

# FIELD DIAGNOSIS OF CHALLENGES AND FACILITATORS TO THE ADOPTION OF GREEN BUILDING PRINCIPLES IN MULTI-PURPOSE OFFICE FACILITIES

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The study is a qualitative investigation of the implementation of green building projects, and the identification of the facilitators regarded as the most important to enhance the adoption of green building. To realise a robust outcome, case studies were conducted on purposive selected green building projects based in Cape Town, South Africa. The primary data were obtained using a semi-structured interview, and respondents included consultants, and contractors' management teams registered with the Green Building Council of South Africa (GBCSA). Regulatory factors were identified as key challenges to implementation of green building projects. The study also identified some key facilitators that enhance the adoption of green building. These include attributes of adopters such as skill, experience, and reputation of firms to undertake green building projects, green policy framework, incentives, and financial support from financial institutions. Design and construction firms should institute a mechanism for evaluating performance periodically, and identify challenges encountered in respect of green building projects they are involved in. Early identification of challenges and taking proactive steps to rectify problems are likely to ensure survival in the industry. The findings of this research contribute to a better understanding of the challenges of constructing green building, and the factors that engender the implementation of green building projects.

Keywords: professional, developing country, facilitators, green building

## INTRODUCTION

Green building is defined “as a high-performance property that considers and reduces its impact on the environment and human health” (Yudelson, 2010: 13). Green building is viewed as a long-term business opportunity since it continues to influence construction in both developed and developing economies (Jones and Mandyck, 2016). A global study conducted by Dodge Data and Analytics reveals that some international firms, including architects, engineers, contractors, specialist consultants, and property developers, are focusing on sustainable design and construction, as at least 60% of their projects will be ‘green’ by 2018, an increase from 28% in 2012

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(Jones and Mandyck, 2016). For example, it is anticipated that the percentage of construction firms in South Africa incorporating green practices in their business is expected to increase from 27% in 2015, to a planned 61% by 2018 (Jones and Mandyck, 2016). Thus, South Africa emerged as one of the countries with the highest green share among all the survey participants, indicating a market conducive to green building (Jones and Mandyck, 2016). Despite this development, however, significant impediments persist, erected by the inertia of the building professions and the construction industry and compounded by the difficulty of changing building codes (Osec, 2010). Industry professionals, including consultant team members, contractors, and developers are generally slow to adopt change and tend to be risk-averse. Similarly, amendments to building regulations are inherently difficult to pursue, and fears of liability and litigation over the performance of new products and systems pose appreciable challenges (Osec, 2010). Hence, the research problem statement states that significant challenges of implementing/constructing green building persist in the South African construction industry as a result of overly prescriptive and conflicting building codes, slow / resistance to change, lack of information and incentives, inadequate technical skills, litigation over the performance of new systems and green products, cost of green building and the lack of collective vision and guidance in terms of decision making for adopting future green building projects. This raises the following questions that the study aims to address: what is the most significant challenge affecting the implementation of green building projects, and which facilitators are regarded as the most important to enhance the adoption of green buildings? The purpose is pursued by analysing qualitative data obtained from three case studies based in Cape Town, South Africa. The structure of this paper summarises and presents brief discussions with regard to the extant literature relative to the challenges of implementing green building and facilitators that engender the adoption of green building. This is followed by the methodological approach adopted for collecting and analysing the data. Thereafter, the findings from the case studies are presented and discussed. The final section presents the conclusions of the study.

## **LITERATURE REVIEW**

### *Overview of challenges of implementing green building*

Many researchers have identified the underlying reasons responsible for the inertia in implementing green building projects (e.g. Isaksson and Linderoth, 2018; Häkkinen and Belloni, 2011; Djokoto *et al.*, 2014). According to Isaksson and Linderoth (2018), the first reason for the sluggishness in implementing green building is costs. Hankinson and Breytenbach (2012) revealed that clients / developers would have to incur an additional cost between 10% and 20% in order to implement green innovation in construction. Besides, the cost to be borne by built environment stakeholders is prohibitive for the first green building of a client or the consultant team members and contractors since the design and construction process is often characterised by significant learning curve costs, and design schedule problems including late and costly change orders (Kats and Capital, 2003). The second significant challenge that the industry is confronted with regarding the implementation of green building is skills shortages and lack of industry skill with regard to green design and construction (DST, 2014; Hankinson and Breytenbach, 2012). According to Jones and Mandyck (2016), the high level of activities related to green building may contribute to the fact that one of the biggest challenges is finding sufficient skilled professionals. Regulatory and steering barriers are also key challenges in implementing green concepts. According to Häkkinen and Belloni (2011), different

types of instruments are used for steering. However, the lack thereof or wrongful steering may rather stifle the growth of green building whilst on the other hand; green building may also be promoted at least to a certain extent with the help of regulations (Djokoto *et al.*, 2014). The fourth key challenge hampering the implementation of green building is organisational culture. Djokoto *et al.*, (2014) opine that the construction industry is conservative and presents itself as an industry which is slow to adopt to change specifically with regard to construction techniques practiced and building materials used. The construction industry has traditionally been a slow adopter of new technologies in general, mainly due to the perceived associated risks (DST, 2014).

#### *Facilitators of green building*

There are many facilitators that could help to ensure a successful project implementation and overcome a range of challenges inhibiting the adoption of green projects. Firstly, improving the availability of reliable information and knowledge relative to the benefits of green building would better inform stakeholders and the general public and help to diminish misperceptions (Darko *et al.*, 2013). Khoshbakht, *et al.*, (2017) opine that the accumulation of diverse cost-benefit variables is imperative for a full package of economic evaluations, and that it should be communicated to various stakeholders in the green building industry. Secondly, the implementation of green building, thus, requires a joint team effort by uniting a wide range of different professionals who possess the right mix of skills. According to French *et al.*, (2008), the most outstanding attributes of members of high-performance teams have the right mix of skills, including technical skills, problem-solving and decision-making skills, and interpersonal skills (Sanderford *et al.*, 2015). Thirdly, developing enablers for green building could be one of the significant steps toward creating a holistic view of the complexities of the construction sector, as it serves as a guiding principle for the government to develop policies as well as instigating more actions amongst stakeholders within their own realm of responsibility (Abidin *et al.*, 2013). Numerous enabling factors have been identified to ensure a successful implementation of green projects. The main enabling factors were found to be: changes to regulatory framework; provision of monetary and non-monetary incentives; ensuring sufficient financing; involving appropriate experts, and embracing partnerships (Majdalani *et al.*, 2006; Choi, 2009; Kapur *et al.*, 2011).

## **METHODOLOGY**

The research was undertaken by conducting an empirical study using a qualitative approach in conjunction with a literature survey. To achieve the purpose of the study, case studies were conducted among selected firms in the Western Cape Province to investigate how and why challenges of implementing green building persist and how the enablers could be used to encourage the adoption of green building. According to Yin (2009), a case study allows researchers to explore individuals, organisations, communities and programs, to test research mechanisms and techniques. Yin (2009) further asserts that there is no ideal number of cases that should be undertaken. To date, there are a total of 63 certified green building projects in the Western Cape Province. Out of the 63 certified projects, 22 are green star office buildings. However, purposive sampling method was adopted to select three green star office buildings based in Cape Town. These projects were selected on pragmatic considerations, namely their availability. Purposive sampling consists of handpicking purportedly typical or interesting cases (Blaxter *et al.*, 2001). The following parameters were used in selecting the three cases, the type of project and facility type,

whether the buildings had been certified as green by the GBCSA, the date of certification, and ease of access to information. In total, three (3) respondents were interviewed (thus one respondent from each firm). Interviewees included environmental specialist, junior site manager, and an architect who were directly involved in the construction of green buildings. A semi-structured interview questionnaire as described below and a site visit approach (visual inspection) were adopted in the data collection. The survey participants from the three selected firms were interviewed face-to-face. A three part questions guided the interviews. Section 1 - Relates to general information regarding the green building project. Section 2 - Explored respondents' opinions regarding the challenges encountered during the construction of green buildings. Section 3 - Relates to lessons learnt from the project and successful corrective solutions to faced challenges. The qualitative data were analysed using content analysis. The analysis of the qualitative data consisted of transcribing and conceptualising the data obtained from the interview that were deemed to be relevant to the topic under investigation.

## **FINDINGS**

### **Preparation of Interview**

Prior to conducting the interview, the respondents were contacted by phone and informed about the purpose of the interview. Thereafter, the semi-structured questionnaire was sent as an attachment with the email and this provided the interviewees an opportunity to prepare in advance for the interview. With respect to project A, the contractor's environmental specialist / transformation manager was interviewed. The interview was conducted in the environmental specialist's office and lasted 1 hour 30 minutes. Concerning project B, the interview was held on site with the junior site manager and lasted 30 minutes. With regard to project C, a half-hour interview was held with the architect in the office. All the discussions were tape recorded using a tape recorder.

### **Case Description: Analysis of Project A**

Project A was 32 floors, comprising 3 floors of basement, upper and lower ground floor as retail area, 7 structured parking levels, 19 floors of office space, 2 floors of dedicated plant room and 1 sky plaza with over 52000m<sup>2</sup> of office space. The level of certification of the project was 5-star. The respondent stated that the most significant green features that were used for the building include: Design so that over 95% of the total façade can be disassembled; LED lighting scheme; electric car and electric bicycle charging points, and cycle racks.

#### *Challenges Encountered During the Construction of Green Building*

##### *Lack of materials and certification / testing of materials*

According to the interviewee, there were two difficulties with respect to materials and certification of materials during the execution of the project. One of the challenges according to the interviewee was sourcing green materials / products with low percentage of volatile organic compound (VOC) content, low environmental impact and recyclable. The second issue that confronted them was the high cost of green materials with low VOC values coupled with the cost of testing these materials. The interviewee lamented that the cost of testing green materials is more expensive than standard materials. The interviewee stated that:

The green building council is very stringent when it comes to the use of formaldehyde. Formaldehyde minimisation is one of the things that really cause a pain. For instance, there is a premium for the formaldehyde content in terms of the joinery work. That is

there is a price for the formaldehyde, is actually very high. There are different board types and typically they will prefer the E1 board type which must be tested and the test is very expensive. For items such as the boards and paints, there is a premium to be paid specially to have the formaldehyde and zero VOCs. And if you go for IEQ13 test for instance, which is mostly what pushes up the price, hence the cost implication of the project. Hence, we are obliged to look for local within say 15km radius but elsewhere it will cost less.

#### *Financial barriers*

With respect to financial challenges, the respondent expressed concern regarding the high percentage premium associated with the certification process of green building, coupled with the cost of green materials. The respondent further stated that there is a system in place for monitoring purchasing of materials from suppliers other than BEE suppliers. The respondent argued that this system act as a barrier as it has an impact on the company's BEE scorecard. The respondent lamented that:

High percentage premium and prices of the raw materials, as well as the impact on our BEE scorecard with buying from suppliers other than BEE suppliers. For instance, the premium as a percentage of the total cost of the building for gaining green certification was 17%.

#### *Capacity barriers*

The respondent also expressed concern in relation to the lack of capacity as far as the green building industry is concern, although the respondent was of the opinion that most of the consultant team members were experienced enough to ensuring the success of the project judging from their previous experience. However, the uniqueness of this very project posed lots of challenges to the design team members as well as the contractor. The respondent also highlighted that:

The contractor and other consultants were on the learning curve, as a result, there were a lot of design related and site related rework which escalated the cost of the project and subsequently affected the duration of the project.

#### *Regulatory barriers*

The respondent stated that the main regulatory barrier encountered with respect to this project was the time spent in getting the green building project certified and the difficulty in adhering to green certification requirement such as recycling, and dumping of waste materials. The respondent cited examples such as:

Slow rate of progress of certification delayed the commencement of the project. The way we look at our waste, did the truck dump the waste at a responsible place? Is easy for me not to bring to the GBCSA attention because is going to make life easier for me on site, how' if I say I diverted 80% of waste from landfill, they still send it to landfill, but they used it to build road.

#### *Lessons learnt*

The interviewee stated that the push behind going green should be based on certain parameters including perceived benefits from green building, the extra cost of green building material and technology, the operational costs of green building, availability of green technologies, availability of green materials, and availability of consulting and project management expertise. The respondent emphasised that these parameters will ensure the success of the project and encourage stakeholders within the built environment to go green.

In my opinion, more emphasis should be placed on the impact of current methods, and the benefits of going green should be sold more aggressively with real financial incentives and affordable to all.

*Successful Corrective Solutions to Faced Problems*

Liaising with consultants on a regular basis, do things while the building is on, constant follow-ups, and two-way communication. Holding back payments of certain subcontractors, regular inspection of the actual materials used, and regular checking of the drawings.

**Case Description: Analysis of Project B**

The second case study that is project B consisted of a 5-storey office complex (approximately 23.8m high) with a total site area of 23755m<sup>2</sup>, with a building footprint of 7195m<sup>2</sup> and landscaped areas of 7280m<sup>2</sup>. The level of certification of the project was 5-star and the total cost of the project was R 218,206,912.37. Some of the innovative technologies used for the project include biometric readers' system (BRS). Therefore, each floor can only be accessed by biometric readers, and the occupants need to be on the system to have access to a particular floor. The BRS also controls all the electronics and water supply to the building.

*Challenges Encountered During the Construction of Green Building  
Capacity barriers*

According to the junior site manager, one of the biggest mistakes on this project was the appointment of subcontractors with inadequate skill or know-how with regard to how green principles should be implemented. This situation resulted in time overrun and increased in the cost of the project due to rework. The respondent opined that:

Firstly, this is our first green building endeavour, so you need to make sure that those that you employ such as your subcontractors and their workers have the skills and the know-how of what is required. And not just the skills and knowledge but also channels of communication are important. That was a huge issue on the site and I think that is one of the downfalls that is why we are still here today.

Another example cited by the respondent with respect to appointing sub-contractors was in the case of the landscaping work.

There were palm plants in the pond to be planted, so we have this subcontractor who does mostly civil works. But for this specific job he decided he's going to tender for civil and landscaping because he can do landscaping for some reason. It will be his responsibility to supply and plant the water lilies in the pond. And water lilies are water plants and not a refill so they have their own compos or certain compos that need to be used and he was adamant that he would supply it, try and get it sorted. Now, two-three weeks later we have dead water lilies in our pond, and we told him how to do what he was supposed to do and he did not.

*Regulatory barriers*

The respondent stated that the major barrier encountered was that their firm has limited knowledge with respect to green strategies. This was evident during the implementation stage of the project where they failed to comply with green certification requirement such as recycling of material.

But when we came to doing as built for the green building to get our certification, we noticed that there was a regulation for how much OPC needed to have been in the cement, how much of it was like a re-use material that they had used to comprise that made up our cement. I think someone overlooked that when we started with the building project and when we came to the end, there is the building standing and we not going to get a point, and that was like 2 point. I think we overlooked that regulation.

### *Cultural barriers*

The cultural barrier that was apparent in the interview was organisational culture. The respondent argued that some of the role players would want to do something their way that they know that the end result will be satisfactory, but not a green building way.

An example will be the outside of the building was finished with face brick and that in old days how you will clean face brick is to do it with diesel and it will get rid of the white resin that comes out on the outside of the face bricks and it will make the bricks look very nice, it brings out the redness in the brick. This is one of the things that was suggested that we should use in cleaning the facing bricks but we can't. Obviously on a green building you can't use something like diesel to be cleaning face brick, because is flammable and is one of the big no on a green building.

### *Lessons learnt*

According to the respondent, the most important lessons are that green building is a good thing, thus good initiative; it should be low maintenance if it is done right the first time. The interviewee stated that:

The initial cost is very expensive but very worth it at the end of the day, if you look at how it saves and helps the environment and the staff that are occupying the building. More so, communication in general is a big key especially in green building. There is so much information and if you don't have people that are on board, then that can lead to lost in translation and then you end up where we ended up.

The interviewee opined that a lot of rework ensued since "*this was their first green building endeavour*". Therefore, the respondent suggested that:

The experience and knowledge base of contractors and sub-contractors are very vital during the construction of green building. The respondent was also of the view that design team members should also have the necessary skill, experience, and reputation in undertaking green building projects as these characteristics are important to ensure the success of green building projects.

### **Case Description: Analysis of Project C**

Project C consisted of a 2-storey building, the total floor area was 3800m<sup>2</sup>. The level of certification of the project was 4-star and the total cost of the project was R 24,000,000.00. Some of the innovative technologies used for the project include: PV / off grid energy and black water recycling system.

### *Challenges Encountered During the Construction of Green Building*

#### *Regulatory barriers*

The respondent was asked to explain some of the regulatory barriers, according to the respondent, overly prescriptive and conflicting building regulations resulted in difficulty and unnecessary delays in obtaining green certification and permits for the green building project. The interviewee maintained that:

The process of obtaining green building certification was a very lengthy process and a bit tricky. It was prohibitive, and after we have done the one, we said we wouldn't be doing it again. At the same time, we looking at drawing up easy to use guidelines that we can implement the principles and strategies without having to register. We are not going to get the star rated building but we going to be using a good practice, is not ideal if you want the star rating. And I think the way we could achieve that is by having internal green consultant which we don't have, the consultant will do the process for us, and we might be able to achieve it and then run alongside us with the project and do the work involved with the council.' I worry that Green star has become more of a 'tick box' to compliance. This is something I have noticed considerably in the last few years. Consultants are not given the opportunity to provide valuable advice on the design of projects. It is very prescriptive, in my view.

### *Financial barriers*

When questioned about financial barriers and how it affected the project, the architect expressed concern about high percentage premium associated with the certification process of green building and the cost of green consultants.

Percentage premium, and in fact we are implementing the principles but not going through the process of registering at the green building council, because of the work load and cost of appointing consultants; the green building consultant is a costly element. We find that very prohibitive. Then a matter of finding the finance to employ a group of green building consultants or the core workers to get the building certified was a great concern. But the additional issue is the line department has to be prepared to pay the percentage premium as well.

### *Lessons learnt*

Experience of consultant team members is very important to ensure a successful implementation of green building.

Practical training: People who have not studied in a long while cannot in any way be motivated to suddenly study to be accredited for green building profession. However, I believe they can be motivated to do some practical training instead, to be accredited for green building profession. This is worth a try to get the 'old' professionals in the construction industry aware and comfortable with green building practices in the construction industry.

The architect lamented that there should be a green policy framework in place that will fast track the permit process and reduce the time involved in obtaining green certification form the GBCSA. The respondent also stated that there is inadequate system in place for facilitating the adoption of green building and that various incentives schemes should be provide to encourage developers and consultant team members to take up green building projects to assist the nation to achieve its sustainable goals. In addition, financial institution should also come on board to assist in providing financial support to encourage developers and client to adopt green building.

## **DISCUSSION OF FINDINGS**

Challenges: The result of analysis shows a consensus of opinion that there are challenges associated with the implementation of green building. These factors include: lack of materials and certification and testing of materials; financial barriers; capacity barriers; regulatory barriers, and cultural barriers. All respondents also identified regulatory factors as key challenges to adoption of green building. Most of the respondents view financial and capacity factors as major challenges to adoption of green building. In accordance with the review of literature, respondents' perception of risk associated with green building adoption has a negative effect on attitudes. These findings are consistent with green building studies that found how multiple layers of risk and risk aversion by professionals' cause resistance to transitioning to alternative approaches to green building (Häkkinen and Belloni, 2011; Hankinson and Breytenbach, 2012)

Benefits of green building: According to the qualitative analysis, two of the professionals interviewed believe that the push behind adopting green building should be based on the benefits accrued to green buildings. Two of them viewed operational cost savings (low maintenance cost) and reduced percentage premium relative to the cost of going green as major benefits of green building. One of the respondents perceives environmental benefits as one of the benefits of green building. These



findings are akin to previous studies conducted by Park *et al.*, (2014); Darko *et al.*, (2013).

**Attributes of adopters:** The case study analysis revealed that major attributes revolved around skill, experience and reputation of firms to undertake green building projects. For instance, one of the respondents disclosed that a lot of rework ensued since it was the first green building endeavour. Hence, the need to engage contactors and consultant team members with the necessary skill, experience, and knowledge cannot be overemphasised. This is in alignment with the findings in the literature that, the attributes of adopting firms and contractors were found to exhibit significant direct effects on adoption of high performance building products innovation and green building (Sanderford *et al.*, 2015; French *et al.*, 2008).

**Enablers:** The respondents affirm the need to employ other means through which green buildings can be promoted to encourage its adoption. Some of the respondents highlighted the need for a green policy framework as this will fast track the permit process and reduce the time involved in obtaining green certification. This finding aligns with previous study undertaken by Majdalani *et al.*, (2006) who opine that changes to the regulatory framework are considered to be the most effective means for a behavioural shift in transforming the green building sector. Two of the professionals agree that more incentives should be provided to enhance the adoption of green building. Similar findings emerged in research study conducted by Choi (2009) who found evidence for the use of incentives as measures to enhance the adoption of green building. Notably, one of the respondents stated that financial support from financial institution will undoubtedly encourage developers / client to adopt green building. This is corroborated by Kapur *et al.*, (2011) who opine that financial institutions are playing a role in creating financial resources and instruments in facilitating energy efficient investment such as green buildings. One of the respondents also suggested the need for practical training to get the old professionals in the construction industry aware and comfortable with green building practices in the construction industry.

## **CONCLUSIONS**

This study investigated the challenges that built environment stakeholders encounter in their quest to implementing green building, and the facilitators that will create an enabling environment for adopting green building. In all the projects, it was found that challenges to implementation of green building include: lack of materials and certification and testing of materials; financial barriers; capacity barriers; regulatory barriers, and cultural barriers. However, all the respondents identified regulatory factors as the most significant challenges to implementation of green building. The results of the study reveal that although there are risk factors involved in implementing green building, there are also factors that engender the adoption of green building. It should be noted that all the respondents highlighted the need for a green policy framework as this will fast track the permit process and reduce the time involved in obtaining green certification. It was also mentioned that more incentives should be provided to enhance the adoption of green building.

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