the works.

The level of client involvement is perceived to be of great importance so that they can carefully evaluate the choice of procurement strategies and the project management of construction processes [6]. Ideally it is an innovative stance for a client to be the pivotal driver during the design phase of a project; however, commitment to change is not easily implemented [7]-[10] reveal that active involvement by clients on projects tends to improve the performance of these projects as the clients bring previous knowledge from past projects, and they have the power to influence the choice of suppliers resulting in the end product being significantly improved.

In most countries, the government as a client represents a major share of the fixed infrastructure development, and in cases like Singapore, public infrastructure accounts for about 60% of construction projects [11]. Where the government is a client there tends to be problems of performance satisfaction as the projects are not finished on time and within the expected budgets [12]. There tends to be many procedures to follow when doing projects for governments. These affect the decision-making process leading to a poor performance of the

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projects [13]. Most of the time public infrastructure projects are run by governments and these projects are governed by complex policies and regulations [14]. It is a fact that public agencies have what [15] define as "*Well defined jurisdictions, responsibilities and hierarchy of authority*". These regulations tend to affect the delivery of projects under governments and can lead to poor delivery. Reference [12] suggest that these regulations and codes of practice are put in place in order to regulate and facilitate fair and unbiased procurement practices, however [14] argues that these non-flexible polices tend to disadvantage projects in terms of collaborative relationships.

A. Design Processes in the Construction Industry

The design process is defined by Bowen [2] as "*continuous process encompassing all activities associated with design decision-making*", and that it is used to facilitate a process to solve a client's needs with creative (design) skills that are relevant to that problem. Reference [16] state that the design process determines how a building is going to perform in terms of its function and will also determine if it will yield some profit. This process involves intense decision-making processes and requires great knowledge and experience.

Reference [17] reveals that processes from previous projects can be remodelled and improved in the design of a new project and while adopting these historical data, the process should be inclusive of everyone, including the non-white collar professionals [18]. Reference [19] suggests that consideration should be given to maximising constructability when making design decisions that could have been learnt from previous projects and incorporated within the new designs.

The design process is crucial because it is here where most of the unwanted waste can be identified and reduced for the entire life cycle of the building [20]. Some waste arises from "design defects" [21], but [22] suggest that if early construction expertise is involved at the design phase these design defects can be reduced significantly to achieve better 'constructability'. The design team should invest their creativity and decision-making at this stage because it will affect the life cycle of the structure and the process should have different options giving the client a choice in order to maximise the performance of the building [23].

Current literature reveals that the design phase should also cater for the health and safety of the physical state of the building and the construction activities. This gives the design team the opportunity to identify hazards and reduce the chances of unsafe activities during the execution of the works [24]. Furthermore, the design team should aim at reducing the reworks that arise due to improper decision-making and incorrect implementation [25]. They ascertain that it will ease the constructability of the projects. Constructability aims at connecting the design phase with the construction phase [26], and moreover by doing so delivers benefits to the project by saving on costs and completing the projects within the required time frame. Thus, there is a strong argument for making the design process flexible so that other parties as end users - sub-contractors and suppliers - can be accommodated during the design phase, so as to maximise the economics of the design of the buildings [27].

B. Overview of the Construction Design Team

The design team within a construction project are involved at the early stages of the project in order to determine the shape, aesthetics and performance of the building, and these teams have a direct influence on the choice and selection of materials, construction methods and the facilities management state during the life of the building [24]. During the design phase, the designers have the responsibility for the safety of activities during construction and the whole life of the building [28].

Within the South African context, it is also explicit in the Occupational Health and Safety Act (OHS) and Building Regulations of 2014 that safety must be prioritised and that it is the responsibility of both the client and the contractor to have health and safety representatives on site at all times [29]. However, most designers lack site experience and this makes it difficult for them to actually identify and plan health and safety related issues [30]. However, legislation allows them to delegate authority to competent parties to make up for this lack of expertise [31].

Reference [32] finds the design phase too theoretical as there is no input from the practical side of the project - from the contractor - which could maximise the efficiency and performance of delivery of the project. Therefore, there is a suggestion that there should be inclusiveness of the technical construction professionals during the design stage because they have execution experience and they would be able to identify proper construction methods, good choice of specification and proper health and safety planning for site problem-solving activities [24].

The construction design team is faced with challenges and they can be exposed to the following risks as depicted by Fig. 1.

As depicted in Fig. 1, the design team poses some difficulties which could lead to an inability to perform to the expected level. Reference [33] observed problems in Saudi Arabia on projects that affected the time performance of the projects due to the design team's performance as categorised in Fig. 1. The problems included the following:

- Errors in documentation;
- Late production of designs;
- Ambiguity in designs;
- Unclear briefing from the client;
- Lack of adequate experience within the design team; and,
- Complex designs.

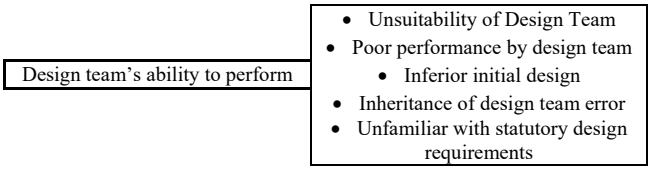

Fig. 1 Risk elements pertinent to design team's ability to perform

The same problems as mentioned above have been highlighted by [34], where major setbacks have occurred because the design team were unable to meet their objectives.

C. Parties Involved during the Design Process

During the design phase of projects there are various professionals making up the design team, and it mainly depends on the procurement strategy adopted by the client, because when using traditional procurement, the parties in the design teams exclude the contractor and the contractor is only appointed after the designs have been finalised. Many construction projects are carried out according to this procurement package [35].

As stated by [36], the procurement strategy adopted by the client will influence the composition of the design team because in situations of partnering procurement, the client, together with the contractor, contribute towards designs and the contractor is appointed at an early stage of the design phase in betterment of a relationship to the achieve mutual objectives of the project.

D. Traditional Design Process

The traditional design process is depicted by [32] as planning stages, in Table I. All the stages of planning are executed by the client and the contractor is only featured during construction.

TABLE I
PLANNING STEPS AND RESPONSIBILITIES

Planning Step	Responsibility
Initial Assessment	Client
Conceptual Design stage	Client
Basic Engineering stage	Client
Approval Planning stage	Client
Detail Engineering stage	Client

Evident in Table I that there is a lack of emphasis in trying to integrate the design activities with the construction activities. Most of the aspects emphasised at these stages include aesthetics, spatial designs and functionality of the building [37]. The disintegration between design and construction activities lead to contractors having problems on site trying to replicate activities shown on the designs which are not viable to carry out, and thus, buildability and constructability is intensely affected. These problems are claimed to arise due to the lack of incorporating the buildability concepts during the design phase of a building [19].

E. The Paradigm of Green Buildings

The construction industry is used as a catalyst in economies to provide employment and produce different buildings needed for social and economic services [38]. As these services are provided by the construction industry, a lot of environmental issues arise as there is a depletion of natural resources, emission of gases on site and pollution to the environment arising from their activities [39]. With all these activities the public, governments, legislatures and environmentalists scrutinise the industry and push it to come up with sustainable methods to minimise negative environmental impacts. Reference [38] states that there needs to be strong integration and emphasis on how interventions can be carried out through all the stages of a project which are: briefing, design, construction and operation. Construction activities by nature intensively consume natural resources and emit carbon in its various forms [19].

Findings by the World Business Council for Sustainable Development (WBCSD) state that the construction industry consumes 40%, 25% and 16% of stone, timber and water respectively, globally, per annum and at the same time [40] reveal that carbon emissions arise due to the use of fuel and electricity during the construction process. Reference [41] argue that increasingly more responsibilities are being imposed on contractors by society through regulations etc., to control these emissions during construction, minimise the use of natural resources and reduce waste. Yet despite this growing and increasingly intensive need to make construction activities sustainable, contractors are excluded during the inception stages of projects where the key design decisions are made, and where they could have the opportunity to reduce the impact of construction activities.

Yet in most projects in South Africa contractors are appointed after drawings and specifications have been finalised by the design team and client [42]. Even in the case of green buildings, this late appointment of contractors applies despite the recognition of the benefits of contractor involvement [43]. The basis of their selection remains largely dependent on their response to the design information in the form of tenders to provide prices [43].

The construction industry, like other industries, is faced with the challenge of the current paradigm shift towards the implementation and adaptation of green design principles. South Africa, like other developing countries, is also moving in line with implementing green designs and non-governmental bodies, such as the GBCSA, have been established to award ratings to green buildings and promote green design and construction practices.

Globally, the construction industry has made this development a priority to meet the standards of achieving sustainability [44]. The principles of green design require the meeting of social needs without affecting future generations, by attaining budgeted costs of the projects and expected quality whilst minimising environmental depletion and complying with legislature [45]. All these fundamental project needs should be met without compromising one another. These pillars are the governing mechanisms of green construction, namely; environmental protection, social well-being and economic prosperity [46].

During the construction phase, there tends to be many activities that adversely affect the environment including air, water and noise pollution. Some of these activities are directly under the control of the contractor, whereas others are the function of the design of the building. Whilst the contractor can take independent steps to reduce environmental impacts during the construction phase, the major impacts are likely to

be derived by the operation of the building, hence the importance of design in mitigating these impacts. The actions taken by the contractor are therefore constrained by the design decisions of the design team, of which they are not a part under the traditional procurement path.

Some construction waste is also hazardous to the environment thus affecting the eco-system [47]. With these problematic issues the industry needs to come up with strategic and innovative ways to reduce these environmentally adverse attributes [48]. Some governments have positively responded to these problems and come up with policies and regulations to control construction activities [49].

Even though green construction is perceived to be of growing importance within the construction industry, there are challenges that hinder the implementation and adoption of initiatives in support of green construction [50]. There remain a lack of awareness and knowledge from investors and clients as to how these designs will influence cost reduction [51], despite the fact that adapting these designs in actual fact depends on the knowledge and understanding of the overall concepts [45]. Some surveys reveal that managerial skill was a concern, as adaptation to these initiatives requires skill and knowledge by contractors [51].

III. Research Approach

The research was conducted from a random sample of construction professionals that have experience in green construction, identified in the database for the Green Building Council of South Africa (GBCSA). This is an organization that trains, registers and grades such professionals. An online survey was sent to participants. A response rate of 60% was attained based on individuals who opened their emails on receipt of the survey.

Different statistical methods were used to analyze and present the data. The choice of data collection was to ensure that a diversity of professionals from different projects participate in the survey.

IV. Findings

Based on the pie chart on Fig. 2, it is evident that private clients are more receptive to the green building ideology compared to the state and parastatal sectors, which are almost identical in their share. This means that these buildings require greater promotion and their benefits need to be shared with government and parastatal entities. The South African state is the biggest client in the construction industry and it can also benefit from adopting these types of buildings.

Fig. 2 reveals that 81% of participants perceive that a majority of private clients adopt green buildings and practices. The government and parastatal sector shares almost half the proportion of the remaining 19%. The state is ranked lowest as a client that uses and adopts green building practices in South Africa despite the findings of [29], which state that there are some legislative measures in place for the South African construction industry to follow in green implementation and compliance. Another reason why the public sector shows a low rate might be because the public sector is said to have a shortage of skills in construction project delivery as identified by [52].

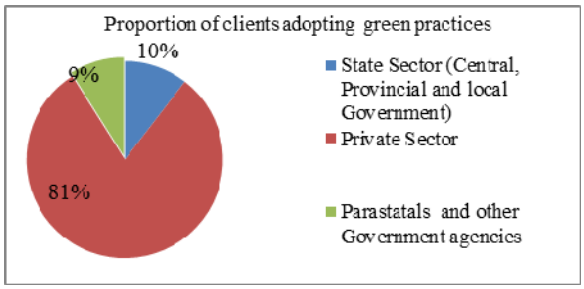

Fig. 2 Proportion of clients as per adoption of green buildings

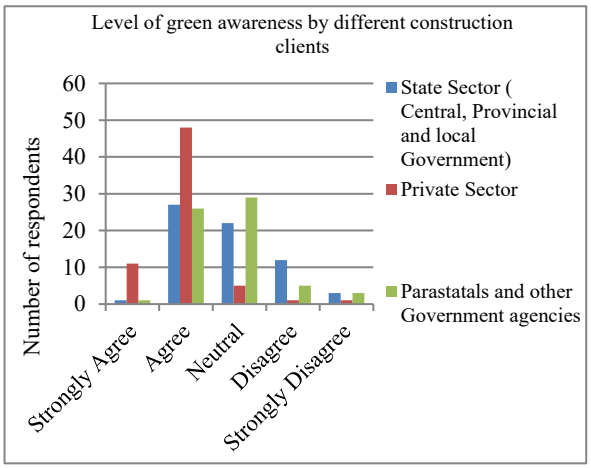

Fig. 3 Level of awareness by clients on green initiatives

The level of awareness and knowledge of different clients with respect to benefits of adopting green building practices, still shows that the private sector is the lead client compared to government and parastatal entities. Figs. 2 and 3 reveal that private clients are knowledgeable about the benefits of adopting green building practices which lead them to investing more in green buildings than other clients. It would therefore seem that there are low levels of awareness on the full benefits of green building initiatives, as revealed in the findings by [53], suggesting that clients, contactors and policymakers should be made more knowledgeable and become more skilled and aware of the field of green construction.

TABLE II
Chi-Test Results: Level of Clients Awareness on Green Buildings

	Chi-Square	fd	Asymp. Sig.
Private Sector	95.493[g]	2	.000
Parastatals and other Government agencies	13.138[i]	2	.001
State Sector (Central, Provincial and local Government)	12.030[g]	2	.002

In the chi square test results shown, it is noted that the scoring patterns per question, per option were significantly different.

The private sector is said to be greening their projects, this is because it is agreed that they are knowledgeable about the benefits of green buildings, and hence their adoption of them. It evidently shows that state projects are also on the move to green some of its projects. It is agreed that most private clients are greening their projects. Similar trends and patterns have been identified by [43].

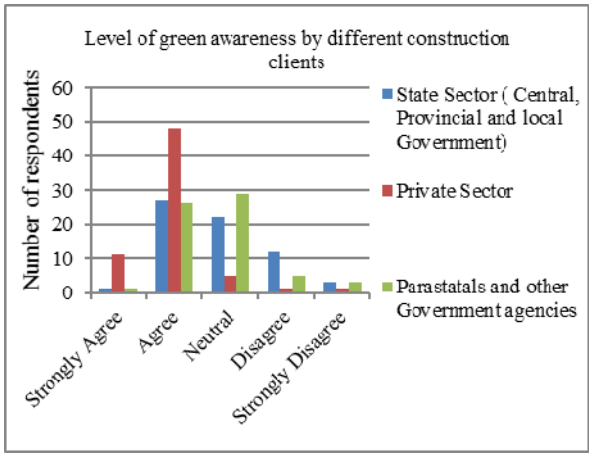

Fig. 4 Clients that are greening projects

It is evident that the traditional procurement path is still the most preferred. The majority of projects investigated opted to use a traditional procurement path despite the problems that have been discussed. The second preferred procurement path is design and build, despite the perception that it is the most ideal method for green construction as discussed in question 20. The least used methods that account for 2% usage are management contracting and Public-Private-Partnership.

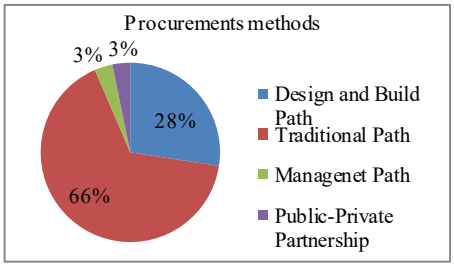

Fig. 5 Procurement path

The data reveal that most of the projects, accounting for 47%, use selected tendering to appoint contractors. The method of appointment is against that perceived as the ideal method, which is negotiated tendering, and while it ranks as the second preferred method followed by public tendering.

Contracts play a big role in the delivery of projects. The most used contract for green buildings is the popularly known local contract of JBCC. It accounts for 79% usage as compared to other contracts. This might be due to the fact that it is commonly used and local clients and contractors are familiar with it.

TABLE III
METHOD OF CONTRACTOR APPOINTMENT

Answer	*Percentage (%)*
Negotiated Contract	27%
Pubic Open Tender	23%
Selected Tender	47%
Other (Please specify)	3%
Total	100%

TABLE IV
TYPE OF CONTRACT USED IN PROJECTS

Answer	*Percentage (%)*
JBCC	79%
NEC	5%
FIDIC	3%
GCC	3%
Other (Please specify)	10%
Total	100%

From Table IV, it seems the in most contracts the contractor was appointed after the design had started. This is still evident because traditional procurement was used. In some instances, it seems there were partial designs and the contractor had to execute other designs. This still reflects the use of JBCC as it supports the traditional procurement path. It was clear that most clients wanted buildings that have clean energies and mainly wanted buildings with recyclable energies.

Some participants revealed that private clients adopt green buildings in order to minimise energy usage costs and to increase the interior comfort without resorting to extreme energy usage. The other factor is to increase the green star rating of the building. It is evident that some clients are aware of green principles and would like to save operating costs of buildings, by investing in cleaner energies.

Operational costs are said to be greatly reduced in green buildings as compared to conventional buildings - this study was done on different properties such as retail, residential and office spaces. Another interesting driver of clients that was mentioned by numerous participants was for the client to have a green rated building for marketing purposes and to increase the value of the property. It was noted that some clients green their buildings in order to get the targeted green star score. Some participants aligned star rating with returns because the rents are presumed to be higher in green rated buildings. The star rating was also aligned with internationalism.

Other issues include the comfort that green buildings create. The occupants are said to be provided with comfort as compared to conventional buildings. One participant believed that clients prioritise on factors of pleasing aesthetics in combination with the comfort of inhabitants and the saving of energy costs, as well as there being a perception of "*healthy office*" building that they and their staff could be proud of.

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