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CHALLENGES AND ENABLERS OF GREEN COMMERCIAL OFFICE BUILDINGS IN SOUTH AFRICA, GAUTENG: A FOCUS ON COST RELATED FACTORS

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Research proposal submitted in partial fulfilment of the requirements for the BUQS7027 course in the School of Construction Economics and Management at the University of the Witwatersrand

Supervisor: Dr Obinna Ozumba

25 October 2018

DECLARATION

I Lorenzo Lacovig (Student number: 0211525T) am a student registered for MSc Building in the field of Construction Project Management in the year 2017. I hereby declare the following:

I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.

I confirm that ALL the work submitted for assessment for the above course is my own unaided work except where I have explicitly indicated otherwise.

I have followed the required conventions in referencing the thoughts and ideas of others.

I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.

Lorenzo Lacovig, 0211525T

Signed……..

Date……..

ACKNOWLEDGEMENTS

I would like to thank my supervisor Dr. Obinna Ozumba for the guidance and support on achieving such a feat in this research report.

I would like to also thank my family for giving me the time required to complete this research and their loving support through the difficult times. I love you all.

This research is dedicated to the environment and to saving and preserving our planet for our future generations, every living being deserves to experience the wonder of such a beautiful world which we live in.

ABSTRACT

There seems to be a general consensus from green building literature that financial related factors are the most influential to investment decisions for stakeholders. Despite this consensus, research continues to focus on multi-disciplinary factors instead of only financial. Such studies have focused on the categorisation of factors into challengers or enablers; however the level of influence was not determined. There is a need to identify and classify the level of influence of financial related factors in terms of investment decision for green commercial buildings to aid in investment decisions.

The research aimed to identify, classify and determine the nature and occurrence of cost related factors for green commercial buildings in South Africa, Gauteng throughout the life of the project. A pragmatic philosophy was adopted and mixed methods were used to gather the information and data required to meet the aim of the research. The data was analysed and each cost factor was classified and ranked. The required stakeholders were identified through the use of purposive, convenience and snowball sampling. Data was collected via interviews and questionnaires.

Research findings revealed the top five factors categorised as enabling factors and which significantly influenced investment decisions on green commercial projects as: 'lower operating costs', 'water use reduction', 'rising energy costs', 'higher return on investment' and 'increased property value' respectively. Contrary to literature findings, marketing and environmental factors were also found to influence investment decisions. The operational stage of the project was the most cost intensive while the inception stage the most influential.

The small sample data set and respondent constraints on answering the questions could affect the credibility or validity of the findings of this research.

Findings conclude that investors in green commercial buildings in South Africa, Gauteng should be mindful of the top five cost factors before investing, they should be aware that the majority of cost saving opportunities lie in the operational stage of the project and should ensure the top five factors are discussed in detail during inception stage of the project. Marketing and environmental factors should be considered during inception stage of the project as they are found to influence investment decisions through tenant's requirements.

This research provides stakeholders with a deeper understanding on how the cost related factors affect green commercial projects. The findings have increased awareness and knowledge amongst professionals, clients and tenants as well as provided a solid baseline study for further research on cost related factors.

TABLE OF CONTENTS

Declaration ..... **i**

Acknowledgements ..... **ii**

Abstract ..... **iii**

Table of Contents ..... **iv**

List of Figures ..... **viii**

List of Tables ..... **ix**

1. Introduction **1**

1.1. Research Problem 4

1.2. Research Question 5

1.3. Research Aim 5

1.4. Research Objective 5

1.5. Justification for Research 5

1.6. Methodology 6

1.7. Summary 6

2. Literature Review **7**

2.1. Definitions of Terms 7

2.1.1. Sustainability/Sustainable Development 7

2.1.2. Green Buildings 8

2.1.3. Conventional Building 8

2.1.4. Commercial Building 8

2.1.5. Stakeholders 9

2.1.6. Cost Factors 10

2.1.7. Life Cycle Stages 10

2.2. Green Building Council of South Africa (GBCSA) 11

2.3. Green Commercial Buildings 11

2.4. Cost Factors Influencing Adoption of Green Buildings 13

2.4.1. Business Case 13

2.4.2. Certification 19

2.4.3. Education 19

2.4.4. Environmental 21

2.4.5. Incentives 21

2.4.6. Innovation 24

2.4.7. Maintenance 24

2.4.8. Market 25
2.4.9. Materials 29
2.4.10. Operational 30
2.4.11. Professional 32
2.5. Cost Factor Table 34
3. Research Design and Methodology 36
3.1. Data Source 38
3.1.1. Literature review 38
3.1.2. Survey 40
3.2. Data Collection Techniques 42
3.2.1. Literature Study 43
3.2.2. Survey 43
3.3. Issues of Reliability and Validity 48
3.3.1. Triangulation 48
3.3.2. Qualitative Data 48
3.3.3. Quantitative Data 49
3.3.4. Sample Size 49
3.4. Sampling Techniques 50
3.4.1. Interviews 50
3.4.2. Questionnaires 51
3.5. Data Analysis 51
3.5.1. Literature study 51
3.5.2. Qualitative Data 51
3.5.3. Quantitative Data 52
3.6. Research Ethics 54
3.6.1. Theory and Literature 54
3.6.2. Data collection, use and disposal 54
3.6.3. Ethical Plan for Research 55
4. Research Results 56
4.1. Summary of Results 57
4.2. Nature and Occurrence of Cost Factors 62
4.2.1. Origin of Factor Awareness 62
4.2.2. Awareness Level of Cost Factors 63
4.2.3. Frequency of Occurrence of Factor 65

4.2.4. Cost Factor Life cycle Stage 66
4.3. Stakeholders' Perception of Cost Factors 67
4.3.1. Enabler or Challenge 67
4.3.1. Most Influential Life cycle Stage 68
4.3.2. Nature of Main Driving Factor 70
4.4. Influence of Cost Factors in Investment Decisions 73
4.4.1. Influence on Decision Making Process 74
4.4.2. Impact on Time 75
4.4.3. Impact on Quality 76
4.4.4. Impact on Client Satisfaction 77
4.4.5. Impact on Sustainability 78
4.4.6. Impact on Overall Project 79
4.4.7. Other Influential Cost Factors 80
4.4.8. Influential Non-cost Related Factors 81
5. Findings and Discussion 85
5.1. Nature and Occurrence of Cost Factors 87
5.1.1. Awareness of Factors 87
5.1.2. Frequency of Occurrence 88
5.1.3. Cost Factor Life cycle Stage 89
5.2. Stakeholders Perception of Cost Factors 89
5.2.1. Enabler or Challenge 90
5.2.2. Most Influential Life cycle Stage 92
5.2.3. Nature of Main Driving Factor 92
5.3. Influence of Cost Factors to Investment Decisions 93
5.3.1. Influence on Decision Making Process 93
5.3.2. Impact on Aspects of Project 95
5.3.3. Other Influential Factors 95
5.4. Validity and credibility of research 96
5.4.1. Sample Population Size 96
5.4.2. Cronbach Alpha Test 97
5.4.3. Open-ended Questions 98
6. Conclusion 99
6.1. Implications of Findings 102
6.2. Recommendations 104

6.3. Limitations 106
6.4. Closing Statement 107
7. References 108
Appendices 116
Ethical Clearance Certificate 116
Interview Schedule 117
Questionnaire Schedule 124
Questionnaire Explanatory Email 128
Consent Form 129
Information Document 130

LIST OF FIGURES

Figure 1. Word Cloud Example 52
Figure 2. Origin of Factor Awareness Themes 62
Figure 3. Origin of Awareness of Factors 63
Figure 4. Relevant Life Cycle Stage Themes 68
Figure 5. Relevant Life cycle Stage 69
Figure 6. Reason for Relevant Life Cycle stage Themes 69
Figure 7. Reason for Relevant Life Cycle Stage 70
Figure 8. Nature of Main Driving Factor Themes 71
Figure 9. Nature of Main Driving Factor 71
Figure 10. Reason for Nature of Main Driving Factor Themes 72
Figure 11. Reasons for main driving factor nature 72
Figure 12. Other Influential Cost Factors Themes 80
Figure 13. Other cost factors 80
Figure 14. Influential Non-cost Related Factors Themes 81
Figure 15. Other non-cost related factors 82
Figure 16. Reason for Influential Non-cost Related Factor Themes 83
Figure 17. Reason for non-cost related factors being influential 83

LIST OF TABLES

Table 1. Cost Factor References....34
Table 2. Cost Factor References (Cont.)....35
Table 3. Cost Factor Table (including life cycle stage) 39
Table 4. Cost factor table (including life cycle stage) cont. 40
Table 5. Summary of Questionnaire and Interview Questions....45
Table 6. Summary of Cost Factor Table Results....59
Table 7. Summary of Qualitative Results....61
Table 8. Awareness Level of Cost Factors....64
Table 9. Frequency of Factor 65
Table 10. Life cycle Stage Specific to each Cost Factor....66
Table 11. Enabler/Challenge Classification....68
Table 12. Influence on Decision Making Process....74
Table 13. Impact on Time....75
Table 14. Impact on Quality....76
Table 15. Impact on Client Satisfaction 77
Table 16. Impact on Sustainability....78
Table 17. Impact on Overall Project....79

1. INTRODUCTION

Climate change, as a global phenomenon, is believed to be a direct result of global warming caused by greenhouse gas emissions (Stern, 2007). In a concerted effort to curb greenhouse gas emissions, the need has arisen for countries throughout the world to consider the utilisation of more sustainable renewable resources in the production and harnessing of energy (Stern, 2007). The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) pointed to human activity as one of the major causes of global warming (Pagels, 2010). Recent scientific findings have shown that in order to slow down the momentum of climate change, greenhouse gas emissions must be reduced significantly (Malte Meinshausen, 2009). Most global CO_2 emissions have stemmed from developed countries. However, while developing countries have been found to contribute a small percentage to the total amount, these emissions are steadily increasing (Stern, 2007).

A study by the United Nations on the global status in 2017 (UN Environment, 2017) showed that, combined, the building sector and construction industry consume nearly 40% of total final energy usage and produce 35% of the global CO_2 emissions. This clearly points to the fact that, as a significant consumer of energy, the construction industry has a significant role to play in the reduction of CO_2 emissions in order to curb the effects of global warming. Despite the efforts of a number of countries to reduce energy consumption via policy regulation to improve building performance, the effects of these improvements have been diminished by the rapid growth of developing countries (UN Environment, 2017).

To overcome and reduce the negative impacts of excessive energy use and CO_2 emissions, the construction industry has adopted a new means of construction defined as 'green buildings'. McGraw-Hill defines a green building as a construction project, certified under a globally-recognised green rating system; such projects would include those certified by the Green Building Council of South Africa (GBCSA) or those that have been built to qualify for such certification (McGraw-Hill, 2013). In order to reduce the carbon footprint created by the construction industry, sustainable construction or green buildings have become the most globally-recognised methods to achieve this (McGraw-Hill, 2013). A green building, depending on the green certification acquired, is built by minimise the amount of water and electricity used during construction and once the building starts operating. A green building is made up of recyclable or recycled materials, and is designed to minimise pollutants to air and water systems, and therefore tries to minimise the impact on the natural environment (Hussin, Rahman, & Memon, 2013), (Aminu, Kandar, & Ossen, 2010) and (Li YY,

et al., 2014). A study by the World Green Building Council (WGBC) proposed that the impact on social aspects, such as the promotion of productivity due to a healthy working environment for the building habitants, is also an intended benefit (WGBC, 2016).

South Africa has responded to this green movement. Significant growth in green building activity is projected with 60% of firms reporting that they have future green plans for new commercial buildings; 58% indicated that they had green plans to retrofit existing green buildings by 2015 (McGraw-Hill, 2013). South Africa is also showing an increase in green involvement; firms confirmed that 31 per cent of their work was classified as green in 2015 (McGraw-Hill, 2013). While the push towards green construction by South African firms is positive, there is a lack of definition on the level of details with respect to green construction projects in South Africa. There has been a significant increase in green building work in the world in recent years, and South Africa is one of the countries, which has shown the biggest growth from 2012 to 2015 (McGraw-Hill, 2013). When compared to developed countries, green buildings in South Africa are relatively new; however, McGraw Hill shows that 44% of South Africans believe green buildings are the right thing to build, a fact confirmed by others (Kibert, 2013). South Africa has also updated its building energy code SANS 10400 XA which has been published promoting greener more sustainable building regulations (UN Environment, 2017). The GBCSA has also joined an initiative to advance Net Zero projects as of 17th October 2017 (UN Environment, 2017). This positive outlook on green buildings presents an opportunity to adopt and grow a sustainable construction industry in South Africa.

Literature has continually described the environmental, social and economic benefits associated to green buildings; however a more sensitive aspect of green building construction has become apparent, namely the economic factor, and has been the centre of much research. Generally, studies have shown that green buildings offer a significant profitable investment, primarily achieved through the reduction of life cycle costs with respect to building (Bond, 2010). Some research even points to a possible higher return on investments, compared to conventional buildings (Hwang & Ng, 2013), while there is a perception that green buildings cost more than conventional buildings (Hwang, Zhu, Wang, & Cheon, 2017). This perception has made it difficult for the industry and professionals to verify a viable business case to investors. A study by (Hwang & Jac, 2012) found that the high premium of green buildings is one of the main barriers towards adopting and growing green buildings as it directly affects the business case. The financial barrier theme is shared in a study by (Oyedokun, 2018) whereby it concluded that developers and investors are only motivated to invest in green buildings when it makes financial sense to invest. A study by (Windapo, 2014) found that

the main barriers towards implementing green buildings were financial and not environmental. This idea is supported by (Oyedokun, 2018) who has shown that developers and investors throughout the globe will only invest in green projects if it makes financial sense. A study in Cambodia by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) reaffirmed that the high cost of sustainable practice is perceived to be the most significant hindering factor regardless of the socio-economic status of the country. A study by (Eichholtz, Kok, & Quigley, 2010) showed that green buildings require a 7% rental premium when compared to conventional buildings of the same size. This green premium has been identified as a driver to sustainable building investment by (Oyedokun, 2018), once again pointing to financial factors as the main barriers or enablers to green building investments. There seems to be a general consensus amongst researchers in the field that the main barriers to the investment in green buildings are financial, rather than environmental. It is logical to assume, therefore, that, in order for investment to exist in green buildings a sound business case must exist.

There has been significant research based on the South African construction industry towards green buildings and their associated enablers and challengers. A study by (Hoffman & Cowie, 2014) showed that the green construction industy is on the rise in South Africa and that, in 2014, 68 per cent of developers interviewed had experience with green projects. The same study concluded that developers were largely of the opinion that green project costs would increase given their green nature. However, they also pointed to the fact that there is an increased demand in green buildings from tenants, which will give impetus to the business case for green buildings in South Africa. This, again, highlights financial factors as a significant factor. (Emuze, Ntoi, & Isa, 2015) research identified five main topics of barriers to green buildings in South Africa: stakeholder's awareness and demand, cost implication, education and experience, political and policy issues, and materials. The cost implication was identified as the most significant barrier by all respondents involved in the research.

There are various requests to make information on the financial benefits of green buildings better and more readily available to investors and owners (Chan, Darko, & Ameyaw, 2017) and (Simpeh & Smallwood, 2015). Informed decisions on investing in green buildings can only be made by creating awareness, and providing investors and owners with the correct factual information on the financial benefits of green buildings. The lack of knowledge and awareness of the benefits of green buildings has become one of the main barriers towards the adoption of green buildings. A study by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) found that lack of knowlege and awareness is one of the main barriers towards adoption of green buildings in developing countries. The same outcome was found in research done in Oman and Kuwait, both developing countries (Saleh & Alalouch,

2015), (Sanad, 2015). Within the South African context, a study by (Simpeh & Smallwood, 2015) identified the main barriers to green buildings were a lack of incentives, inadequate cost data on green buildings, and a lack of information on financial and economic benefits of green buildings. This shows investors require more awareness and knowledge in order to invest in green buildings, as they do not understand all of the factors influencing them.

Various strategies on how to adopt and grow green buildings within a country have been defined throughout literature. Studies continually point to external influences and support in order to adopt and grow the sustainable industry, such as building codes, legislation (aimed at sustainable construction methods and materials), incentives from government, private financial benefits or incentives, and government involvement, showing interest in such projects (Olubunmi, Xia, & Skitmore, 2016); (Bohari, Skitmore, Xia, & Zhang, 2016); (Ho, Wong, & Iyer-Raniga, 2017). Such external factors can be linked to financial aspects of a project, as incentives influence the higher upfront costs of a project whereas legislation and building codes help increase the demand for such buildings by guiding firms to build green. South Africa lacks such external driving factors (Emuze, Ntoi, & Isa, 2015). This suggests a need to understand factors which challenge or drive green buildings in South Africa, within the financial aspect of the projects.

1.1. Research Problem

A large number of studies on green building factors have focused on distinguishing between factors as challengers and factors as enablers with respect to the adoption of green buildings. However, studies have not been specific to financial factors only; rather, studies have considered all three aspects: social, economic and environmental. General consensus points towards financial factors as the main influence towards adopting and growing green buildings within a country. This consensus points to a lack of understanding of the nature and occurrence of financial and cost-related factors in relation to green buildings. A sound business case can only be developed further, if the factors, which influence investors' decisions to invest, are fully understood. This knowledge will significantly reduce investment risk and help build a sound business case for green buildings, allowing investments to grow, and leading to financial, social and environmental benefits to be derived from green buildings. The scope of this study is focused on commercial green buildings in Gauteng, as the pool of certified buildings from the GBCSA was large enough to source the professionals involved. Commercial buildings also form part of profitable projects for investors' portfolios, as they generally have one tenant for long lease terms, making it easier to calculate returns.

The research problem can then be stated as:

There is inadequate knowledge regarding the nature and occurrence of cost-related factors in relation to green buildings, thereby resulting in low capacity to critically reduce investment risk in order to make acceptable business case on which investment decisions can be made with confidence

1.2. Research Question

The main question which this research report seeks to answer is what are the nature and occurrence of cost-related factors and their influence on investment decisions for green building projects?

1.3. Research Aim

In view of the above discussion, this research paper seeks to examine the impact cost-related factors have in green building projects, and how these factors influence stakeholders' decisions with respect to investing in green buildings.

1.4. Research Objective

The objectives of this research are three fold:

A. To determine the nature and occurrence of cost related factors related for green office building projects
B. To determine the perceptions of stakeholders regarding the nature and occurrence of cost related factors in green office building projects
C. To determine the level of influence of cost factors in decision making to invest in green office buildings according to stakeholders perceptions

1.5. Justification for Research

The findings of this research will aid clients, investors, owners and tenants (stakeholders) to gain a deeper understanding on how cost-related factors affect green office projects in South Africa, Gauteng. The research is focuses on actual green projects and their associated influencing factors towards investment in green commercial buildings. Through gaining of a deeper understanding of actual green commercial projects, investment risk can be significantly reduced hence aiding promotion of the green construction industry in South Africa. Strategies can be devised by stakeholders to capitalize on the enabling factors and reduce, eliminate or restrict the challenging factors identified through this study. By understanding what cost-related factors influence the investment decisions, such factors can be further investigated, potentially helping to reduce costs of

green projects significantly, also aiding in the promotion of green commercial buildings in South Africa. This study will also serve as a baseline for further studies on the same subject matter.

1.6. Methodology

The research philosophy was based on pragmatism using mixed methods through triangulation. An in-depth literature review was the first step to the research. It was used to extract information required to design a cost factor table which formed the integral part of the data collection techniques. The qualitative and quantitative data was gathered through the use of interviews and questionnaires. Three 4-star rated green commercial projects in Gauteng, South Africa were selected and stakeholders such as professionals, owners, investors whom were directly involved in the projects were targeted for interviews and questionnaires. A mix of purposive, snowball and convenience sampling techniques were for the sample population. The interviews comprised of two parts, part one was made up of open ended questions and part two was made up of the cost factor table derived from the literature review. The cost factor table listed each cost factor and required respondents to rank each factor using a Likert scale or Yes/No answers based on the question proposed. The questionnaire comprised solely of the cost factor table, hence interviews were conducted first to ascertain how easily the cost factor table questions were understood and how to guide the respondents to complete the questionnaire as required. From the interview outcome an explanatory letter was added to the questionnaire to give a more detailed explanation on how to complete the questionnaire and was sent out together with the questionnaire to respondents. The questionnaire was sent out to the entire sample population in order to gather a larger quantity of responses from the restricted sample population. The data from the cost factor table from both interviews and questionnaire was merged and frequency analysis was used to extract results. The open ended question responses were grouped and themes extracted which addressed the research objectives. Issues of reliability and credibility data were dealt with according to the nature of the data. Qualitative data credibility was addressed based on the actual respondents and their experience in their profession. Quantitative data credibility and reliability was addressed through the use of Cronbach alpha test. The qualitative and quantitative results extracted were grouped in order to specifically address the research objectives.

1.7. Summary

To summarise, the introduction describes green buildings as the future and in order to fully embrace and understand such green projects there must be a deeper understanding as to what factors influence stakeholders in investing such projects. Similar research has been started overseas

however in South Africa the information on this topic is limited as the green industry is still small and growing. The aim of this research was to determine and rank cost related factors for green commercial buildings and understand how they influenced the decision by stakeholder to invest in the green project. South Africa, Gauteng was the location chosen to target three 4-star green commercial buildings rated by the Green Building Council of South Africa (GBCSA) and stakeholders for each projects the selected sample population. The justification for this research was described as an opportunity to devise strategies to capitalise on the influential factors and devise strategies to mitigate the challenging factors towards investing in green commercial projects. The literature review was used to extract cost related factors based on similar green buildings research throughout the world. The methodology used was outlined, explained and from the data gathered results extracted to address the aim, objectives and the proposed research question.

2. LITERATURE REVIEW

The aim of the literature review section of this research is to investigate literature on green buildings and determine a list of cost related factors which affect adoption of green buildings in South Africa.

The review section begins with definitions of terms used, followed by a description of green commercial buildings, then continues with a literature investigation on factors, influencing the adoption of green buildings with specific focus on factors related to cost. References are provided for each factor, followed by a detailed discussion on the factor, including substantiation as to why it is important and why it is regarded and classified as a cost factor. A final list is then tabulated and summarised which forms the basis of the data collection technique described in the design and methodology section of this report. Stakeholders of green building projects in South Africa are also briefly discussed.

2.1. Definitions of Terms

2.1.1. Sustainability/Sustainable Development

There are many views and opinions on what sustainability and sustainable development actually is and what an acceptable definition is (Bond & Perret, 2012). Sustainability can be viewed as a matter to ensuring environmental protection; it requires a balance between the need to conserve the natural environment with the requirement for a just society as well as economic survival. For the purpose of this research paper, sustainable property and sustainable development will be defined as a building which is economically viable, and environmentally and socially acceptable.

2.1.2. Green Buildings

A green building can have various degrees of meanings depending on the context which it is used. For the purpose of this research the definition for a green building will correspond with McGraw-Hill and Kibert's: a green building is defined as a construction project which is certified under a globally recognized green rating system such as the Green Building Council of South Africa (GBCSA) or has been built in accordance to qualify for such certification (McGraw-Hill, 2013). The main purpose of a green building is to create well-being and harmony for the triple bottom line namely social, environmental and financial (Kibert, 2013).

The GBCSA defines a green building as one that incorporates design, construction and operational practices that significantly reduce or eliminate the negative impact of development on the environment and occupants with strategies that address the following (GBCSA, 2012):

- Energy efficiency;
- Greenhouse gas emission abatement;
- Water conservation;
- Waste avoidance, reuse and recycling;
- Pollution prevention - noise, water, air, soil & light;
- Enhanced biodiversity and a positive impact on the ecology of the site;
- Reduced natural non-renewable resource consumption;
- Productive and healthier environments, and
- Flexible and adaptable spaces.

2.1.3. Conventional Building

A conventional building can have varying definitions depending on country, state or province one is referencing from For the purpose of this research, a conventional building was defined as a building built in traditional means, using traditional materials, techniques and practises associated with building regulations and standards in South Africa which are in circulation during the period of this research.

2.1.4. Commercial Building

A commercial building is defined as a building used for commercial use such as warehouse, retail or offices (Definitions, 2018). This definition was adopted for the purposes of this research.

2.1.5. Stakeholders

A stakeholder is defined, according to the Project Management Institute as an individual, group, or organisations, who may affect, is/are affected by, or perceived to be affected by a decision, activity, or outcome of a project (Institute, 2013). For the purpose of this research a stakeholder will be regarded as any entity who was part of the decision making process for investment of green building projects, as well as the professional teams or organisations involved in the project from inception to completion.

Stakeholders in green projects for this research consist of clients, owners, tenants, professional team and investors.

Client

The client is defined as either the owner of the building or tenant, depending on which point of view is taken. The definition of a client is a customer or professional service provider or the principal agent or contractor (Business Dictionary, 2018).

Investors

Investors could be regarded as the owners, or external investors who helped to finance the project, which usually request a return from the investment. An investor is defined by (Business Dictionary, 2018) as a speculator whose primary objective is to preserve the original investment, ensure a steady income and capital appreciation in the investment made.

Property Owner

A property owner is defined by (Business Dictionary, 2018) as an entity in possession of title for land, building or other item. Owner is responsible for paying taxes relation to the property owned.

Tenant

A tenant is defined by (Business Dictionary, 2018) as an entity which occupies or possesses a property by any type of claim, right or title, which pays periodic rent for a temporary right to possess the property granted by the property owner through a lease or tenancy agreement.

Construction Professionals

The construction professional team usually consists of the following professions:

- Architect;
- Quantity Surveyor;
- Project Manager;
- Structural Engineer;
- Mechanical Engineer;
- Electrical Engineer;
- Green Professional, and
- Building Contractor.

2.1.6. Cost Factors

Cost factors can be defined as factors which associated with financial aspects of a project. A cost factor is a tangible factor and has a monetary value associated to it. In accounting a cost factor is defined as any activity or item that incurs a cost (Investorguide, 2018).

2.1.7. Life Cycle Stages

There are four main life cycle stages of a project as defined by (Pinto & Prescott, 1988):

Conceptualisation/Inception

During this stage concepts of the project are drawn, goals set and alternatives reached (Pinto & Prescott, 1988). This stage can also be known as the inception stage.Planning

During this stage more formalised set of plans for the project are established to achieve the set project goals (Pinto & Prescott, 1988).

Execution/Operation

For a construction project this stage correlates to the start of physical work such as construction, material and resources sourcing, procurement starts (Pinto & Prescott, 1988).

Termination/Residual Value

This is the final stage of a project which occurs once the project has been completed; project is transferred to intended user/s (Pinto & Prescott, 1988). Residual value can be considered to fall within the termination stage of the project.

The sale of the project would also fall within this stage of the project.

2.2. Green Building Council of South Africa (GBCSA)

In South Africa the Green Building Council of South Africa (GBCSA) was established in 2007 to regulate and certify green buildings and sustainable construction. The purpose of the GBCSA, as well as any other green building council, is to accelerate the development and adoption of green building practises (GBCSA, 2012) as it creates awareness of sustainable construction in the country and in turn raises the demand for firms to want to do the right thing and be enviornmentally concious.

South Africa has moved in the right direction regarding green building adoption, as according to (Oyedokun, 2018) in order for a developing country to grow their green building industry a green building certification entity must exist. This establishment of the South African green building council is a step in the right direction in order to grow the adoption of green buildings as described by (Bohari, Skitmore, Xia, & Zhang, 2016). There have been 11 years of green certified construction in South Africa until now, therefore it can be safely assumed that the South African green construction industry has grown from infancey to a growing phase when compared to developed countries with fully matured green construction industries such as USA, Australia and UK. Through this green growth South African has gained valuable experience in green buildings and their associated technologies and systems thereby ensuring clients become more aware of the benefits of green buildings. There is however room for growth and opportunities in the South African green construction industry and many lessons to be learned from developed and developing countries.

The majority of GBCSA certified projects in South Africa are commercial projects, specifically in the Gauteng region (GBCSA, 2018), therefore pointing to the fact that the damand for green projects is mainly in the commercial sector (GBCSA, 2012)

2.3. Green Commercial Buildings

McGraw-Hill defines a green building as a construction project which is certified under a globally recognized green rating system such as the Green Building Council of South Africa (GBCSA) or has been built in accordance to qualify for such certification (McGraw-Hill, 2013). The main purpose of a

green building is to create well-being and harmony for the triple bottom line namely social, environmental and financial (Kibert, 2013).

The commercial property market in most cases is associated with an owner letting the property to a firm for a long lease period in the aim of trying to produce a positive financial gain in the investment (Oyedokun, 2018). Tenants of commercial properties demand occupation satisfaction whether it is from a conventional or green building; they are also concerned with the maximisation of their profits, and could choose to occupy a conventional building instead of a more costly green building in favour of financial profitability (Oyedokun, 2018). This comment leads to the belief that a firm's financial aspects are more important than environmental or social ones.

Green commercial buildings are defined and ranked by the green star rating system in accordance with the Green Building Council of South Africa on the level of fulfilment of requirements set out by the Green Star Rating system (GBCSA, 2012). There are various criteria which the building is scored based on the Green Star Rating system for commercial office buildings, the categories which buildings are rated against are listed below, with each category showing the weighting given (GBCSA, 2008):

- Management – 9% weight;
- Indoor environment quality (IAQ) – 15% weight;
- Energy – 25% weight;
- Transport – 9% weight;
- Water – 14% weight;
- Materials – 13% weight;
- Land Use and Ecology – 7% weight, and
- Emissions – 8% weight.

Based on these weightings, energy carries the biggest weight, with IAQ, water and materials next. An extra 10 points or 7% can be achieved for innovation category.

From the GBCSA website (GBCSA, 2018), there are two different systems in which to rate a commercial building namely Office v1 and v1.1. The office v1 rating system was limited to registrations up to end of June 2015, thereafter, any other projects requesting registration needed to use and comply with the Office v1.1 rating system. Recently, GBCSA has introduced a new rating tool, giving certification to projects, which go above and beyond partial reduction in the current rating tools. This tool is the Net Zero rating tool.

2.4. Cost Factors Influencing Adoption of Green Buildings

A range of local and international literature has been identified and investigated relating to factors seen as challengers or enablers in the promotion of green buildings by the respective researchers. In this section of the report the factors which influence the adoption of green buildings or sustainable construction in developed and developing countries are investigated and extracted, specifically referring to the factors associated to costs

South Africa is a developing country hence close attention is given to literature based on the South African construction industry and on literature based on developing countries. There is some concern with the validity of using extracted data and factors from developed and developing countries for this study, as in the study by (Ametepey, Aigbavboa, & Ansah, 2015) have shown that barriers can differ between developing countries (Ghana) and developed countries such as Australia, US and Canada. However, research relating to developed and developing countries points to the higher costs of green as a major barrier to the adoption of green buildings. It can therefore be deduced that research and findings extracted from developed and developing countries can be used in this research. The factors extracted from literature can also be deemed usable as they have been sufficiently tested in the original research which they originated from, irrespective of whether research was conducted in a developed or developing country. The factors gathered from this review form the basis of this research.

The factors associated to cost of green buildings are categorised into 11 sub-categories where the factors are derived from namely: business case, certification, education, environmental, incentives, innovation, maintenance, market, materials, operational and professional. The factors are not defined as challengers or enablers, they are simply listed with their associated reference and substantiation as to why they are regarded as cost factors.

Table 1 and Table 2, in section 2.5, summarise all cost factors with their associated references.

2.4.1. Business Case

Factors derived from the business case of green construction projects associated to cost are identified as: higher return on investment, increased rental amount, payback period, occupancy cost saving, rising energy costs, challenge with split incentives, cost of energy in South Africa, fuel price and exchange rate.

Higher Return on Investment

A return on investment is defined by (Business Dictionary, 2018) as the earning power of a business or project measured as the ratio of net income to the average capital employed. It is usually expressed as a percentage.

A higher return on investment for any project would naturally be regarded as a driver for any investment. A higher return on a leased property is directly linked to the rental amount acquired, hence if the rental amount is higher for a green building compared to a conventional building then there must be a higher return on the higher rental investment, depending on the costs associated to the investment. (Hwang & Ng, 2013) study agrees with this assumption and suggests that there is in fact a higher return on investment for green buildings when compared to conventional buildings due to an increased rental, however since there is a lack of sound quantitative data on green buildings (GBCA, 2008) it is difficult to confirm and prove that higher returns are indeed achievable with green buildings.

The Royal Institute of Chartered Surveyors report (RICS, 2010) on green commercial properties conducted in USA in 2010 concluded that the transaction market prices of green commercial properties are higher when compared to conventional commercial properties. This outcome is difficult to prove in South Africa since the number of green buildings which have changed hands is small when compared to the USA, as the valuation of a property relies on the sale prices of similar buildings (GBCSA, 2012). However, despite this South Africa can rely on information from developed countries to forecast green property costs and investment decisions in the near future. According to research by (McGraw-Hill, 2013) 21% of the respondents in South Africa agreed that a higher return on investment in green buildings was a trigger for investing in green buildings, while only 7% of global respondents agreed.

Despite the notion that profits are usually at the top of investor's priority list, profitability/productivity was only ranked 7th out of a possible 13 drivers in a study, aimed at determining the drivers and challenges towards green buildings in Cambodia by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018).

A study by (WGBC, 2016) showed that from a survey of 200 Canadian building owners, 46% agreed it is easier to lease a green building compared to a conventional building. This is not directly linked to a higher return on investment factor, however by leasing a building more easily and quickly it can reduce standing costs of the building (WGBC, 2016).

The evidence provided demonstrates the importance of this factor towards the business case of green buildings. This factor is regarded as a cost factor as it directly influences the financial aspect of a green project. It has been shown that having a higher return on investment directly influences the investment decision for investors. If green buildings do propose a higher return on investments then investors should be drawn towards investing in them.

Increased Rental Amount

Rent is defined by (Business Dictionary, 2018) as the compensation or remuneration paid by a tenant to the property owner for occupancy of the property.

Green buildings owners have been found to request an increased rental amount when compared to conventional buildings as to recover the additional costs of the green technology integrated in the building. The (GBCSA, 2012) suggests that the industry bases its calculations on return on investment by taking into account the upfront costs of the building and not the full life cycle costs of the building, hence leading to a higher calculation on the rental premiums required.

(Bond & Perret, 2012) research ranks increased rental amount as the third highest benefit of commercial green buildings in New Zealand. In the same study it was found that the tenant reaps the benefits of the integrated green technology, hence the owner requests a higher rental amount from the tenant in order to recover the additional costs of the technology.

(WGBC, 2016) study showed that in a survey of 200 Canadian building owners 28% commanded a rental premium for letting a green building to a tenant, while a study by (RICS, 2010) showed that rental premiums in the US for green buildings ranged between 5.9% and 6.6% when compared to conventional buildings. A similar study by (Eichholtz, Kok, & Quigley, 2010) showed that green buildings attract a 7% rental premium when compared to conventional buildings of the same size.

Due to the South African green building industry being relatively new and the number of buildings leased is small, it is difficult to determine the exact rental a tenant can be charged for green property (GBCSA, 2012). According to (GBCSA, 2012) time will tell on what the actual premium for green buildings is in South Africa, however based on the findings from other countries it can be deduced that a green premium amount will be set in the near future.

The evidence provided demonstrates the importance of this factor with respect to the business case of green buildings. This factor is regarded as a cost factor as it directly influences the financial aspect

of a green project. It has been shown that an increased rental amount should more than likely lead to an increase in return for investors and owners, making the project a more viable investment.

Payback period for investment is relatively good if incentives exist in country

Payback period is defined by (Business Dictionary) as the time to recover an initial investment or loan.

A research on local as well as global case studies on green buildings compiled by (GBCSA, 2012) showed the payback period was significantly reduced for specific integrated green technologies or for the actual building primarily via the reduction in operational costs. However it was also proposed that should government incentives for green buildings exist in the country then the payback period would be reduced further therefore enhancing the business case.

This factor is considered important and is a cost factor as it directly influences the financial aspect of a green project; hence if incentives exist in the country then the payback period is reduced thereby making the business case more viable for investors.

Occupancy cost saving

The benefit of lowering the operational costs of the building are usually gained by the tenant and in green buildings these savings usually pertain to the major operational cost items, such reduction in water and electricity usage (GBCSA, 2012).

The importance of this factor is shown by (Bond & Perret, 2012) research which ranks occupancy cost saving as the top benefit of commercial green buildings in New Zealand. The occupancy cost saving factor is essentially the same factor as the reducing operational costs which has been categorised under the operational section below; see section 2.4.10 for further references on cost savings.

Occupying cost saving is regarded as a cost factor as it directly influences the financial aspect of a green project. By reducing the occupying costs for the tenant, the tenant is essentially assured of lower monthly costs and will drive the tenant to increase the lease period, therefore assuring investment return for a longer period (Bond & Perret, 2012). This factor is linked to the increased in rental amount.

Rising energy costs

As fossil fuels become scarce, energy costs rise as technology to extract them becomes more expensive. Renewable energy production is relatively new, especially in South Africa; hence costs for renewable energy production are higher than the conventional fossil fuel energy production.

In a study by (Bond & Perret, 2012) based on New Zealand's construction industry, it was found that rising energy costs were ranked 3rd out of 10 by respondents for possible drivers towards green building development. A study by (Smith & Baird, 2007) concurs as it was identified that rising energy costs was a primary driver for green development in New Zealand. Within the South African context, a study by (Windapo, 2014) identified the primary drivers for adoption of green buildings as rising energy costs and reduction in operational costs. This finding corresponds with the research conducted in New Zealand, a developed country.

The evidence provided demonstrates the importance of this factor towards the business case of green buildings. This factor is regarded as a cost factor as it directly influences the financial aspect of a green project since rising energy costs directly affect the operational costs of the building; hence if the building is energy efficient then less will be spent on energy costs therefore shortening the payback period and assuring lower operational costs to the tenant.

Challenge with respect to the split between capital expenditure and operating cost savings

A split incentive is defined by (GBCSA, 2012) as the benefits of improved performance or efficiency not accruing to the party who paid for them. For green buildings it is defined as the tenant reaping benefits of operational cost reductions when the owner paid for the technology that lead to the operational cost savings for the tenant.

A study by (McGraw-Hill, 2013) identified the second most important factor to overcome in order to increase green building activity in the US was the challenge split between capital expenditure and operating cost savings with 43% of the respondents who formed part of the study agreeing it was a critical challenge to overcome. According to this research, US firms have difficulties in justifying the increase in capital expenditure when the paybacks are coming from another budget line item. (Bond & Perret, 2012) research in New Zealand also identifies the difficulty in splitting incentives between the landlord and the tenant, where landlord invests and tenant reaps the benefits.

The (GBCSA, 2012) suggests that split incentives issues stem from the industry which bases its calculations on return on investment solely on the upfront costs of the building. This leads to non-

representational calculations on the rental premiums and split incentives. The (GBCSA, 2012) report suggest that life cycle costing should be used when calculating the return on investment of a green building project as it takes into account costs throughout the life of the project and gives a better estimate of actual returns.

The evidence provided demonstrates the importance of this factor towards the business case of green buildings. Being a financial aspect of a green project, the split incentive is regarded as a cost factor

Current cost of coal energy is less than renewable energy cost in South Africa

South Africa has traditionally produced and sold cheap electricity when compared to the rest of the world (GBCSA, 2012); however prices have increased in recent years making renewable energy more appealing.

In South Africa renewable energy cost around R1.67/kWh in 2017 while Eskom produced electricity costs R0.61/kWh, this is according to (Lloyd, 2017). Due to South Africa's current energy surplus, renewable energy production is not being considered, as it remains costly when compared to coal energy (Lloyd, 2017). However, as renewable energy is regarded as a long-term, sustainable solution to power generation for any country, it should be pursued irrespective of the costs associated to it.

This factor is important and regarded as a cost factor as it influences the decision for investors to include energy production as part of the investment in a green building. The cheaper the cost of coal energy the less inclined investors will be to invest in energy producing technology integration for a green building.

Fuel price

The fuel price is regarded as a cost factor as it directly influenced the cost of transport, materials and cost of machinery on site. Due to the recent highly volatile South African Rand and fuel price this factor could be a potential influence on the costs of a project (CIDB, 2017).

Exchange rate

The exchange rate is regarded as a cost factor as it influences the cost of importing green material and technologies not available in South Africa. Due to the recent highly volatile South African Rand the exchange rate could influence the costs of a project if measures are not implemented to mitigate the volatility in the currency at the start of the project. According to a report by the Construction

Industry Development Board (CIDB) on public sector construction, the exchange rate has an impact on the prices of all imported components (CIDB, 2017).

2.4.2. Certification

Factor derived from the certification of green projects associated to cost is the cost to achieve green star status.

Costs to achieve green star status

The costs to achieve green star status refer purely to the costs associated to the certification of a building by the GBCSA. Such costs are usually based on a percentage of the project cost.

According to a study by (Zenios & Allen, 2016) the additional costs incurred due to the additional accreditation phases to achieve green star status were significant and ranked 5th out of 6 possible factors towards green buildings in South Africa. Actual costs to achieve green star status in South Africa can be extracted from actual case studies investigated by (GBCSA, 2012). Costs of certification from these actual case studies from (GBCSA, 2012) showed that cost range from 0.2% to 1% of the total project cost, these are based on four star green star rating SA Office v1.

Despite the fact that percentage increase of the project cost with respect to the actual certification process is relatively small when comparing the total cost of the project, this factor is still regarded as important and regarded as a cost factor. It directly influences the cost and financial aspect of the project as a 1% difference in return on an investment could decide whether investors will invest or not.

2.4.3. Education

Education, as a factor related to the cost of green buildings, is associated with a lack of clients' understanding regarding benefits derived from investing in green projects.

Lack of understanding from clients regarding the actual benefits from going green

Green building clients rely on their professional team to advise on green technologies and their related benefits in order to make an informed decision on whether to pursue the green path or not (Aigbavboa, Ohiomah, & Zwane, 2017). A study based on the English construction industry by (Williams & Dair, 2007) showed there is a lack of adequate information to stakeholders in order for them to make a sustainable decision on their chosen developments. In a specific case within the same study by (Williams & Dair, 2007) the engineer was not aware of grey-water recycling systems

or how they operate. As a consequence, he was unable to advise the client on such a system and its benefits and costs. It should therefore be a requirement for the professional team involved in green projects to be aware and have knowledge on the sustainable technologies available in order to advise clients/investors/owners correctly.

A study by (Ahn, Pearce, & Wang, 2013) pointed to the increase in awareness from clients on green buildings and their benefits as a direct driver to the promotion of green buildings, meaning the more aware clients become of green buildings the more aware they become of the associated benefits from going green. (Hakkinen & Belloni, 2011) concur as their research concluded that one of the most important promoters to green buildings is the client's awareness on the benefits of sustainable building. Conversely (Pitt, Tucker, Riley, & Longden, 2009) showed that client's lack of awareness is a major barrier with respect to investing in green buildings.

A study on the Ghanaian construction industry on the barriers to implementation of sustainable construction by (Ametepey, Aigbavboa, & Ansah, 2015) also highlights the lack of stakeholder understanding of the benefits of sustainable buildings as a major barrier. (Emuze, Ntoi, & Isa, 2015) research describe the lack of demand for green buildings in South Africa as a direct response from the level of awareness of stakeholders towards green buildings, their costs, technology and associated benefits. (Simpeh & Smallwood, 2015) point to the lack of adequate information regarding the economic and financial benefits as well as the opportunities for going green as major factors affecting positive growth of green buildings in South Africa. This lack of available adequate information could essentially lead to stakeholders making assumptions based on incorrect evidence. (Ho, Wong, Iyer-Raniga, & Yang, 2017) study based in Australia concluded that new generation green buildings are costing less than previous generation as knowledge becomes more accessible to the public, hence awareness from professional team and clients can effectively lead to green buildings costing less making the business case more viable. A different study by (Isa, Rahman, Sipan, & Hwa, 2013) regarding factors affecting the return on green office building investments in Malaysia concludes that, despite the numerous factors which should be considered when investing in green office buildings, good investment returns result from informed investment decisions in line with the objectives of the investor.

This factor is regarded as a cost factor as it can be indirectly linked to the financial aspect of a green building by showing the lack of understanding from clients is directly linked to an increase in investments in green buildings. This increase in investments would lead to a reduction in the overall costs of green projects and, thus, a growth in the green building industry. The evidence provided

demonstrates the importance of this factor towards the business case of green buildings and could be classified as one of the most important influential factors as it affects all aspects of the business case.

2.4.4. Environmental

The factor associated with the environmental category of green buildings relating to cost is water use reduction. Water use reduction is considered a cost factor as it forms part of the operational costs of a building and its occupants.

Water use reduction

According to a study by (Hoffman & Cowie, 2014), South African developers are of the view that by reducing water usage in a green building a significant value will be added to the property as water is becoming a scarce resource in South Africa. Even though water use reduction should be classified as an environmental factor it has been included in the cost factors due to the importance it has in our lives. The most recent Cape Town water crisis of which started in May 2017 has increased the public's awareness on water conservation hence reinforcing the need to include this factor in the research.

Water use reduction is regarded as a cost factor as it forms part of the operational costs of a building.

2.4.5. Incentives

Factors derived from incentives for green buildings associated to cost are: government incentives, feed-in-tariffs and private incentives. Incentives are used as a means to reduce high upfront costs by receiving some offset to the investment.

Government Incentives

Government financial incentives for green projects are usually in the form of tax reliefs, direct grants, rebates and discounted development application fees (Olubunmi, Xia, & Skitmore, 2016).

Research by (Bohari, Skitmore, Xia, & Zhang, 2016), investigating drivers and challengers relating to green building adoption in Malaysia, showed the biggest driver was government policies and industry guidelines. The same research showed that government incentives motivated stakeholders to invest in the green industry as the higher upfront costs were partially recuperated through tax incentives. According to this study these tax incentives were one of the biggest promoters towards

green buildings. The same research also concluded that incentives from government increase the interest amongst private developers and owners and therefore increase knowledge of green buildings as more invest in them. The same conclusion was shared in an international study by (Chan, Darko, & Ameyaw, 2017) which aimed to identify and rank strategies for promoting green building technologies and showed the top driving strategies towards implementation of green buildings were government incentives, government policies and legislations.

(Simpeh & Smallwood, 2015) research showed there is lack of incentives for demonstrating best green practices in South Africa and agreed that such incentives can serve as a catalyst to enhance the growth of the green building industry. (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) research in Cambodia also agrees that incentives are important to the implementation of sustainable building practices as respondents ranked government incentives as 2nd out of 13 identified barriers.

An interesting study by (Olubunmi, Xia, & Skitmore, 2016) on a systematic review of green building incentives suggest a number of issues which contradict what is thought by other researchers on incentives; firstly owners are more incentivised by non-financial incentives rather than financial ones. Secondly governments are moving away from incentives and rather regulating green buildings through legislation and building codes as it has proved to be a more substantial driving force towards implementation of green buildings within a country. Lastly, commercial building owners experience low demand from tenants as the incentives offered by certain governments cannot be passed onto the buyers or tenants.

The evidence provided demonstrates the importance of this factor towards the business case of green buildings even though the latter research points to non-financial incentives as the main driving factor. This factor is therefore regarded as a cost factor as it is directly linked to the financial aspect of a green building as it affects the costs of the project. Depending on the type of monetary incentive, it has been shown that this will normally reduce the higher upfront costs of the green project (Olubunmi, Xia, & Skitmore, 2016).

Feed-in-tariffs

Feed-in-tariffs (FITs) are defined as the compensation any small-scale energy producer will receive when any surplus energy if fed back into the national grid (Judith, 2007).

USA, Germany and Belgium as well as other European countries use FIT systems and have been for some time now. A study by (Judith, 2007) concluded FITs are the most effective in promoting and accelerating green building construction within the countries it has been implemented in such as

Denmark and Germany. In the UK FITs were introduced in 2010 which helped to accelerate installation of small-scale power generation systems for buildings (Shan, Hwang, & Zhu, 2017).

Within the South African context, in 2011 NERSA approved conditions where generators of 100kW were able to register and allowed to sell electricity back to municipalities (Burkhardt, 2015). As per (Oxford, 2015) a temporary FIT system is currently being implemented in Cape Town, South Africa and has been documented that, in 2015, the city was paying 56.58 cents for every kWh of electricity fed into the national power grid. When comparing the cost of electricity drawn from the national grid at R1.09 per kWh, the rebate is small. To add the city of Cape Town also added a daily R13.03 standing charge used to cover the infrastructure cost required to keep the building on the power grid. By comparison in 2015 French municipalities paid domestic energy producers R1.51 per kWh (Oxford, 2015) while paying R2.42 per kWh, this compensation by Cape Town to pay for the energy fed back into the national grid shows that the technology does exist in South Africa however the low compensation represents a lack of confidence in the system by the South African government.

FITs are regarded as a cost factor as they influence the payback period of the project as well as reduction in operational costs, should FITs be available in the country then they can significantly influence the viability of the business case for green projects. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

Private Incentives

Private incentives are defined as financial assistance by the private sector to an owner/client for a project in order to motivate actions which might not occur without the incentive. These incentives would take the form of loans, or actual returns such as equity (Business Dictionary, 2018)

Private investments for green buildings are regularly required as public funding is usually limited and has stringent requirements attached to it, sustainable construction requires investments for the long-term (Chan, Qian, & Lam, 2009). Research by (Olubunmi, Xia, & Skitmore, 2016) points to a need for collaboration between government and private institutions regarding incentives in order to promote green buildings as there is limited participation from private sectors.

Private incentives directly influence the financial aspect of the project, decreasing payback periods and allowing for some of the higher upfront costs to be recuperated. It must however be noted that should private incentives or loans be used to fund a green project, this would naturally incur additional interests which could deter investors from investing in green (Abidin & Azizi, 2016). The

additional interest would need to be included in the return on investment calculations before deciding whether the business case is viable.

The evidence provided demonstrates the importance of this factor with respect to the business case and related cost factor of green buildings.

2.4.6. Innovation

Factors derived from the innovation of green buildings associated to cost is the reduction in renewable technology costs as more people start to implement them. This is an important factor as it directly influences the energy usage of the building and the operational costs.

Renewable technology costs reducing

In 1990 Germany a photovoltaic (PV) rooftop system cost around 14000 €/kWp, in 2016 the cost of the same rooftop system cost 1270 €/kWp (ISE, 2016). This works to be a compound price reduction of 9% p.a. (ISE, 2016), resulting from economies of scale and technological improvements (ISE, 2016).

A similar result shown showing a downward trend in costs can be seen in a study by (Ho, Wong, Iyer-Raniga, & Yang, 2017) whereby green office buildings in Australia over 12 years have shown to decrease in costs. The reason for the downward trend was not established in the study; however it could be related to a similar basis as was the case in Germany for PV systems. As more people start to use renewable technology the costs will reduce as they start to become the norm. This fact is enhanced through the use of building regulations and legislations driving towards green buildings.

This factor is regarded as a cost factor as it directly influences the financial aspect of a green building. For specific self-sustaining green buildings whereby power generation is one of the key features, the business viability of green project increases as there is a significant reduction in energy costs through this technology. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

2.4.7. Maintenance

Factors derived from the maintenance of green buildings associated to cost are the costs of maintenance or tune ups required for green buildings.

Maintenance or tune up costs

Maintenance of green buildings is required especially when complex technology has been integrated in the building which requires highly skilled personnel to maintain. The cost associated to maintaining a green building could be more than a conventional building (Theunissen, 2017), which could affect the bottom line of a firm and affect the viability of a business case. A study by (Zuo & Zhao, 2014), which contradicted this assumption, revealed that maintenance and cost savings on operation and maintenance can range from 30% to 50%, this lowering of maintenance costs is shared by (Yudelson, 2010) whereby maintenance costs were significantly reduced with green buildings when compared to conventional ones. Another factor to consider is that maintenance of the building will significantly reduce any costly upgrades that might be required in the future provided the building is maintained as originally designed ensuring long-term viability of the property (Eichholtz, Kok, & Quigley, 2010).

Tune ups of green buildings relate to the setting of green technology within the building to ensure it functions as designed. Some green buildings have multiple highly complex technologies integrated which need to work together harmoniously for the building to function as designed (GBCSA, 2012). A conventional building usually does not require any tune up as the technology is well known and simple, however according to (Bond S., 2010) high performance green buildings require tune ups at least quarterly, this additional attention adds to the operational costs of the building.

This factor is regarded as a cost factor as it is a direct cost which influences the financial aspect of the project. Maintenance or tune-up costs affect the life cycle costs of the building, hence the influences the investment decision. However it must be noted that the more complex the technology and systems integrated into the building, the more tune ups will be required which could add to the costs instead of reducing them. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

2.4.8. Market

Factors derived from the market of green projects associated to cost are identifies as: client driven process, increase in property value, increase in rental, depreciation of the property and residual value of the property.

Client driven process, hence clients are mostly unwilling to pay additional costs for green technology

Green buildings require the investment and drive from clients in order to grow the industry. It has been well documented that clients are mostly unwilling to pay the additional costs associated with green technology in a green building as shown from the referenced literature below.

Research from developed countries as by (Williams & Dair, 2007) based in England, points to costs as the main barriers towards implementing sustainable building. Developers interviewed as part of the same study were of the opinion that anything other than conventional buildings would incur additional costs. (Bond & Perret, 2012) concurs with this opinion as their research ranks clients unwillingness to pay for additional costs for green building technology as the top barrier to incorporating sustainable features for a commercial green building in New Zealand.

Research from developing countries share the same conclusion as developed countries such as (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) research concludes that higher upfront costs of green buildings is the top factor towards implementation of sustainable construction in Cambodia ranking the factor as 1st in its list of 13 barriers. A study in Malaysia by (Samari, Ghodrati, Esmaeilifar, Olfat, & Shafiei, 2013) on the barriers towards implementation of green buildings concurs that higher up-front costs is the top barrier. Two studies by (Ametepey, Aigbavboa, & Ansah, 2015) and (Albert, Amos, Ayokunle, & Ernest, 2017) based on the Ghanaian construction industry also concur that higher upfront costs is in fact the major barrier towards implementing sustainable construction. The same study by (Ametepey, Aigbavboa, & Ansah, 2015) points to clients being generally reluctant to pay the higher upfront costs for green buildings as the long term benefits are seen to be geared towards environmental and social aspects rather than financial. As shown, there seems to be a consensus amongst most research that the main barrier to overcome is the additional cost of green buildings.

According to a study by (Zenios & Allen, 2016) based on South Africa, respondents did not agree with the statement that life cycle cost benefits of green buildings outweigh the additional high upfront costs as they only ranked this factor as 7th out of 8 factors. A study also based in South Africa by (de Villiers, 2011) however suggests that developers can and will find ways in which to integrate green technology and requirements into their buildings without incurring additional costs and, thus, ensuring that the project remains within the set budget.

The actual percentage increase of upfront costs of green buildings has been difficult to quantify as in the United Arab Emirates (UAE) a study by (Maguina, 2011) found that the green premium is as high as 30% more than conventional buildings, this notion is shared by (Kats & Capital, 2003) whereby the green buildings cost premium can be anywhere from 1-25%. The research by Kats and Capital was concluded in 2003, since then the premium percentage could have decreased as costs of green buildings tend to decrease over time (see section 2.4.6). A more recent study by (GBCSA, 2012) on green buildings in South Africa deduced from various case studies that the green premium peaked at 10%, while the average was around 5%. A study by (GBCA, 2008) and BCI Australia show that higher costs for green buildings are only a perception and that the actual facts show that green buildings can be cost neutral when compared to conventional buildings. In 2006 it was found that a 4 star green rated building in Australia cost almost the same as an equivalent sized conventional building as the materials, expertise, and technology existed in Australia (GBCA, 2008). Currently in 2018 these buildings should be cost neutral.

This factor is regarded as a cost factor since the client's unwillingness to spend additional costs on green technology directly influences the decision to invest in green or not. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

Increased Property Value

Property value is defined by (Business Dictionary) as the marketing worth by a client or customer of that specific asset. Increased property value refers to the financial value of the property in contention; this is achieved by: adding new features to an existing property, increasing the rental amount or by directly responding to the market demand and designing the building to be more marketable.

Green buildings should rely on positive effects and their influence on increasing their property value by merely being green, however (Hakkinen & Belloni, 2011) states that an increase in market value is difficult to quantify as the environmental and energy efficiency benefits from green buildings are not directly visible.

A study by (WGBC, 2016) shows that out of 200 Canadian building owners, 38% of the respondents were of the opinion that healthy green buildings are worth 7% more in value than a conventional building. According to (Yudelson, 2010), property value for green buildings has increased due to an increase in rental amount leading to an increase in the net operating income. A study by (RICS, 2010) shows that a green building value can increase due to tenants being secured more rapidly as there is

an increasing demand from tenants for green buildings, this also leads to an increase in property value. (GBCSA, 2012) states that by decreasing operational costs, increasing rental amounts and reducing the overall risk in projects by building a green sustainable building the value of the property is essentially increased. There exists significant proof of this factor in the USA and Australia (GBCSA, 2012).

This factor is regarded as a cost factor as it directly influences the financial aspect of the project and investment. By the property value increasing a positive return on investment of the asset is guaranteed. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

Increase in Rental as Tenant Reaping Benefits of Technology

Rent is defined by (Business Dictionary) as the compensation or remuneration paid by a tenant to the property owner for occupancy of the property.

In order to recover the additional costs of green technology implemented in a green building by the owner, a higher rental is required to be paid by the tenant in order to cover these additional costs/premiums as the tenant is reaping the benefits of the technology paid by the owner.

This factor is the same as the increased rental amount factor in section 2.4.1; hence the same references are applicable for this factor.

Depreciation

Depreciation is defined by (Business Dictionary, 2018) as the decrease in value or economic potential of a specific asset over its useful life. Depreciation of a conventional building is usually expressed as a function of time and is uniform for that period of time. Green buildings can possess various complex and highly technical features which make it difficult to calculate the depreciation of the entire building (Rodi, Hwa, Mahamood, Said, & Abdullah, 2015).

A study by (Rodi, Hwa, Mahamood, Said, & Abdullah, 2015) based on the Malaysian construction industry describes the loss of investment return through depreciation. A high depreciation rate will result in the loss of a tenant, an increase in vacancy rate, the owner suffering a loss in rental income, and potential future tenants being deterred from occupying a depreciated old building. The results from this research suggest that green buildings have a lower depreciation rate when compared to conventional buildings.

The study conducted by (Bond & Perret, 2012) identified one of the benefits from green buildings as a decrease in obsolescence of the building which can be regarded to encompass residual value and depreciation of the property. Respondents from the study however ranked this factor as 6th out of 7 as a benefit of green buildings, hence important but not as important as other factors.

Depreciation is regarded as a cost factor as it influences the investment decision of a project. By ensuring a slower depreciation rate than conventional buildings, occupancy can be extended hence contributing positively to the period of return of the property. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

Residual Value

Residual value is defined by (Business Dictionary, 2018) as the market selling value of a property once the useful life of the property has ended.

The future outlook on the resale and resale value of a green building can be a significant factor towards investing in green buildings. This notion is supported by a study (Bond & Perret, 2012) where investors believe that property owners might find it difficult in the near future to sell or lease a building which is not green.

Residual value is regarded as a cost factor as it directly influences the investment decision for investors. A higher residual value ensures the property can be resold at a higher price which can influence the return on investment on the green property. The evidence provided demonstrates the importance of this factor towards the business case of green buildings.

2.4.9. Materials

Materials, as a factor relating to the cost of green buildings, are associated with availability and costs of green products, and materials and technologies. Green buildings depend on the use of such items in order to function as a green building and reduce the carbon footprint.

Availability, cost and difficulty in sourcing green products, materials and technologies

Green buildings require green products, materials and technologies to reduce the environmental impact and function as designed.

Green materials, products and technologies can significantly increase the overall cost of a green project as shown by the study based in Dubai by (Maguina, 2011). This study shows that since green materials and equipment were not locally available they had to be imported which raised the cost of

green buildings by up to 30% when compared to conventional buildings. This also highlights that in order to keep the costs of green buildings as low as possible there needs to be a local supply chain of green products, technologies and products readily available for construction. (GBCSA, 2012) concurs, noting that the effective design and building of a green project requires a local supply chain of green products and materials.

According to (Zenios & Allen, 2016) the additional costs incurred due to the use of specialised materials for green buildings ranked as the top challenging factor in South Africa. The same study showed that materials ranked 3rd out of 10 possible factors which influence the costs of green building construction in South Africa. (Hoffman & Cowie, 2014) study agrees that materials significantly increase the construction costs of green buildings in South Africa. (Simpeh & Smallwood, 2015) also conclude that, in South Africa, the limited range of green materials was important, and ranked it 5th overall as a challenge to be overcome in promoting green buildings.

Materials are regarded as a cost factor, as they directly influence the cost of the project and financial aspect. Green materials, technologies and products costs can significantly increase the cost of the overall project, provided there is a need for imported materials from overseas, due to an absence of a local supply. This factor is dependent on the technology and materials required by the owner/client for the property. The evidence provided demonstrates the importance of this factor in respect of the adoption of green buildings.

2.4.10. Operational

Operational factors relating to the cost of green buildings are associated with the following: minimising the costs and impacts of churn, lower operating costs, and increase in worker productivity. .

Minimizing the costs and impacts of churn

Churn is defined by (GBCSA, 2012) as the frequency in which a building's occupant moves in or out. As is the case in South Africa, most business leases are relatively short ranging from 3-5 years (GBCSA, 2012); hence churn rate is high when compared to longer lease periods of 20 years. One of the benefits of green buildings is to deliver tenant requirements while increasing worker productivity, these benefits aid in securing the same tenant for a longer lease, hence assuring viability of the business investment (GBCSA, 2012). High churn rates impact on the financial viability of the project by incurring costs such as lost rental, fit out costs for new tenants as well as standing costs (GBCSA, 2012).

This factor is regarded as a cost factor as it influences the financial aspect of the green building by reducing the costs associated with high tenant turnover (churn). This factor is important as it influences the business case of green projects.

Lower operating costs

Operating cost is defined by (Business Dictionary) as the annual cost incurred from operating processes. The lower operating costs factor can be defined as the lowering of costs associated to operational processes within a building by implementation of smart technologies or systems.

The benefits of operational cost savings are usually gained by the tenant and in green buildings are mostly associated with water and electricity usage reduction (GBCSA, 2012). According to (RICS, 2010) 30% of buildings costs are attributed to energy costs, hence by significantly reducing energy consumption the cost savings are large. A study by (Bond & Perret, 2012) based on New Zealand's construction industry ranked occupancy cost savings, relating to lower operating costs, as the top benefit from a green building. This finding is shared by (Windapo, 2014), whose study based on the South African construction industry concluded that the primary drivers for green buildings are rising energy costs and reduction in operational costs.

Water use also forms part of the operational costs and the reduction of water use is important, however currently the cost of water is less than electricity in most countries, especially South Africa, hence why water use reduction is not seen as important when relating to operational cost reduction. The latest water crisis experienced in Cape Town is swiftly raising the awareness of water use and cost.

Lower operating cost is regarded as a cost factor as it directly influences the financial aspect of a project. The rental premium of the tenant needs to be increased in order for the owner to recover the initial costs of the technology implemented which lowers operating costs to the benefit of the tenant. The evidence provided demonstrates the importance of this factor towards the adoption of green buildings.

Increases worker productivity

The most valuable resource in any firm are its staff, this is defined by (WGBC, 2016). The same definition is shared by (GBCSA, 2012) whereby increasing worker productivity is deemed as the most powerful potential advantage available to any firm.

Various research points to increases in worker productivity to have significant increases in a firm's bottom line. Research conducted by (Yudelson, 2010) demonstrated that the basis of the productivity increase in staff was due to better health and reduced absenteeism, benefits derived from occupying green buildings. (Bond & Perret, 2012) research concluded that tenant satisfaction and productivity was the top driver for green building development in New Zealand. A research by (Zenios & Allen, 2016) on South African construction industry concluded that the most important factor towards implementation of green buildings was better occupancy usage which is linked to worker productivity.

In contrast, research conducted by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) in Cambodia ranked profitability/productivity 7th out of a possible 13 drivers with respect to the adoption of green buildings. Notwithstanding this result, this finding still points to the relevant importance of this factor. While consideration should be given to separating profitability and productivity as two distinct factors, it should be noted that productivity can be directly linked to profitability, as suggested by (Odum & Barrett, 2005) who demonstrate that economics and ecology are intrinsically linked.

Increasing worker productivity is regarded as a cost factor as research has shown that a small percentage increase in staff productivity within a firm occupying a green building can have significant affects on a firm's bottom line. Tenant satisfaction leads to a longer lease, which, in turn, influences the return on investment. The evidence provided demonstrates the importance of this factor towards the adoption of green buildings.

2.4.11. Professional

The professional aspect, as a factor relating to the cost of green buildings, is associated with the hiring of green professionals and their related fees.

Green Professionals

A green professional or a sustainability consultant is defined as a professional who aids in planning and achieving a green certification requirement for a given project.

It is deemed crucial to include a green professional in a professional team, when building a green building (GBCSA, 2012). These professionals are certified and must adhere to the correct green procedures in order to achieve the green certification rating applied for. The green professionals, as any other professionals, request a certain fee in order to facilitate the transition from conventional

building to green (GBCSA, 2012). This green consultant fee is an additional cost which must be included in the project cost (GBCA, 2008) when compared to conventional buildings. A study by (de Villiers, 2011) on the construction cost gradient for green buildings in the Western Cape, South Africa concluded that any additional costs to a green building would be predominantly soft costs such as green professional fees and fees for green certification processes.

Research by (GBCA, 2008) based in Australia found professionals in general, tend to increase their fees when it comes to designing a green building which can significantly increase the budgeted cost assigned to professionals for the project as well as the entire project. Research by (Shariffudin & Abidin, 2015) on professionals issues with green buildings concludes that professionals request a higher fee when involved in green buildings as more responsibility is required when compared to conventional buildings, the standard fee percentage may not be applicable and their fees will require negotiation. (Hydes & Creech, 2000) reaffirms this notion and states that a portion of the higher costs of green buildings can be attributed directly to increases in consultant's fees and indirectly to the design team and contractors with unfamiliar methods of construction.

Professionals are also responsible for informing clients and investors on the benefits of green buildings and associated financial implications. (Bartlet & Howard, 2000) research concluded that consultants tend to overestimate the capital cost and underestimate the cost savings from green buildings, leading to a skewed negative view of the investment return of green projects.

The addition of a green professional fee as well as increases in the professional fees when involved in green projects, directly influence the financial aspect of the project as it is an additional cost incurred when compared to conventional buildings, hence why this is factor is regarded as a cost factor to green buildings. The evidence provided demonstrates the importance of this factor towards the adoption of green buildings.

2.5. Cost Factor Table

Table 1. Cost Factor References

No	Factor Description	Category	References
1	Renewable technology costs reducing as more people start implementing the green technology	Innovation	(Ho, Wong, Iyer-Raniga, & Yang, 2017) (ISE, 2016)
2	Higher return on investment	Business Case	(Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Hwang & Ng, 2013) (McGraw-Hill, 2013) (WGBC, 2016)
3	Increased rental amount	Business Case	(Bond S, Perret G, 2012) (Eichholtz, Kok, & Quigley, 2010) (GBCSA, 2012) (RICS, 2010) (WGBC, 2016)
4	Increased property value	Market	(Hakkinen & Belloni, 2011) (RICS, 2010) (WGBC, 2016) (Yudelson, 2010)
5	Payback period for investment is relatively good if incentives exist in country	Business Case	(GBCSA, 2012)
6	Occupying cost saving	Business Case	(Bond S, Perret G, 2012)
7	Minimizing the costs and impacts of churn	Operational	(GBCSA, 2012)
8	Lower operating costs	Operational	(Bond, 2010) (GBCSA, 2012) (Windapo, 2014)
9	Rising energy costs	Business Case	(Bond S, Perret G, 2012) (Smith & Baird, 2007) (Windapo, 2014)
10	Challenge with split between capital expenditure and operating cost savings	Business Case	(Bond & Perret, 2012) (GBCSA, 2012) (McGraw-Hill, 2013)
11	Current cost of coal energy is less than renewable energy cost in South Africa	Business Case	(GBCSA, 2012) (Lloyd, 2017)
12	Availability, cost and difficulty in identifying green products, materials and technologies	Materials	(GBCSA, 2012) (Hoffman & Cowie, 2014) (Maguina, 2011) (Simpeh & Smallwood, 2015) (Zenios & Allen, 2016)
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Certification	(Zenios & Allen, 2016) (GBCSA, 2012)
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Maintenance	(Yudelson, 2010)
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Market	See factor 3 references
16	Cost associated in introducing a green building professional to the professional team	Professional	(Bartlet & Howard, 2000) (GBCA, 2008) (GBCSA, 2012) (Hydes & Creech, 2000) (Shariffudin & Abidin, 2015) (de Villiers, 2011)
17	No private financial incentives available for going green in South Africa	Incentives	(Abidin & Azizi, 2016) (Chan, Qian, & Lam, 2009) (Olubunmi, Xia, & Skitmore, 2016)
18	FIT system	Incentives	(Burkhardt, 2015) (Judith, 2007) (Oxford, 2015) (Shan, Hwang, & Zhu, 2017)
19	External funding or incentives available from government for implementing green technology on a small-scale	Incentives	(Albert, Amos, Ayokunle, & Ernest, 2017) (Bohari, Skitmore, Xia, & Zhang, 2016) (Chan, Darko, & Ameyaw, 2017) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (Olubunmi, Xia, & Skitmore, 2016) (Oxford, 2015) (Simpeh & Smallwood, 2015)
20	Lack of understanding from clients regarding the actual benefits from going green	Education	(Ahn, Pearce, & Wang, 2013) (Ametepey, Aigbavboa, & Ansah, 2015) (Emuze, Ntoi, & Isa, 2015) (Hakkinen & Belloni, 2011) (Pitt, Tucker, Riley, & Longden, 2009) (Simpeh & Smallwood, 2015) (Williams & Dair, 2007)

Table 2. Cost Factor References (Cont.)

21	Water use reduction	Environmental	(Hoffman & Cowie, 2014)
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Business Case	(Ametepey, Aigbavboa, & Ansah, 2015) (Bond S, Perret G, 2012) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Kats & Capital, 2003) (Maguina, 2011) (Saleh & Alalouch, 2015) (Samari, Ghodrati, Esmaeilifar, Olfat, & Shafiei, 2013) (de Villiers, 2011) (Williams & Dair, 2007) (Zenios & Allen, 2016)
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Market	(Bond S, Perret G, 2012) (Rodi, Hwa, Mahamood, Said, & Abdullah, 2015)
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Market	(Bond S, Perret G, 2012)
25	Increases worker productivity	Operational	(Bond S, Perret G, 2012) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Odum & Barrett, 2005) (WGBC, 2016) (Yudelson, 2010) (Zenios & Allen, 2016)
26	Fuel price	Business Case	
27	Exchange rate	Business Case	

The cost factor table on Table 1 and Table 2 summarises the factors identified by the researcher through literature associated to costs for green buildings which influence the decision to build green. The literature extracted comprises of studies of green buildings from developed as well as developing countries, with a specific focus on South Africa. The table defines the references whereby each factor was extracted from. Each factor is also categorised into a pre-defined sub-category associated to cost.

Based on the literature reviewed, it was noted that the following two factors were found to have the highest volume of literature relating to them:

- client-driven process, hence client is mostly unwilling to pay for additional costs associated with green technology;
- lack of understanding from clients regarding the actual benefits derived from going green.

It was noted that most information extracted from literature was based on qualitative data and based on opinions of the respondents for that specific study. In general there seems to be a lack of quantitative data to confirm the outcomes and conclusions drawn from these studies.

3. RESEARCH DESIGN AND METHODOLOGY

Research design answers the question “how”, meaning it defines how the research objectives will be achieved. (Fellows, 2015) describes research design as ‘the methodological approach for finding solutions/answers to the research problem or research question’. In other terms it is defined as stating the way in which the researcher intends to accomplish the research objectives (Fellows, 2015). According to (Saunders & Thronhill, 2007), the research onion was developed to illustrate the stages the must be covered when developing a research strategy.

To answer the proposed research question of “how investors, clients and stakeholders can be expected to invest in green projects unless they fully understand how and why specific cost related factors influence the financial viability of green building projects in South Africa”, the methodology adopted in this research describes how this will be done starting with the research philosophy, approach, strategy, time horizons and collection methods.

According to (Collins & Hussey, 2014), pragmatism uses various methods available to the researcher to find answers to the research questions. This research was based on collected data being interpreted in an objective way, even if the data was at times subjective in nature. A deductive approach was used for the in-depth literature review as factors were extracted and justified as to why they were regarded as influential to the adoption of green commercial projects as well as justified why they were regarded as cost factors. The research data is based on empirical data gathered through survey data collection techniques in the form of interviews and questionnaires.

Current investigations and research carried out across the world on green buildings has been extensive, however there is limited literature available on the nature and occurrence of factors and how they influence the investment and ultimate decision to proceed with a commercial green building project. When investigating within the South African context, even less literature is available on the subject. A pragmatic philosophy through the use of mixed methods was adopted in this study.

A study by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) adopted a mixed-method approach, which included in-depth analysis of literature, as well as a descriptive survey method including qualitative and quantitative analysis methods. A similar approach was adopted in this study where, a mixed method approach was used using a triangulation design and a data convergence model which comprised of qualitative and quantitative survey methods used to gather and analyse the data separately to achieve a converged result. The mixed-method lends itself to

achieve a pragmatic research philosophy which also aligned with the nature of the subjective results obtained from interviews and questionnaires in this research. The factors extracted from literature were not ranked in any way by the researcher and a cost factor table was created which formed as the primary tool to gather the required data. The questionnaire comprised solely of the cost factor table, interview comprised of open-ended questions and the cost factor table. Interviews were conducted first before the questionnaire was sent to the rest of the respondents in order to gain an understanding from the responses from the interviewees. This can be described as a pilot study which served to create an explanatory letter to respondents of the questionnaire on how to answer the cost factor table. It must be noted that the qualitative and quantitative data was captured and analysed using the separate methods which corresponded with the nature of the data as defined by (Sandelowski, 2000). Qualitative data was analysed using qualitative methods and quantitative data was analysed using quantitative methods. The proposed research strategy of this study was based on a similar research by (Bond, 2010), (Bond & Perret, 2012) and (Windapo, 2014) where a list of factors to green buildings was extracted from a literature study, then a questionnaire was designed based on these factors and respondents ranked the factors according to their opinions and experience in the green building industry. (Abidin & Azizi, 2016) recognise the need to carry out fieldwork in order to interpret factors identified in their research via a survey, consisting of interviews and questionnaires with professionals.

The sample population for the study was selected via purposive, convenience and snowball sampling techniques. Purposive sampling was initially used to select a list of 4-star green rated commercial buildings in South Africa, Gauteng. Convenience sampling was then used to select three of projects from this list which were closest to the researcher, as interviews would be conducted for the stakeholders. The rest of the sample population projects were used for the questionnaires. Purposive sampling was then used to target stakeholders directly involved in each project. Finally snowball sampling techniques were used to obtain the contact information for all the stakeholders involved in each project and each potential respondent contacted for participation. The total number of stakeholders formed the sample population of the research.

This research was based on a cross sectional time horizon as the outcomes were not dependant on the time of the results. The research was concerned with differences which exist between each stakeholder within the green building environment of South Africa. This difference is irrespective of the process of change over time (University of Southern California, 2018)). The data was gathered sequentially, first from the interviews, then from the questionnaire.

The following sections describes in detail the data sources, data collection techniques and sampling techniques used for the literature study and surveys, thereafter the issues of reliability and validity are described, followed by data analysis methods, ending off with research ethics of the research.

3.1. Data Source

Two sources of data were implemented for the research namely an in-depth literature study and surveys (interviews and questionnaires).

3.1.1. Literature review

Literature relating to green buildings based on the construction industry of developed and developing countries was the main source of information used on the literature study part of this research. The study specifically referred to multi-disciplinary factors deemed to be challengers or enablers to green building promotion and factors associated to costs. The information making up the literature study comprised of journals, international and local reports, white papers, conference proceedings and consultation papers. Literature based on the South African construction industry was given special attention.

For this research, the initial step taken to produce a list of cost factors was to determine an initial list of multi factors, defined as enablers or challenges, which appear to influence the promotion of green buildings in the literature study. The final list of 27 cost related factors were grouped into 11 sub-categories. The researcher then assigned a pre-determined life cycle stage of a construction project to each factor based on the opinion of the researcher. This list of cost factors was comparable to the research done by (Abidin & Azizi, 2016) where the researchers identified and categorised factors which influenced costs for green projects and specifically identified 23 factors which could influence costs however, this research comprised of 27 factors

The final cost factor table was made up of 27 cost factors and incorporating the pre-defined life cycle stages is shown on Table 3 and Table 4. Question (6) of the interview and questionnaires is based on this table.

Table 3. Cost Factor Table (including life cycle stage)

No	Factor Description	Lifecycle stage	Category	References
1	Renewable technology costs reducing as more people start implementing the green technology	Construction	Innovation	(Ho, Wong, Iyer-Raniga, & Yang, 2017) (ISE, 2016)
2	Higher return on investment	Inception	Business Case	(Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Hwang & Ng, 2013) (McGraw-Hill, 2013) (WGBC, 2016)
3	Increased rental amount	Operation	Business Case	(Bond S, Perret G, 2012) (Eichholtz, Kok, & Quigley, 2010) (GBCSA, 2012) (RICS, 2010) (WGBC, 2016)
4	Increased property value	Residual Value	Market	(Hakkinen & Belloni, 2011) (RICS, 2010) (WGBC, 2016) (Yudelson, 2010)
5	Payback period for investment is relatively good if incentives exist in country	Inception	Business Case	(GBCSA, 2012)
6	Occupying cost saving	Operation	Business Case	(Bond S, Perret G, 2012)
7	Minimizing the costs and impacts of churn	Operation	Operational	(GBCSA, 2012)
8	Lower operating costs	Operation	Operational	(Bond, 2010) (GBCSA, 2012) (Windapo, 2014)
9	Rising energy costs	Operation	Business Case	(Bond S, Perret G, 2012) (Smith & Baird, 2007) (Windapo, 2014)
10	Challenge with split between capital expenditure and operating cost savings	Operation	Business Case	(Bond & Perret, 2012) (GBCSA, 2012) (McGraw-Hill, 2013)
11	Current cost of coal energy is less than renewable energy cost in South Africa	Inception	Business Case	(GBCSA, 2012) (Lloyd, 2017)
12	Availability, cost and difficulty in identifying green products, materials and technologies	Construction	Materials	(GBCSA, 2012) (Hoffman & Cowie, 2014) (Maguina, 2011) (Simpeh & Smallwood, 2015) (Zenios & Allen, 2016)
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Inception	Certification	(Zenios & Allen, 2016) (GBCSA, 2012)
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Operation	Maintenance	(Yudelson, 2010)
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Operation	Market	See factor 3 references
16	Cost associated in introducing a green building professional to the professional team	Inception	Professional	(Bartlet & Howard, 2000) (GBCA, 2008) (GBCSA, 2012) (Hydes & Creech, 2000) (Shariffudin & Abidin, 2015) (de Villiers, 2011)
17	No private financial incentives available for going green in South Africa	Inception	Incentives	(Abidin & Azizi, 2016) (Chan, Qian, & Lam, 2009) (Olubunmi, Xia, & Skitmore, 2016)
18	FIT system	Operation	Incentives	(Burkhardt, 2015) (Judith, 2007) (Oxford, 2015) (Shan, Hwang, & Zhu, 2017)
19	External funding or incentives available from government for implementing green technology on a small-scale	Inception	Incentives	(Albert, Amos, Ayokunle, & Ernest, 2017) (Bohari, Skitmore, Xia, & Zhang, 2016) (Chan, Darko, & Ameyaw, 2017) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (Olubunmi, Xia, & Skitmore, 2016) (Oxford, 2015) (Simpeh & Smallwood, 2015)
20	Lack of understanding from clients regarding the actual benefits from going green	Inception	Education	(Ahn, Pearce, & Wang, 2013) (Ametepey, Aigbavboa, & Ansah, 2015) (Emuze, Ntoi, & Isa, 2015) (Hakkinen & Belloni, 2011) (Pitt, Tucker, Riley, & Longden, 2009) (Simpeh & Smallwood, 2015) (Williams & Dair, 2007)

Table 4. Cost factor table (including life cycle stage) cont.

21	Water use reduction	Operation	Environmental	(Hoffman & Cowie, 2014)
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Inception	Business Case	(Ametepey, Aigbavboa, & Ansah, 2015) (Bond S, Perret G, 2012) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Kats & Capital, 2003) (Maguina, 2011) (Saleh & Alalouch, 2015) (Samari, Ghodrati, Esmaeilifar, Olfat, & Shafiei, 2013) (de Villiers, 2011) (Williams & Dair, 2007) (Zenios & Allen, 2016)
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Residual Value	Market	(Bond S, Perret G, 2012) (Rodi, Hwa, Mahamood, Said, & Abdullah, 2015)
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Sale	Market	(Bond S, Perret G, 2012)
25	Increases worker productivity	Operation	Operational	(Bond S, Perret G, 2012) (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) (GBCSA, 2012) (Odum & Barrett, 2005) (WGBC, 2016) (Yudelson, 2010) (Zenios & Allen, 2016)
26	Fuel price	Inception	Business Case	
27	Exchange rate	Inception	Business Case	

3.1.2. Survey

In order to fulfil the objectives of this research, respondents for the survey must have worked as part of an organisation who was involved in the chosen green commercial projects and the respondent must have worked on the project themselves within South Africa in the Gauteng province.

Potential respondents were located through the use of the GBCSA website which includes contact details of the sustainability consultant directly involved on each of the green commercial projects in South Africa, Gauteng.

The sustainability consultant was the initial point of contact for each of the chosen projects. Once initial contact was made, the contact details of the other professionals involved in the project were shared. The survey comprises of two parts: firstly, the conducting of interviews and, secondly, the completion of questionnaires.

The following stakeholders in green projects were classified as the respondents for this research:

- Owners;
- Architects;
- Quantity surveyors;
- Main Building contractors;
- Project Managers, and
- Sustainability consultants.

Interviews

In order to fulfil the objective requirements, three green commercial projects were selected from the GBCSA database within Gauteng South Africa; from these three projects the stakeholders were then contacted and interviewed. As previously discussed, for each of the three projects chosen the respondents had to be directly involved with the project.

The three green commercial buildings for the interviews were chosen based on the following criteria:

1. Project must be a commercial building;
2. Project must be certified with GBCSA and obtain a rating of 4 Green Stars using the GBCSA Office v1 ranking system, the selected projects must all have the same Green Star Rating;
3. Project must be located in Gauteng, South Africa;
4. Project green star rating type must be defined as an as-built project;
5. Total gross floor area:
    a. One project was selected based on large size (Total Gross Floor Area > 40 000m^2).
    b. One project was selected based on medium size (10 000m^2 < Total Gross Floor Area <40 000m^2).
    c. One project was selected based on small size (Total Gross Floor Area < 10 000m^2).

The rationale underlying the inclusion of varying floor areas serves to investigate whether specific cost factors are more relevant to the size of the green projects. At the time when the projects were chosen for interviews, on the GBCSA website (GBCSA, 2018) there were 14 projects which received a 4 star rating and which fit the criteria 1-4 stipulated above. Of the 4 star rated projects from the GBCSA website, 2 projects fitted the large size criteria, 7 projects fitted the medium size criteria and 1 is on 10 000m2 floor area. Projects for the interview are numbered 1 to 3.

It must be noted that the number of commercial green certified buildings has since increased to 15 in total since the selection process was done, however for the basis of this research the total number was 14.

Questionnaire

Questionnaire respondents focussed on the professional bodies defined above. The projects selected were not based on any specific size, but on the same criteria used for the interview projects, thus ensuring that the objective requirements have been met, namely:

1. The project must be a commercial building;
2. The project must be certified with GBCSA and obtain a rating of 4 Green Stars using the GBCSA Office v1 ranking system, the selected projects must all have the same Green Star Rating;
3. The project must be located in Gauteng, South Africa;
4. The project green star rating type must be defined as an as-built project.

Similar to the interviews conducted, a total of 14 projects fitted the criteria above. Excluding the 3 selected for the interviews, 11 projects remained. As two of the remaining projects were combined into one, only 10 were available to be selected.

3.2. Data Collection Techniques

The data collection techniques designed and used for this research served to fulfil the objectives and aims of this research.

The factors extracted from the literature review were used to the cost factor table which was the primary source of quantitative data. The design of the collection of data for the research was two split into two phases namely:

Phase 1 comprised of collecting data through interviews. The interview comprised of open-ended questions (qualitative in nature) and the cost factor table (quantitative in nature). Interviews were completed before conducting the questionnaire in order to understand the design of the cost factor table and if they were easily understood by respondents. From the outcome of the interviews an explanatory email was designed to be emailed with the questionnaires to aid respondents on how to answer the questions and further explain questions which were found difficult to understand in the interview process. Respondents who could not be interviewed were then emailed the interview and asked to complete it before sending back to researcher.

Phase 2 comprised of the questionnaire which comprised solely of the cost factor table. This collection of data was designed and implemented firstly to increase the number of respondents from the sample population, secondly in order to speed up the data collection process as interviews are time consuming.

The data from the cost factor tables from interviews was merged to the data from the questionnaires in order to increase the sample size so as to carry out quantitative analysis.

The data collection techniques used for each of the data sources are discussed in detail below, including explanations on how they were specifically designed to meet the stated objectives of this study.

3.2.1. Literature Study

Literature associated to green building factors which influence the adoption of green buildings was identified, reviewed and the factors extracted. Content analysis through a systematic review process was undertaken in order to ascertain which factors were related to costs of green buildings. These factors were then summarised and formed a cost factor table. The cost factor table was the primary tool used to fulfil the objective of determining the nature and occurrence of cost related factors for green commercial buildings in general.

3.2.2. Survey

An introductory email was drafted and emailed to each of the potential respondents for interviews and questionnaires explaining the reason why they had been selected to participate in the research, what the research entailed, and why it was being conducted. Once a response was received from the respondents the formal introductory letter, consent form and the interview/questionnaire was then sent to the willing respondent, see Appendix. The respondents were required to print the questionnaire and consent form and complete them by hand and return scanned copies via email to the researcher. The interview schedule was sent to the respondents in order for them to prepare and understand what questions were being asked, this also served to reduce the time of the interview.

The cost factor table questions formed the core of the research data collection techniques and were quantitative in nature. The cost factor table was common in both the interviews and questionnaires. Questions within the cost factor table were designed for respondents to answer for each of the cost factors listed in the table, in order to address the research objectives being: to determine the nature, occurrence and influence of cost factors to green commercial building investments. The interview comprised of the cost factor table questions with additional open-ended questions aimed to explore and test the objectives further and aid in converging to a common result. The questionnaire comprised solely of the cost factor table questions with classifying questions at the start. Table 5 represents a summary of the questions making up the interview and questionnaire. The question numbers, where the question was used, the type of question and what objective the question was

designed to address are shown on the table. For clarity purposes the cost factor table questions were assigned the same number while the interview specific questions were assigned other numbers.

The cost factor table was designed for respondents to determine the nature and occurrence of each factor derived from the literature review and to determine if the factor was influential or not. The first two questions on the cost factor table being, viz (6.1) 'Awareness of factor' and (6.2) 'Did factor affect decision making process', were designed to determine if the factor was taken into considering during the project. If either of the two questions were answered as 'No' then the respondent was not required to answer the remaining questions for that factor, and was asked to move onto the next factor. The reason behind these pre-requisite questions was to initially determine if the respondent was aware of the factor and if the factor affected the decision making process to invest in green for the project. If the respondent answered no then it meant they were and have never been aware of it including for that project or the factor did not affect any decision making process, hence making the factor non-influential.

Should the respondent have answered questions (6.1) and (6.2) as 'Yes' than the next question (6.3)requested respondents to rank the frequency of occurrence of each factor using a five point Likertscale:1-not at all influential; 2-slightly influential; 3-somewhat influential; 4-very influential, 5-extremely influential. This was designed, in part, to determine the nature and occurrence of the factor from the stakeholder's perspective. The respondents were then required to determine the life cycle stage which the cost factor affected. Question (6.4) requested respondents to confirm or not whether the pre-determined life cycle stage of the project corresponded to the specific cost factor. The next question (6.5) was designed to determine the nature of the cost factor, whether it was perceived as a challenger or an enabler to the green project. This was answered using a simple 'Yes' or 'No'.

For the next five questions (6.6 to 6.10) the respondents were required to rank the factor on its impact towards time, quality, client satisfaction, sustainability and overall project using a five point Likert scale (1-not at all influential, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential). These five questions were designed to address the influence of the cost factor on the project. The cost factor table questions were ended by an open-ended question whereby respondents were required to state how each factor affected the decision making process (6.11).

The design of the cost factor table predominantly used the Likert scale as this design lends itself to practicality for ranking of items. The dichotomous questions in the cost factor table also made

analysis of data easy and practical for ranking. As described in section 3.3, the use of Likert scales and dichotomous data lends itself to credible and reliable results with little bias from the researcher.

In the next sections the interview specific questions are explained in details as well as the rest of the questionnaire data collection techniques. Both questionnaire and interview were recorded by hand and were transcribed onto Microsoft Excel for ease of analysis.

Table 5. Summary of Questionnaire and Interview Questions

Question Number	Description	Origin	Type	Objective Designed to Address
5	How did you become aware of these factors	Interview	Open ended	Nature and occurance of factor
6.1	Awareness of factor	Factor Table	Y/N	Nature and occurance of factor
6.2	Did factor affect decision making process	Factor Table	Y/N	Influence of factor
6.3	Frequency of factor	Factor Table	Likert scale	Nature and occurance of factor
6.4	Lifecycle stages	Factor Table	Closed	Stakeholder's perception
6.5	Enabler (E) or challenger (C)	Factor Table	E/C	Stakeholder's perception
6.6	Impact on Time	Factor Table	Likert scale	Influence of factor
6.7	Impact on Quality	Factor Table	Likert scale	Influence of factor
6.8	Impact on Client Satisfaction	Factor Table	Likert scale	Influence of factor
6.9	Impact on Sustainability	Factor Table	Likert scale	Influence of factor
6.10.	Impact on Overall Project	Factor Table	Likert scale	Influence of factor
6.11	How did factor affect the decision making	Factor Table	Open ended	Stakeholder's perception
7.1	At what stages of the life cycle of the project are cost related factors most influential when referring to the investment decision in the project?	Interview	Open ended	Stakeholder's perception
7.2	Reason for answer to 7.1	Interview	Open ended	Stakeholder's perception
8.1	What other cost related factors can you describe from your experience in the project which are not stated in the table in question 6? (please note the factors need to have influenced the decision making of the stakeholders in the project)	Interview	Open ended	Influence of factor
8.2	Why do you refer to these factors as influencing the decision to undertake the project?	Interview	Open ended	Influence of factor
9.1	What other non-cost related factors influenced the decision making of the stakeholders in the project?	Interview	Open ended	Influence of factor
9.2	How did you come to conclusion for 9.1	Interview	Open ended	Influence of factor
10.1	In your opinion what type of factors (cost/environmental) were the main drivers in the ultimate decision to invest in this green project?	Interview	Open ended	Stakeholder's perception
10.2	Reason for 10.1	Interview	Open ended	Stakeholder's perception

Interviews

Respondents were initially contacted via email to participate in the research. The consent form, an information document on the research being conducted was sent to the interview sample population. If no response was sent by the potential respondent then a second email was sent followed by a telephone call. Once respondents agreed to participate in the research a meeting was scheduled which best suited the respondent's schedule to conduct the interview.

The interviews conducted were face-to-face and semi-structured in nature allowing for some flexibility of answers from the respondents for the open-ended questions. Research by (Turpin, Asano, & Finlayson, 2015) was conducted using a similar mixed method approach by combining open-ended questions, resulting in qualitative data, and closed-ended questions, resulting in quantitative data, conducted through interviews. The same method for data collection was adopted for the interviews in this research, as qualitative data resulted from the open-ended questions and the cost factor table resulted in quantitative data.

Where there was consent from the interviewee the interviews were recorded for further analysis at a later stage. In the case where the interview could not be done face-to-face with the respondent, the interview questions, consent form and explanatory email on how to answer the questions was emailed to the respondent. Once the respondent completed the questions they were requested to scan to email the answers and consent form to the researcher. In these cases, the interview would then become part of the questionnaire, but included the open-ended questions which were specific to the interviews. The open-ended questions were designed to explore factors not included in the cost factor table which influenced the decisions to invest in the green commercial building the respondents were involved with.

The interview questions were split into four parts. The first part requested respondent's particulars such as name, position, company they worked for, the project they worked on and the years of experience in their respective field. This information was used to demonstrate the respondent's demographics while maintaining and confidentiality and anonymity as per the ethics requirements of the research. The second part consisted of five questions, whereby Question (1) and (2) designed to determine the level of awareness and experience of the respondent with reference to green buildings. Question (3) was a determinant question as it confirmed whether the respondent was involved with the project from inception, this was a requirement of the study. Should the respondent not have been involved from the inception of the project then they would not have been aware of what factors affected decision making processes from the start of the project where most important decisions are made. Question (4) and (5) were designed to address the nature and

occurrence of the cost factor in general by requesting the respondent to state "if they were aware of factors which influenced the decision for owners to invest in a green buildings" and "how they became aware of the factors". The third part consisted of the cost factor table already described in detail. The fourth part of the interview consisted of four open-ended questions designed to determine the respondents view and perception of the cost and other factors towards green commercial buildings. Question (7.1) and (7.2) were designed to address the stakeholder's perception to determine which life cycle stage of the project cost factors is most influential in investment decision for the project in question. Question (8.1) and (8.2) requested the respondent to name any other cost related factor they deemed important and influential, which was not part of the original cost factor table, and state why they deemed it important and influential. Question (9.1) and (9.2) requested the respondent state what non-cost related factors they felt were highly influential in the decision to invest in this green project and why. Questions 8 and 9 were designed to address the influence of the cost factor. Question (10.1) and (10.2) required respondents to confirm whether environmental or cost related factors were most influential when making the decision to invest in this green project and why. These questions were designed to determine the stakeholder's perception of green commercial buildings, as well as to identify which other factors influenced the decision in investing in the green commercial project which had not been identified by the researcher based on the respondent's experience in this green project and other green projects.

Questionnaire

The same process for contacting respondents for interviews was adopted for the questionnaire, however in addition to the documents an explanatory email was also included which described a step-by-step process on how to complete the questionnaire, see Appendix under Questionnaire Explanatory Email for the sample email.

Respondents were then requested to scan and email the complete questionnaire together with the signed consent form back to the researcher. In some instances the respondents requested further identification of the researcher hence the ethical clearance certificate was emailed to the respondents. Should the respondents not have accepted the clearance certificate as proof of research then a letter from the researcher's supervisor would have been requested, however this was not required for any of the respondents.

The questionnaire was split into two parts. The first part was as per the interview first section, requesting respondent's particulars such as name, position, company they worked for, the project

they worked on and the years of experience in their respective field. The second part consisted of the cost factor table questions described in section 3.2.2.

3.3. Issues of Reliability and Validity

Reliability and validity from the data was minimised through the use of various techniques adopted for qualitative and quantitative research methods. Since this study adopted the mixed method approach, the issues of reliability and validity for qualitative and quantitative data sets needed to be addressed separately as defined by (Sandelowski, 2000).

The open-ended questions forming part of the interviews only dealt with issues of reliability through qualitative measures, while Likert type data and dichotomous data (Yes and No answers) were deal with quantitative measures. Both methods are described below. Sample size was also dealt with separately in terms of validity and credibility of the research.

3.3.1. Triangulation

The mixed method approach uses triangulation of qualitative and quantitative sources, data and results to minimize the effects of reliability and validity through convergence of the two methods (Golafshani, 2003).

3.3.2. Qualitative Data

The open-open ended questions which formed part of the interview were qualitative in nature. Qualitative research presents difficulties in dealing with issues of reliability and validity in the results obtained. The reliability and validity of the qualitative data and results in this research was addressed by conforming to the credibility criteria described by (Tracy, 2010):

Credibility

This refers to the trustworthiness, verisimilitude and plausibility of the research findings (Tracy, 2010). Qualitative results can achieve credibility through four practises as defined by (Tracy, 2010):

1. Thick Description: The study must illustrate in depth cultural meanings and abundant concrete detail.

2. Crystallisation and Triangulation: The results are more credible if multiple sources of data, theoretical frameworks, and types of data collected converge on the same conclusion.

3. Multivocality: The results are more credible if the research includes multiple and varied voices. Qualitative researcher should not put words in respondents mouths, but rather express the viewpoints of the respondents sincerely

4. Member reflection: The researcher seeks to gain credibility by seeking input during the processes of analysing data and producing the report.

3.3.3. Quantitative Data

Cronbach Alpha Test

The Cronbach Alpha test was used to test for internal reliability of the quantitative data. The alpha test was conducted on the Likert type data and the dichotomous data. (Nunally, 1967) described reliability as "the extent to which measurements are repeatable and that any random influence which tends to make measurements different from occasion to occasion is a source of measurement error".

Likert Scale Data

The original 5-point Likert scale was reduced to a 3-point Likert scale as described in section 3.5.3; this reduction in scale increased the internal consistency reliability as stated by (Hinkin, 1995). A supporting article by (Pather & Uys, 2008) state that the larger the number of items in a scale the usual negative response rate, shorter scales minimise bias. Further to this (Cortina, 1993) also suggests that the Cronbach alpha coefficient was a function of the number of items on the scale, hence reducing the Likert scale to 3-points further improves reliability of data.The mean score from a collapse of a Likert scale does not affect the mean or result in any significant decrement in reliability or validity (Jacoby & Matell, 1971). By using parametric tests on Likert style data the robustness of the analysis can be assumed (Sullivan & Artino Jr, 2013).

3.3.4. Sample Size

The sample size was not calculated prior to the research study, rather the margin of error was calculated once all respondent data were captured. The effective margin of error for the number of sample size was calculated based on the following formula, re-arranging the formula to make e (margin of error) the subject of the formula:

$$\frac{\frac{z^2 \times p(1-p)}{e^2}}{1+(\frac{z^2 \times p(1-p)}{e^2 N})}$$

Small sample size issues affected this study and the means to address them were discussed below. The mixed method approach was chosen due to the fact that it lent itself to a small sample size, as was experienced in this study.

3.4. Sampling Techniques

A mix of purposive, convenience and snowball sampling technique were adopted for this research. Purposive sampling is defined by respondents being selected according to a defining characteristic that makes them role players of the data needed of the study (Nieuwenhuis, 2007). This sampling technique was used to identify and locate contact details of the sustainability professionals involved for each of the green projects used for this research. According to (Teddlie & Tashakkori, 2009), purposeful sampling typically uses small sample sizes of 30 or less, as was the case for this research.

The rest of the professionals selected for this research were contacted by means of snowball sampling. In some cases the actual person identified was not part of the project from inception hence they would then share the details of the correct person who was involved from inception. The small sample size of this research lent itself to this type of sampling techniques.

3.4.1. Interviews

Sampling techniques used for interviews varied. As described above, the initial technique used was purposive sampling to determine the three commercial projects samples which fitted the specific criteria defined in section 3.1.2 under Interviews. Secondly from the list of possible projects fitting the criteria convenience sampling was used to select projects closer to the researcher as to minimise time travelled to conduct interviews. Thirdly the specified stakeholders were selected using purposive sampling, as each stakeholder was directly involved in each of the projects selected.

Once the initial stakeholder was contacted, through snowball sampling the rest of the stakeholders for that specific project were contacted via the initial contact. The interviewee, who formed part of the project team then assisted to find and contact other professionals and stakeholders involved in the same project. In some cases the interviewee assisted in finding the contact details or contact the stakeholders involved in the other rest of the selected projects which formed part of the interviews and questionnaires.

The maximum number of sample population for the interviews was 18.

3.4.2. Questionnaires

A similar approach was used on the questionnaires as was done for the interviews, however instead of using convenience sampling techniques to select the green commercial projects in South Africa, Gauteng, all of the available projects fitting into the criteria defined in section 3.1.2 under questionnaire were chosen. The maximum number of projects which conformed to the criteria was 10, while the maximum number of possible respondents for the questionnaire was 60.

It must be noted that the cost factor table questions were part of the interviews and questionnaires, hence by adding the sample population for interviews and questionnaires the total sample population for the cost factor table was effectively 60 + 18 = 78.

3.5. Data Analysis

An in depth literature review was conducted and the information critically reviewed and relevant information extracted. The list of factors related to costs which made up the cost factor table was extracted from such literature.

A descriptive analysis method of the data using central tendency (mean, median, and mode) and variance (standard deviation and variance) was adopted for the cost factor table data comprising of Likert scales and dichotomous responses. The open-ended question responses from the interviews were firstly organised into themes through a software program and the outcomes were grouped into themes and displayed on histograms showing the number of percentage of respondents. The data analysis techniques used for each data source are described in detail below.

3.5.1. Literature study

Factors pertaining to green buildings were extracted from literature through a critical in-depth literature study. Each factor was justified as to why they were related to costs of green construction projects and why they were important to the research. Each factor was then assigned a life cycle stage of the project determined by the researcher.

3.5.2. Qualitative Data

As part of the interview, open-ended questions were asked to each respondent. These open-ended questions were qualitative in nature hence were organised and categorised into themes. The responses from the interviewees were recorded in writing by the researcher in the presence of the interviewee and checked by the interviewee before using the data in analysis. The hand-written

answers from the open-ended questions during the interviews were transcribed onto Microsoft Excel by the researcher. These transcribed answers were imported to a software program 'Qualtrics' where word cloud illustrations were used to identify topics and themes for each question response. The word cloud was limited to 10 words and conjunction and other non-relevant words were excluded from the analysis, as shown on Figure 1 below. The themes were then imported into the same program which displayed the percentage of response results in the form of a histogram.



Figure 1. Word Cloud Example

The results obtained from the open-ended question responses were compared and displayed using histograms making it easier to interpret the outcomes.

3.5.3. Quantitative Data

The cost factor table questions which formed part of both interviews and questionnaires were quantitative in nature. Descriptive, parametric analysis was used using central tendency and variance as a means to interpret the results and extract meaningfulness in order to achieve the research objectives. (Sullivan & Artino Jr, 2013) conclude that parametric tests can be used to analyse Likert scale responses, hence was justifying this research methods. As defined by (Boone & Boone, 2012) mean score is used to define central tendency however mode and median also aid to define central tendency for Likert scale research. The mean, median and mode results defined which factor had a higher score for specific questions. The mean score and frequency of responses was used as the primary source of ranking results. The standard deviation, as defined by (Boone & Boone, 2012), can be used to define variance. The standard deviation was used to differentiate between factors with the same mean score and the factor with the lowest standard deviation and

variance was ranked higher than another factor with the same mean. The lower the standard deviation and variance score the more confidence on that score. The mode analysis describes the most frequent response in the array while the median describes the data centre in the array of data arranged in order by size. The median and mode was analysed for each of the array of responses and compared to the mean value to validate the credibility of the results. Such parametric tests on Likert type responses are defined as robust by (Sullivan & Artino Jr, 2013), as they yield unbiased answers that are close to the actual truth.

The original set of data consisted of respondent's responses based on a 5-point Likert scale (1-not at all influential, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential) however, due to a small sample size of respondents it was more concise to collapse the results from the original scale to a 3-point Likert scale while maintaining the performance of the reduced scale to the original. . This reduction in Likert scale was justified from the study by (Jeong & Lee, 2016) which suggests that collapsing from 5-point to a 3-point could replace the original scale in the analysis phase of a study. This suggestion by (Jeong & Lee, 2016) was made based on a similar performance between the original scale and reduced scale, noting the correlation coefficient was higher than 0.9. The reduction in scale can also improve reliability as suggested by (Cortina, 1993).

The researcher found that respondents were sometimes not sure what the difference was between the Likert scale numbers, hence used 3 as a means of uncertainty towards the question. The five point Likert scale was converted to a three point Likert scale by the following formula as per the study by (Jeong & Lee, 2016):

5-point Likert scale score of 1 or 2 = 1 on the 3-point Likert scale (not influential)

5-point Likert scale score of 2 = 2 on the 3-point Likert scale (somewhat influential)

5-point Likert scale score of 4 or 5 = 3 on the 3-point Likert scale (very influential)

The total number of respondents for the research was 26. However, in some cases, the respondent was not aware of the factor or the factor did not affect the decision making process. . The mean, median, mode, standard deviation and variance calculations were based on the quantity of responses for each factor from Questions (6.1) and (6.2), as the questions following were dependant on both Question (6.1) and (6.2) being answered 'Yes'. If either of Questions (6.1) or (6.2) were answered as 'No' then the rest of the questions would not asked and the respondent was requested to move to the next cost factor

3.6. Research Ethics

Ethical issues in recent research have been focusing on the collection of data from human subjects and the storage, use and disposal of those data (Fellows, 2015). (Fellows, 2015) Ethics is defined as an extension of legal attention to data protection and intellectual property (Fellows, 2015)

In order to be ethically and morally correct, a research study needs to comply to various ethical requirements, usually determined by the educational institution whereby the study is being done through. Plaigerism was one of the main ethical issues which needed to be addressed as past knowledge needs to be credited correctly. There were three main bodies of ethics which needed to be addressed namely: theory and literature, data collection, use and disposal. A good researcher should also state their plan towards complying with ethics within the research.

3.6.1. Theory and Literature

Past literature and theory used within the research was referenced and cited correctly, while copyright was adhered to in the event that the information used was protected by a copyright.

3.6.2. Data collection, use and disposal

An important area of ethics was the data collection, use and disposal. These three issues were dealt with ethically. There are three general principles for the ethical conduct for research (as cited in Fellows, 2015):

- Informed consent;
- Assessment of risk and benefits,
- Selection of subjects.

Informed consent:

Participation was voluntary for all subjects and was communicated to each respondent. Information was sent to each respondent informing them of the research and consent was requested from each respondent before they undertook to participate in the research.

Assessment of risk and benefits:

Generally, if there were any favourable net benefits from the research to the researcher and subjects, then the research should proceed. However, if there were one or more risks with significant probability of occurrence, possibly leading to severe risk, then the research would not proceed (Fellows, 2015).

Selection of subjects:

A letter included the request for the consent to participate in the study as well as contact information on the complaint notification body which the subject could issue complaints to.

3.6.3. Ethical Plan for Research

Taking into account the guidelines stipulated above in 3.6.1 and 3.6.2, the following plan is proposed in order for the research to comply ethically:

- A preamble and background about the research was presented to subjects prior to them accepting to take part;
- Information about the questions was presented to subjects, see Appendix under Information Document for the actual information document distributed to potential respondents;
- Written consent was requested from the company and subjects, stating that they undertake to be part of the research, by voluntary means, see Appendix under Consent Form to see the actual consent form used;
- Written consent was requested to record interviews;
- Once interviews are conducted, the findings will be shown to the respondents for approval before being used in research;
- No minors was questioned or interviewed, unless given consent by a legal guardian or parent;
- Interviews and questionnaire questions were pre-approved by the Wits ethical committee as well as the subjects;
- Ethical clearance was achieved from Wits then from the subjects before any research commenced, see section under Appendices for the ethical clearance certificate issued by the university
- Confidentiality was guaranteed;
- Anonymity was ensured for all subjects ;
- Data stored was safeguarded and preserved from unauthorised access,
- Data was preserved in an archive or personal collection.

If there were any significant changes to the research which might impact the ethical and morality of the research, then these changes had to be presented to the notification body of the University of the Witwatersrand and ethical approval for these changes sought.

4. RESEARCH RESULTS

The research question was defined as “how can stakeholders invest in green projects in South Africa unless they fully understand the nature and occurrence of factors and how such factors influence their decision to invest in green commercial projects”. In order to answer the proposed research question three objectives were defined. The aim of the research was to determine the influence, nature and occurrence of such factors towards investing in green commercial buildings in South Africa, Gauteng. The results of the research were used to achieve these objectives through the methods designed and described in section 3 of the research.

Findings from the literature review presented 27 financial related factors which were found to potentially influence the decision to invest in green commercial buildings. The empirical data was collected by means of a survey comprising of both interviews and questionnaires, and results from the empirical data analysis was used to achieve the objectives and address the proposed research question. The primary tool used to achieve the set objectives was the cost factor table questions which aimed to rank each factor based on the level of influence specified by the respondents.

From a possible 14 green commercial projects in South Africa, Gauteng certified by the GBCSA and which met the stipulated criteria, three were chosen for the interview process and the remainder for the questionnaire. From the 14 projects, two were in fact one project with the same team involved, hence a total of 13 projects were considered for use for the surveys. For each project a total of 6 stakeholders were identified to be interviewed, yielding a maximum of 18 respondents. A total of 14 respondents were interviewed, representing a 78% success rate. For the questionnaire, a maximum of 60 respondents could be interviewed however, only 12 completed the questionnaire, representing a20% success rate. When results from the cost factor table were merged, extracted from interviews and questionnaires, a total of 26 respondents out of a maximum of 78 responded, resulting in a 33% success rate. This response rate was not ideal however was justified in section 5.4.1. Most respondents who did not participate in the questionnaire were not reachable.

The results from the cost factor table questions from interviews and questionnaires were combined to yield a maximum number of responses. As part of the cost factor table questions, respondents were requested to rate each factor on the level of influence for specific questions. A five point Likert scale was used to complete the majority of questions presented on the cost factor table, however later the results were reduced to a three point Likert scale. From the raw data, results were extracted and sorted taking into account the objectives addressed by the questions, and described how the results aimed to answer the research question. The following sections present the data, illustrate the analysis, and display the results. During interviews factor 6 and 8 ‘occupying cost

savings' and 'reduction in operating costs' were found to be similar in nature by respondents and was regarded as the same factor. The results from the data analysis are presented according to the stated objectives.

4.1. Summary of Results

Table 6 summarises results from the data analysis extracted from the cost factor table data. The questions at the top of the table were colour coded in colours corresponding to the legend at the bottom of the table specifying which research objectives the questions were designed to address, as per Table 5. The cost factors are listed with their original factor number corresponding to Table 1 and Table 2. The factors highlighted in red (5, 7, 17, 18, 19, 20 and 26) were excluded from the results due to a low awareness or low influence on the decision making process. This was shown on Table 8 and Table 12 respectively. The mean results from the Likert scale analysis were displayed on the summary table and highlighted with conditional formatting showing the highest mean score in green and lowest in red.

Question (6.1) 'awareness of factor' percentage of awareness was calculated by the number of respondents answering 'yes' to the question. Question (6.2) percentage was calculated the same as (6.1), however respondent were required to be aware of the factor before answering 'yes' to question (6.2). For Questions (6.3), (6.6 to 6.10) a five point Likert scale was used which was reduced to a three point Likert scale during the analysis in order to create a more decisive ranking as justified in section 3.3. The now-reduced three-point Likert scale responses were tallied up, and the mean, median, mode, standard deviation and variance were calculated using Microsoft Excel. Question (6.3) requested respondents to rate the frequency of how often the cost factor was discussed during decision making processes to invest in the green building. Question (6.4) requested respondents to state which life cycle stage each cost factor affected; the outcome was determined by tallying up the majority of responses by respondents. Question (6.5) requested respondents to categorise each cost factor as a challenger or enabler. The outcome of the responses was based on a majority percentage for either enabler or challenger; however some factors had similar percentages and were therefore confirmed as either. Questions (6.6) to (6.10) outcomes were calculated as per Question (6.3). Question (6.11) was excluded due to a lack of response.

The summary of cost factor table results was sorted from the highest percentage to the lowest for results to Question (6.2) "Did factor affect decision making process". The table was sorted in this method as Question (6.2) was deemed the most important. The higher the percentage for Question (6.2) meant the higher the total number of respondents which found the factor to affect the decision-making process to invest in green buildings. The top four cost factor results for Questions

(6.3), (6.6 to 6.10) were all found to have similar results and could only be differentiated by the percentage result to Question (6.2). The following sections in the report discuss the results of the cost factor table in more details, grouping the results to the objectives of the study.

Table 6. Summary of Cost Factor Table Results

		(6.1)	(6.2)	(6.3)	(6.4)	(6.5)	(6.6)	(6.7)	(6.8)	(6.9)	(6.10)
No	Factor	Awarness of factor	Did factor affect decision making process	Frequency of factor (1-3)	Lifecycle stages	Enabler (E) or challenger (C)	Impact on Time (1-3)	Impact on Quality (1-3)	Impact on Client Satisfaction (1-3)	Impact on Sustainability (1-3)	Impact on Overall Project (1-3)
8	Lower operating costs	96%	85%	2,68	Operation	E	1,50	1,77	2,86	2,82	2,55
21	Water use reduction	100%	81%	2,38	Operation	E	1,29	1,62	2,57	2,86	2,29
6	Occupying cost saving	81%	77%	2,70	Operation	E	1,45	1,85	2,60	2,75	2,45
9	Rising energy costs	92%	77%	2,70	Operation	E	1,45	1,65	2,50	2,65	2,35
2	Higher return on investment	85%	62%	2,63	Inception	E	1,13	1,81	2,44	2,38	2,31
4	Increased property value	100%	62%	2,38	Residual Value	E	1,25	2,13	2,94	2,69	2,56
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	77%	62%	2,88	Residual Value	E	1,19	1,63	2,50	2,69	2,38
3	Increased rental amount	88%	58%	2,33	Operation	E	1,13	1,67	2,60	2,40	2,33
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	88%	58%	2,73	Sale	E	1,33	1,73	2,60	2,67	2,47
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	88%	54%	2,36	Inception	C	1,79	1,86	2,14	2,71	2,36
25	Increases worker productivity	73%	54%	2,50	Operation	E	1,43	1,79	2,71	2,57	2,43
1	Renewable technology costs reducing as more people start implementing the green technology	88%	50%	2,77	Construction	E and C	1,31	1,92	2,46	3,00	2,46
10	Challenge with split between capital expenditure and operating cost savings	73%	50%	2,69	Operation	E and C	1,46	1,54	2,38	2,46	2,38
12	Availability, cost and difficulty in identifying green products, materials and technologies	77%	46%	2,50	Construction	C	2,00	2,00	2,25	2,67	2,42
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	77%	46%	2,50	Inception/Operation	E and C	1,58	1,75	2,58	2,25	2,33
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	73%	42%	2,18	Operation	C	1,45	1,45	2,36	2,55	2,09
16	Cost associated in introducing a green building professional to the professional team	96%	42%	2,45	Inception	E and C	1,36	1,64	2,36	2,45	2,45
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	65%	42%	2,55	Inception	C	1,73	1,82	2,09	2,00	2,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	65%	38%	2,60	Inception	E and C	1,20	1,40	1,80	2,40	1,70
27	Exchange rate	77%	38%	2,50	Inception	C	1,70	1,70	1,80	1,90	1,70
7	Minimizing the costs and impacts of churn	50%	27%								
20	Lack of understanding from clients regarding the actual benefits from going green	50%	23%								
26	Fuel price	62%	23%								
5	Payback period for investment is relatively good if incentives exist in country	69%	19%								
17	No private financial incentives available for going green in South Africa	77%	15%								
19	External funding or incentives available from government for implementing green technology on a small-scale	27%	4%								
18	FIT (Feed in tariff) system	46%	0%								

Legend
Nature and Occurance
Stakeholder Perception
Influence of Factors

Table 7 summarises results from the interview open-ended questions. As per results from the cost factor table questions, the interview questions were colour coded to the three research objectives the questions were designed to address, as per Table 5.

The answers for Question (5) were shown to be 'due to client and tenant requirements'. The life cycle stage perceived to be most important was inception, and the subsequent reason was that planning and control was done during this stage of the project. Respondents could not come to a conclusion regarding any other cost related factors which influenced the decision to invest in green building (Question (8.1)), hence no reason was given. Question (9.1) required respondents to state which non-cost related factor they thought of as being influential when taking a decision to invest in a green commercial building. The outcome was 'location to public transport' which was chosen due to 'Marketing' reasons. Respondents perceived that environmental factors influenced the decision to invest in green commercial buildings more than financial factor (Question 10.1) due to the fact that clients perceived to be more environmentally conscious (Question 10.2).

The following sections discuss the results for each question in more details, grouping the results with reference to the objectives of the study.

Table 7. Summary of Qualitative Results

	Question (5)	Question (7.1)	Question (7.2)	Question (8.1)	Question (8.2)	Question (9.1)	Question (9.2)	Question (10.1)	Question (10.2)
Responses	How did you become aware of these factors	At what stages of the life cycle of the project are cost related factors most influential when referring to the investment decision in the project?	Reason to answer of Question 7.1	What other cost related factors can you describe from your experience in the project which are not stated in the table in question 6? (please note the factors need to have influenced the decision making of the stakeholders in	Reason to answer for 8.1	What other non-cost related factors influenced the decision making of the stakeholders in the project?	Reason to answer for 9.1	In your opinion what type of factors (cost/environmental) were the main drivers in the ultimate decision to invest in this green project?	Reason to answer for 10.1
1	Client Requirements	Inception	Planning and control	None	-	Location to public transport	Marketing	Environmental	Environmentally concious
2	Tenant Requirements								

Legend
Nature and Occurance
Stakeholder Perception
Influence of Factors

4.2. Nature and Occurrence of Cost Factors

The nature and occurrence of the cost factors was determined through the analysis of data from each of the following questions designed to specifically address this objective as described in section 3.2 and summarised on Table 5:

- How did respondents become aware of factor which influenced the decision for the client/owner to invest in a green commercial building - Question (5);
- The level of awareness for each of the cost related factors – Question (6.1);
- The level of influence each factor has on the decision making process for the project – Question (6.3),
- What life cycle stage of the project was affected by the cost factor - Question (6.4).

4.2.1. Origin of Factor Awareness

The raw data from the interviews for question (5) were listed and inserted into the software program 'Qualtrics'. Using the word cloud option within 'Qualtrics', and filtering out conjunctions and meaningless words, the themed results were extracted as shown on Figure 2. These results were then displayed on Figure 3 in the form of a histogram to make it practical to extract meaningful results



Figure 2. Origin of Factor Awareness Themes

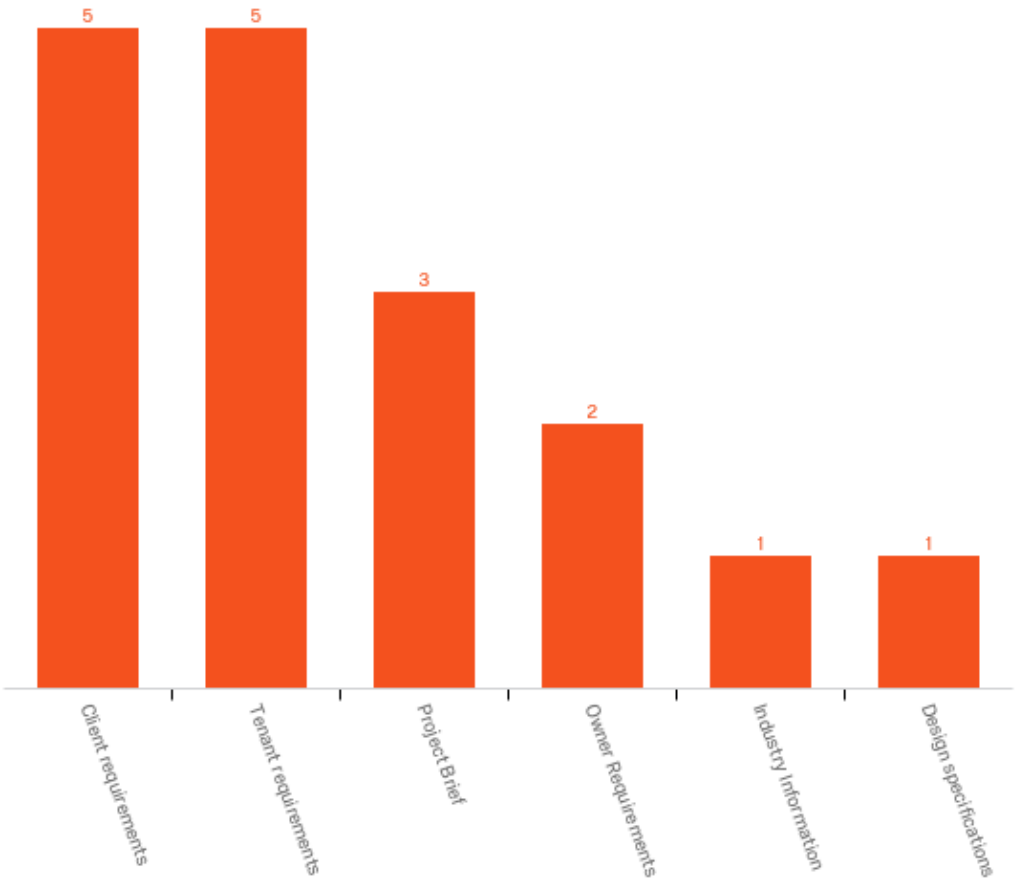


Figure 3. Origin of Awareness of Factors

From the themes extracted in the word cloud, t the top six reasons were displayed on Figure 3. The two reasons showing the highest score were 'client requirements' and 'tenant requirements' both with 5 responses each. These were recorded in the summary section of the results on Table 7.

4.2.2. Awareness Level of Cost Factors

From the cost factor table analysis, Table 8 presented the level of awareness of respondents for each cost factor as a percentage of the total number of responses. The table was sorted to display the cost factor with the most percentage at the top, and the lowest percentage at the bottom.

Table 8. Awareness Level of Cost Factors

No	Factor	Y%	Rank
4	Increased property value	100%	1
21	Water use reduction	100%	1
8	Lower operating costs	96%	3
16	Cost associated in introducing a green building professional to the professional team	96%	3
9	Rising energy costs	92%	5
1	Renewable technology costs reducing as more people start implementing the green technology	88%	6
3	Increased rental amount	88%	6
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	88%	6
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	88%	6
2	Higher return on investment	85%	10
6	Occupying cost saving	81%	11
12	Availability, cost and difficulty in identifying green products, materials and technologies	77%	12
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	77%	12
17	No private financial incentives available for going green in South Africa	77%	12
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	77%	12
27	Exchange rate	77%	12
10	Challenge with split between capital expenditure and operating cost savings	73%	17
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	73%	17
25	Increases worker productivity	73%	17
5	Payback period for investment is relatively good if incentives exist in country	69%	20
11	Current cost of coal energy is less than renewable energy cost in South Africa	65%	21
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	65%	21
26	Fuel price	62%	23
7	Minimizing the costs and impacts of churn	50%	24
20	Lack of understanding from clients regarding the actual benefits from going green	50%	24
18	FIT (Feed in tariff) system	46%	26
19	External funding or incentives available from government for implementing green technology on a small-scale	27%	27

The top five factors, two of which 100% of respondents were aware of, were factor 4 and 21 ‘increased property value’ and ‘water use reduction’ respectively, the third and fourth factors were factor 8 and 16 with 96% each and the fifth factor with 92% was ‘rising energy costs’.

4.2.3. Frequency of Occurrence of Factor

From the cost factor table analysis, Table 9 was created, presenting the frequency of occurrence for each of the cost factors, based on the three-point Likert scale. The table was sorted in two ways. Firstly from the highest mean score and secondly by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 9. Frequency of Factor

(6.3) Frequency of Factor						
No	Factor	Mean	SD	Var	Median	Mode
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	2,88	0,50	0,25	3,00	3,00
1	Renewable technology costs reducing as more people start implementing the green technology	2,77	0,44	0,19	3,00	3,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	2,73	0,59	0,35	3,00	3,00
6	Occupying cost saving	2,70	0,57	0,33	3,00	3,00
9	Rising energy costs	2,70	0,57	0,33	3,00	3,00
10	Challenge with split between capital expenditure and operating cost savings	2,69	0,48	0,23	3,00	3,00
8	Lower operating costs	2,68	0,57	0,32	3,00	3,00
2	Higher return on investment	2,63	0,62	0,38	3,00	3,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	2,60	0,70	0,49	3,00	3,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	2,55	0,82	0,67	3,00	3,00
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,50	0,67	0,45	3,00	3,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	2,50	0,80	0,64	3,00	3,00
25	Increases worker productivity	2,50	0,76	0,58	3,00	3,00
27	Exchange rate	2,50	0,71	0,50	3,00	3,00
16	Cost associated in introducing a green building professional to the professional team	2,45	0,82	0,67	3,00	3,00
21	Water use reduction	2,38	0,86	0,75	3,00	3,00
4	Increased property value	2,38	0,81	0,65	3,00	3,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	2,36	0,74	0,55	2,50	3,00
3	Increased rental amount	2,33	0,62	0,38	2,00	2,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	2,18	0,75	0,56	2,00	2,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were identified as factor 23, 1, 24, 6 and 9 which were 'Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future', 'Renewable technology costs reducing as more people start implementing the green technology', 'Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future', 'Occupying cost saving' and 'Rising energy costs'. The mean values were on the upper side of 2.7 close to 3. Median and modal scores were 3 for all five factors, SD varied from 0.44 to 0.59 and variance from 0.19 to 0.33

The factor numbers highlighted in red were excluded and subsequent results omitted.

4.2.4. Cost Factor Life cycle Stage

From the cost factor table analysis, Table 10 presents the results from Question (6.4), and summarises the perception of the stakeholders with respect to the life cycle stage with which each factor was associated.

Table 10. Life cycle Stage Specific to each Cost Factor

(6.4) Lifecycle Stages		
No	**Factor**	**Confirmed Stage**
1	Renewable technology costs reducing as more people start implementing the green technology	Construction
2	Higher return on investment	Inception
3	Increased rental amount	Operation
4	Increased property value	Residual Value
5	Payback period for investment is relatively good if incentives exist in country	Inception
6	Occupying cost saving	Operation
7	Minimizing the costs and impacts of churn	Operation
8	Lower operating costs	Operation
9	Rising energy costs	Operation
10	Challenge with split between capital expenditure and operating cost savings	Operation
11	Current cost of coal energy is less than renewable energy cost in South Africa	Inception
12	Availability, cost and difficulty in identifying green products, materials and technologies	Construction
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Inception
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Operation
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Inception/Operation
16	Cost associated in introducing a green building professional to the professional team	Inception
17	No private financial incentives available for going green in South Africa	Inception
18	FIT (Feed in tariff) system	
19	External funding or incentives available from government for implementing green technology on a small-scale	Inception
20	Lack of understanding from clients regarding the actual benefits from going green	Inception
21	Water use reduction	Operation
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Inception
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Residual Value
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Sale
25	Increases worker productivity	Operation
26	Fuel price	Inception
27	Exchange rate	Inception

It can be seen from Table 10 above, that the majority of factors are associated to the operational stage of the project.

4.3. Stakeholders' Perception of Cost Factors

The stakeholders' perception of the cost factors was determined through the analysis of data from each of the following questions designed to specifically address this objective as described in section 3.2 and summarised on Table 5:

- Is the cost factor perceived as a challenge or enabler - Question (6.5);
- What stage is perceived as most influential when referring to investment decision in green commercial building, and what was the reason – Question (7.1) and (7.2),
- What type of cost factor (cost or environmental) was regarded as the nature of the factors driving investments in green commercial buildings, and what was the reason – Question (10.1) and (10.2).

4.3.1. Enabler or Challenge

From the cost factor table analysis, each cost factor was classified as a challenge or an enabler with respect to green commercial building investments. In most cases, the respondents classified each factor as either one; however in some instances the respondents identified a cost factor could be both an enabler and a challenge.

The classification of each cost factor into an enabler or challenge was based on the percentage of responses. Table 11 shows the percentage of responses for each factor into an enabler or challenge. Where response percentages were clear it the factor was defined as either an enabler or challenge, however factors 1, 10, 11, 15 and 16 the percentages between enabler and challenge were too close, hence they were determined to have been classified as both enabler and challenge.

Factors highlighted in red, 5, 7, 17, 18, 19, 20 and 26 were excluded due to low general response rate, as explained in section 4.1, and results were omitted from being displayed on the table.

Table 11. Enabler/Challenge Classification

(6.5) Factor enabler or challenge							
No	Factor	Outcome (E or C)	Total response	Enabler (E)	Enabler %	Challenger (C)	Challenger %
1	Renewable technology costs reducing as more people start implementing the green technology	E and C	16	9	56%	7	44%
2	Higher return on investment	E	19	15	79%	4	21%
3	Increased rental amount	E	18	15	83%	3	17%
4	Increased property value	E	18	13	72%	5	28%
5	Payback period for investment is relatively good if incentives exist in country						
6	Occupying cost saving	E	22	19	86%	3	14%
7	Minimizing the costs and impacts of churn						
8	Lower operating costs	E	23	19	83%	4	17%
9	Rising energy costs	E	25	16	64%	9	36%
10	Challenge with split between capital expenditure and operating cost savings	E and C	16	9	56%	7	44%
11	Current cost of coal energy is less than renewable energy cost in South Africa	E and C	13	6	46%	7	54%
12	Availability, cost and difficulty in identifying green products, materials and technologies	C	15	5	33%	10	67%
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	C	17	5	29%	12	71%
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	C	12	4	33%	8	67%
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	E and C	13	6	46%	7	54%
16	Cost associated in introducing a green building professional to the professional team	E and C	14	8	57%	6	43%
17	No private financial incentives available for going green in South Africa						
18	FIT (Feed in tariff) system						
19	External funding or incentives available from government for implementing green technology on a small-scale						
20	Lack of understanding from clients regarding the actual benefits from going green						
21	Water use reduction	E	25	18	72%	7	28%
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	C	14	3	21%	11	79%
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	E	18	16	89%	2	11%
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	E	18	15	83%	3	17%
25	Increases worker productivity	E	15	12	80%	3	20%
26	Fuel price						
27	Exchange rate	C	12	2	17%	10	83%

4.3.1. Most Influential Life cycle Stage

Themes from interview Question (7.1) were extracted using the word cloud option in 'Qualtrics' shown on Figure 4. The interview responses were then grouped into the themes and results displayed on Figure 5 in the form of a histogram.



Figure 4. Relevant Life Cycle Stage Themes

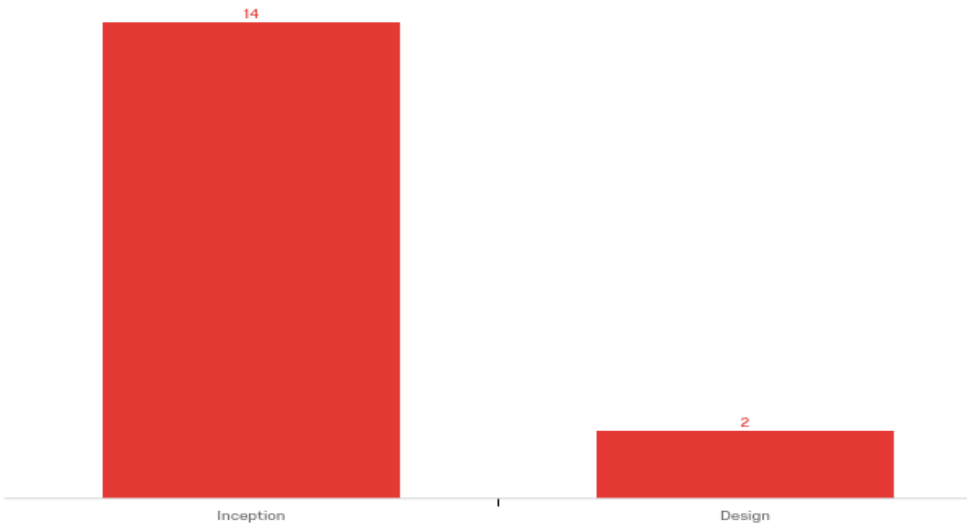


Figure 5. Relevant Life cycle Stage

There were, in total, two life cycle stages identified by respondents as being the most influential with respect to investment decisions, namely 'Inception' and 'Design'. 'Inception' had 14 responses while 'Design' had two.

Question (7.2) required respondents to state a reason as to why respondents had chosen the stages for Question (7.1). Themes were again extracted using the word cloud option in 'Qualtrics' showed in Figure 6. The interview responses were then grouped into the themes, and results displayed in Figure 7, in the form of a histogram.



Figure 6. Reason for Relevant Life Cycle stage Themes

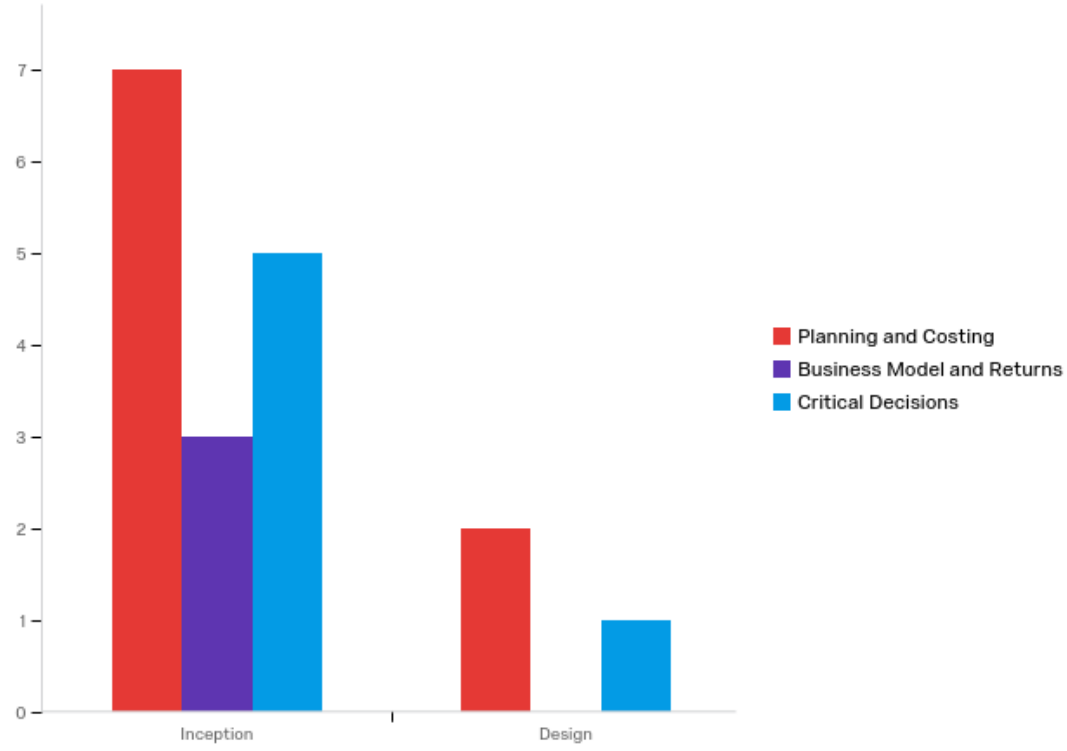


Figure 7. Reason for Relevant Life Cycle Stage

The three main topics identified by respondents were: 'business model and returns', 'critical decisions', 'planning and control'. The x-axis of the histogram represents the two choices of responses from Question (7.1). The bars with colours represent the reason for each response from Question (7.1). The main reason for identifying the 'inception' stage as the most important and used in the results was 'planning and control'.

It must be noted that the total of responses between Question (7.1) and (7.2) differ, due to some respondents finding two or more reasons for the same life cycle stage, identified in Question (7.1).

4.3.2. Nature of Main Driving Factor

Question (10.1) requested respondents, based on their perception and experience on the project involved in, to identify the nature of the main driving factor, leading to investors investing in the green project. Themes were extracted, using the word cloud option in 'Qualtrics', as shown on Figure 8. The interview responses were then grouped into the themes, and results displayed on Figure 9, in the form of a histogram.



Figure 8. Nature of Main Driving Factor Themes

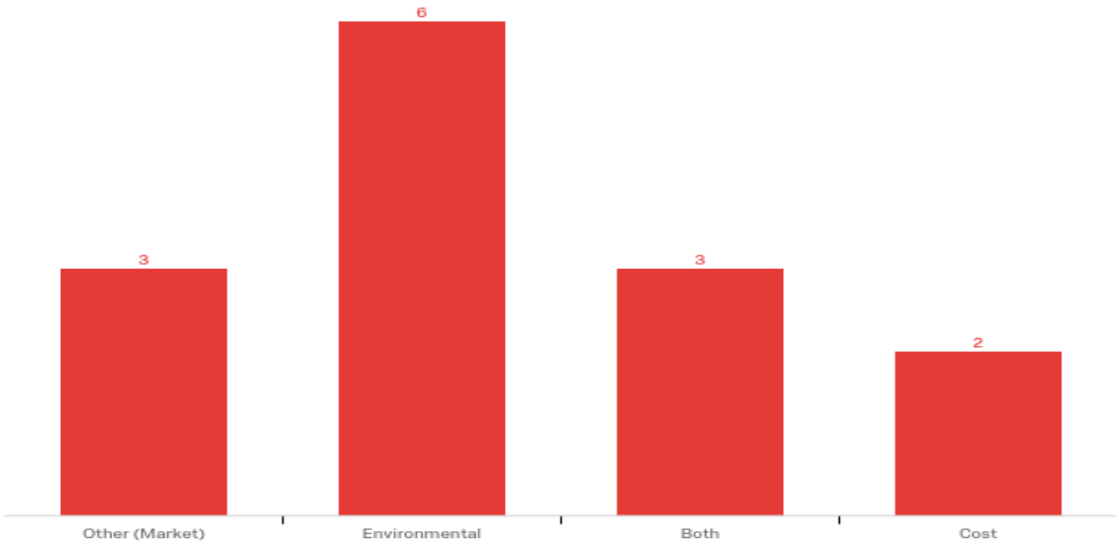


Figure 9. Nature of Main Driving Factor

The majority of respondents perceived 'environmental' nature of the main driving factors for investments towards green projects, while 'cost' was found to have the least number of responses for the same question.

Question (10.2) required respondents to state as to why they had chosen that nature of driving factors for Question (10.1). Themes were again extracted, using the word cloud option in 'Qualtrics', as shown on Figure 10. The interview responses were then grouped into the themes, and results displayed. The results of Question (10.2) are shown in histogram form Figure 11, below.



Figure 10. Reason for Nature of Main Driving Factor Themes

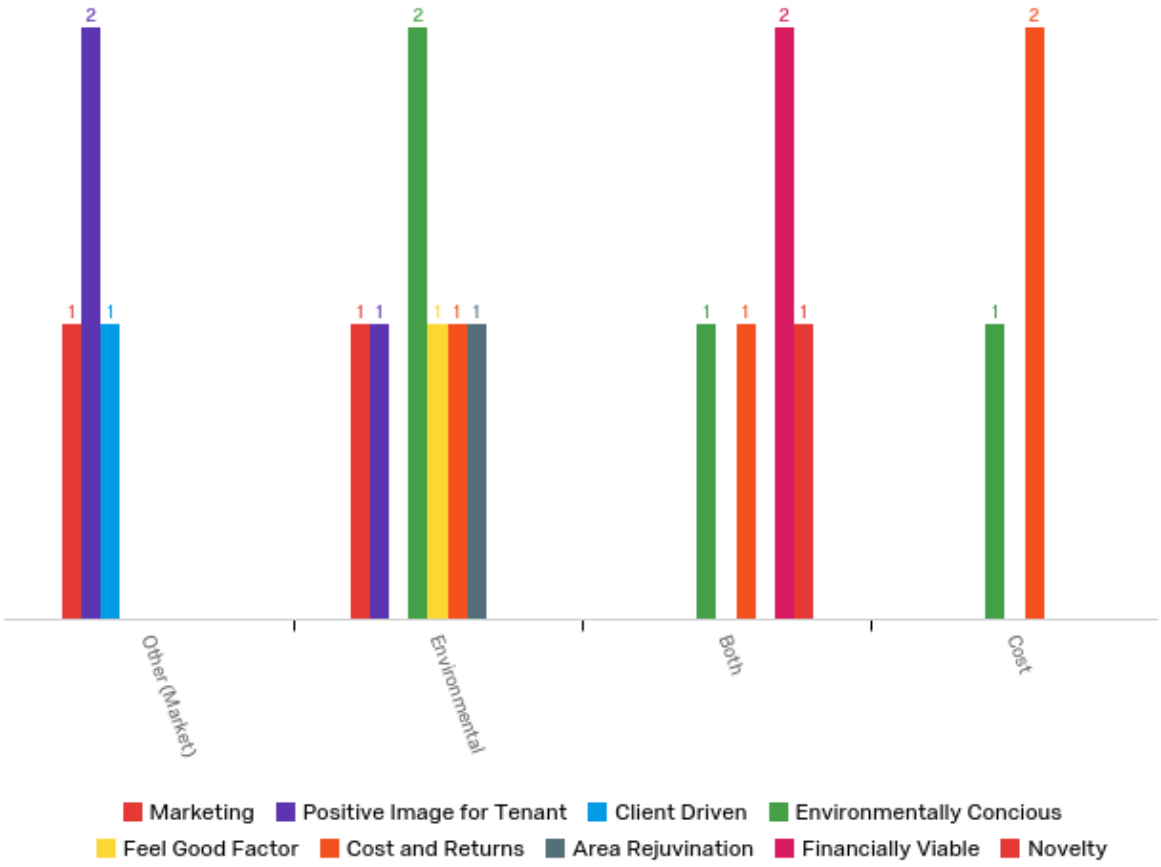


Figure 11. Reasons for main driving factor nature

The x-axis of the histogram represents the four response outcomes from Question (10.1). The coloured bars represent the reasons for Question (10.1) responses. From Figure 11, the main driving factor nature was identified by the majority as environmental. there was however, no clear reason as to why respondents identified the environmental factors as the main drivers nature towards investment decisions for green commercial projects as only two individual respondents agreed that 'environmentally conscious' was one of the reasons as to why they chose environment as the nature of the main driving factors. The other reasons had one response each.

It was noted that the total number of responses between Question (10.1) and (10.2) are not the same, the reason for this discrepancy was due to some respondents were of the opinion that there existed two or more reasons for the determining the nature of the driving factor in Question (10.1).

4.4. Influence of Cost Factors in Investment Decisions

The influence of each cost factor was determined through the analysis of data from each of the following questions designed to specifically address this objective as described in section 3.2 and summarised on Table 5:

- Did the factor affect the decision-making process for the project? - Question (6.2);
- What was the impact of factor on time of project? – Question (6.6);
- What was the impact of factor on quality of project? – Question (6.7);
- What was the impact of factor on client satisfaction of project? – Question (6.8);
- What was the impact of factor on sustainability of project? – Question (6.9);
- What was the impact of factor on overall project? – Question (6.10);
- What were other influential cost factors and reason for these factors? – Question (8.1) and (8.2),
- What were the influential non-cost related factors and the reason for these factors? – Question (9.1) and (9.2).

4.4.1. Influence on Decision Making Process

From the cost factor table analysis, Table 12 present the level of influence on the decision-making process for each of the cost factors, displayed as a percentage of the total number of respondents. The table was sorted to display the cost factor with the most percentage at the top and the lowest percentage at the bottom.

Table 12. Influence on Decision Making Process

(6.2) Did factor affect decision making process			
No	**Factor**	**Y%**	**Rank**
8	Lower operating costs	85%	1
21	Water use reduction	81%	2
6	Occupying cost saving	77%	3
9	Rising energy costs	77%	3
2	Higher return on investment	62%	5
4	Increased property value	62%	5
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	62%	5
3	Increased rental amount	58%	8
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	58%	8
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	54%	10
25	Increases worker productivity	54%	10
1	Renewable technology costs reducing as more people start implementing the green technology	50%	12
10	Challenge with split between capital expenditure and operating cost savings	50%	12
12	Availability, cost and difficulty in identifying green products, materials and technologies	46%	14
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	46%	14
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	42%	16
16	Cost associated in introducing a green building professional to the professional team	42%	16
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	42%	16
27	Exchange rate	38%	19
11	Current cost of coal energy is less than renewable energy cost in South Africa	38%	19
7	Minimizing the costs and impacts of churn	27%	21
20	Lack of understanding from clients regarding the actual benefits from going green	23%	22
26	Fuel price	23%	22
5	Payback period for investment is relatively good if incentives exist in country	19%	24
17	No private financial incentives available for going green in South Africa	15%	25
19	External funding or incentives available from government for implementing green technology on a small-scale	4%	26
18	FIT (Feed in tariff) system	0%	27

The top four factors were factors 8, 21, 6 and 9 which are ‘lower operating costs’, ‘water use reduction’, ‘occupying cost saving’ and ‘rising energy costs’ with percentages ranging from 77% to 85%. The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results are excluded.

4.4.2. Impact on Time

From the cost factor table analysis, Table 13 presents the impact of each cost factor on the time of the project, based on a three point Likert scale. The table was sorted in two ways: firstly, from the highest mean score, and, secondly, by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 13. Impact on Time

(6.6) Impact on Time (1-3)						
No	Factor	Mean	SD	Var	Median	Mode
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,00	0,85	0,73	2,00	1,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	1,79	0,80	0,64	2,00	1,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	1,73	0,90	0,82	1,00	1,00
1	Renewable technology costs reducing as more people start implementing the green technology	1,31	0,63	0,40	1,00	1,00
21	Water use reduction	1,29	0,64	0,41	1,00	1,00
27	Exchange rate	1,70	0,95	0,90	1,00	1,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	1,45	0,82	0,67	1,00	1,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	1,58	0,79	0,63	1,00	1,00
8	Lower operating costs	1,50	0,80	0,64	1,00	1,00
10	Challenge with split between capital expenditure and operating cost savings	1,46	0,78	0,60	1,00	1,00
6	Occupying cost saving	1,45	0,76	0,58	1,00	1,00
9	Rising energy costs	1,45	0,76	0,58	1,00	1,00
25	Increases worker productivity	1,43	0,76	0,57	1,00	1,00
16	Cost associated in introducing a green building professional to the professional team	1,36	0,67	0,45	1,00	1,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	1,33	0,72	0,52	1,00	1,00
4	Increased property value	1,25	0,68	0,47	1,00	1,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	1,20	0,63	0,40	1,00	1,00
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	1,19	0,54	0,30	1,00	1,00
3	Increased rental amount	1,13	0,35	0,12	1,00	1,00
2	Higher return on investment	1,13	0,34	0,12	1,00	1,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were = 12, 13, 22, 1 and 21 which were 'Availability, cost and difficulty in identifying green products, materials and technologies', 'Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project', 'Client driven process, hence clients are mostly unwilling to pay additional costs for green technology', 'Renewable technology costs reducing as more people start implementing the green technology' and 'Water use reduction' with mean scores varying from 1.29 to 2, median scores varied from 1 to 2, however the modal scores were all 1. The SD varied largely from 0.64 to 0.90, while variance from 0.40 to 0.82 The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results were excluded.

4.4.3. Impact on Quality

From the cost factor table analysis, Table 14 presents the impact of each cost factor on the quality of the project, based on a three point Likert scale. The table was sorted in two ways. Firstly from the highest mean score and secondly by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 14. Impact on Quality

(6.7) Impact on Quality (1-3)						
No	Factor	Mean	SD	Var	Median	Mode
4	Increased property value	2,13	0,81	0,65	2,00	3,00
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,00	0,85	0,73	2,00	3,00
1	Renewable technology costs reducing as more people start implementing the green technology	1,92	0,95	0,91	2,00	1,00
2	Higher return on investment	1,81	0,83	0,70	2,00	1,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	1,75	0,75	0,57	2,00	1,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	1,73	0,80	0,64	2,00	1,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	1,86	0,95	0,90	1,50	1,00
6	Occupying cost saving	1,85	0,93	0,87	1,50	1,00
8	Lower operating costs	1,77	0,87	0,76	1,50	1,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	1,82	0,98	0,96	1,00	1,00
25	Increases worker productivity	1,79	0,97	0,95	1,00	1,00
27	Exchange rate	1,70	0,95	0,90	1,00	1,00
3	Increased rental amount	1,67	0,90	0,81	1,00	1,00
9	Rising energy costs	1,65	0,81	0,66	1,00	1,00
16	Cost associated in introducing a green building professional to the professional team	1,64	0,81	0,65	1,00	1,00
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	1,63	0,81	0,65	1,00	1,00
21	Water use reduction	1,62	0,80	0,65	1,00	1,00
10	Challenge with split between capital expenditure and operating cost savings	1,54	0,78	0,60	1,00	1,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	1,45	0,82	0,67	1,00	1,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	1,40	0,84	0,71	1,00	1,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were 4, 12, 1, 2 and 15which were ‘Increased property value’, ‘Availability, cost and difficulty in identifying green products, materials and technologies’, ‘Renewable technology costs reducing as more people start implementing the green technology’, ‘Higher return on investment’ and ‘Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology’”. Only factor 4 scored a mean score above 2, while the others were below 2 but in the upper part of 1.75. The modal score for factor 4 and 12 was 3 while others were 1. The median scored 2 for all five factors. The SD varied from 0.75 to 0.95 and variance from 0.57 to 0.91. Factors 2 and 15 were ranked higher than factors 13 and 6 based on the lower SD and variances, even if the mean was slightly higher for factors 13 and 6.The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results were excluded.

4.4.4. Impact on Client Satisfaction

From the cost factor table analysis, Table 15 presents the impact of each cost factor on the client satisfaction of the project, based on a three point Likert scale. The table was sorted in two ways. Firstly from the highest mean score and secondly by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 15. Impact on Client Satisfaction

(6.8) Impact on Client Satisfaction (1-3)						
No	Factor	Mean	SD	Var	Median	Mode
4	Increased property value	2,94	0,25	0,06	3,00	3,00
8	Lower operating costs	2,86	0,35	0,12	3,00	3,00
25	Increases worker productivity	2,71	0,61	0,37	3,00	3,00
3	Increased rental amount	2,60	0,63	0,40	3,00	3,00
6	Occupying cost saving	2,60	0,68	0,46	3,00	3,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	2,60	0,63	0,40	3,00	3,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	2,58	0,67	0,45	3,00	3,00
21	Water use reduction	2,57	0,60	0,36	3,00	3,00
9	Rising energy costs	2,50	0,76	0,58	3,00	3,00
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	2,50	0,63	0,40	3,00	3,00
1	Renewable technology costs reducing as more people start implementing the green technology	2,46	0,88	0,77	3,00	3,00
2	Higher return on investment	2,44	0,81	0,66	3,00	3,00
10	Challenge with split between capital expenditure and operating cost savings	2,38	0,65	0,42	2,00	2,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	2,36	0,81	0,65	3,00	3,00
16	Cost associated in introducing a green building professional to the professional team	2,36	0,67	0,45	2,00	3,00
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,25	0,87	0,75	2,50	3,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	2,14	1,03	1,05	3,00	3,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	2,09	0,94	0,89	2,00	3,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	1,80	0,92	0,84	1,50	1,00
27	Exchange rate	1,80	0,92	0,84	1,50	1,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were therefore 4, 8, 25, 3 and 6 which were ‘Increased property value’, ‘Lower operating costs’, ‘Increases worker productivity’, ‘Increased rental amount ’ and ‘Occupying cost saving ’. All with mean scores higher than 2.5 however factors 4 and 8 mean scores were significantly closer to 3. All top five factors had median and modal scores of 3, however the SD varied from 0.25 to 0.68 while variance between 0.06 to 0.46The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results were excluded.

4.4.5. Impact on Sustainability

From the cost factor table analysis, Table 16 presents the impact of each cost factor on the sustainability of the project, based on the three point Likert scale. The table was sorted in two ways. Firstly from the highest mean score and secondly by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 16. Impact on Sustainability

(6.9) Impact on Sustainability (1-3)						
No	Factor	Mean	SD	Var	Median	Mode
1	Renewable technology costs reducing as more people start implementing the green technology	3,00	0,00	0,00	3,00	3,00
21	Water use reduction	2,86	0,48	0,23	3,00	3,00
8	Lower operating costs	2,82	0,50	0,25	3,00	3,00
6	Occupying cost saving	2,75	0,64	0,41	3,00	3,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	2,71	0,61	0,37	3,00	3,00
4	Increased property value	2,69	0,70	0,50	3,00	3,00
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	2,69	0,60	0,36	3,00	3,00
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,67	0,49	0,24	3,00	3,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	2,67	0,62	0,38	3,00	3,00
9	Rising energy costs	2,65	0,75	0,56	3,00	3,00
25	Increases worker productivity	2,57	0,76	0,57	3,00	3,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	2,55	0,69	0,47	3,00	3,00
10	Challenge with split between capital expenditure and operating cost savings	2,46	0,78	0,60	3,00	3,00
16	Cost associated in introducing a green building professional to the professional team	2,45	0,69	0,47	3,00	3,00
3	Increased rental amount	2,40	0,91	0,83	3,00	3,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	2,40	0,84	0,71	3,00	3,00
2	Higher return on investment	2,38	0,89	0,78	3,00	3,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	2,25	0,97	0,93	3,00	3,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	2,00	0,89	0,80	2,00	2,00
27	Exchange rate	1,90	0,99	0,99	1,50	1,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were therefore 1, 21, 8, 6, and 13 which were 'Renewable technology costs reducing as more people start implementing the green technology', 'Water use reduction', 'Lower operating costs', 'Occupying cost saving' and 'Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project'. All with mean scores higher than 2.5 however factor 1 had mean scores of 3. All top five factors had median and modal scores of 3. The SD and variance for factor 1 were both 0, for the other top five factors the SD varied from 0.48 to 0.64 and variance between 0.23 to 0.41.The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results were excluded.

4.4.6. Impact on Overall Project

From the cost factor table analysis, Table 17 was created which presents the impact of each cost factor on the overall project, based on a three point Likert scale. The table was sorted in two ways. Firstly from the highest mean score and secondly by the lowest standard deviation (SD) rank. The SD, variance, median and modal results were all used in conjunction to differentiate between factors with the similar mean score.

Table 17. Impact on Overall Project

(6.10) Impact on Overall Project (1-3)						
No	Factor	Mean	SD	Var	Median	Mode
4	Increased property value	2,56	0,73	0,53	3,00	3,00
8	Lower operating costs	2,55	0,60	0,35	3,00	3,00
24	Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	2,47	0,52	0,27	2,00	2,00
1	Renewable technology costs reducing as more people start implementing the green technology	2,46	0,78	0,60	3,00	3,00
16	Cost associated in introducing a green building professional to the professional team	2,45	0,69	0,47	3,00	3,00
6	Occupying cost saving	2,45	0,76	0,58	3,00	3,00
25	Increases worker productivity	2,43	0,85	0,73	3,00	3,00
12	Availability, cost and difficulty in identifying green products, materials and technologies	2,42	0,79	0,63	3,00	3,00
10	Challenge with split between capital expenditure and operating cost savings	2,38	0,77	0,59	3,00	3,00
23	Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	2,38	0,62	0,38	2,00	2,00
13	Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	2,36	0,74	0,55	2,50	3,00
9	Rising energy costs	2,35	0,67	0,45	2,00	2,00
3	Increased rental amount	2,33	0,72	0,52	2,00	3,00
15	Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	2,33	0,78	0,61	2,50	3,00
2	Higher return on investment	2,31	0,87	0,76	3,00	3,00
21	Water use reduction	2,29	0,78	0,61	2,00	3,00
14	Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	2,09	0,83	0,69	2,00	3,00
22	Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	2,00	0,89	0,80	2,00	3,00
11	Current cost of coal energy is less than renewable energy cost in South Africa	1,70	0,82	0,68	1,50	1,00
27	Exchange rate	1,70	0,95	0,90	1,00	1,00
5	Payback period for investment is relatively good if incentives exist in country					
7	Minimizing the costs and impacts of churn					
17	No private financial incentives available for going green in South Africa					
18	FIT (Feed in tariff) system					
19	External funding or incentives available from government for implementing green technology on a small-scale					
20	Lack of understanding from clients regarding the actual benefits from going green					
26	Fuel price					

The top five factors were therefore 4, 8, 24, 1 and 16 and 25 which were ‘Increased property value’, ‘Lower operating costs’ ‘Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future’, ‘Renewable technology costs reducing as more people start implementing the green technology’ and ‘Cost associated in introducing a green building professional to the professional team’. All factors had with mean scores of between 2.4 and 2.6. The median and modal scores were all 3 for all factors except for factor 24 which scored 2. The SD scores varied from 0.52 to 0.78 and variance from 0.27 to 0.60.

The factor numbers highlighted in red depict the factors with a low number of total respondents, hence results were excluded.

4.4.7. Other Influential Cost Factors

Themes from the interview Question (8.1) were extracted using the word cloud option in 'Qualtrics' showed on Figure 12. The interview responses were then grouped into the themes and results displayed on Figure 13 in the form of a histogram.



Figure 12. Other Influential Cost Factors Themes

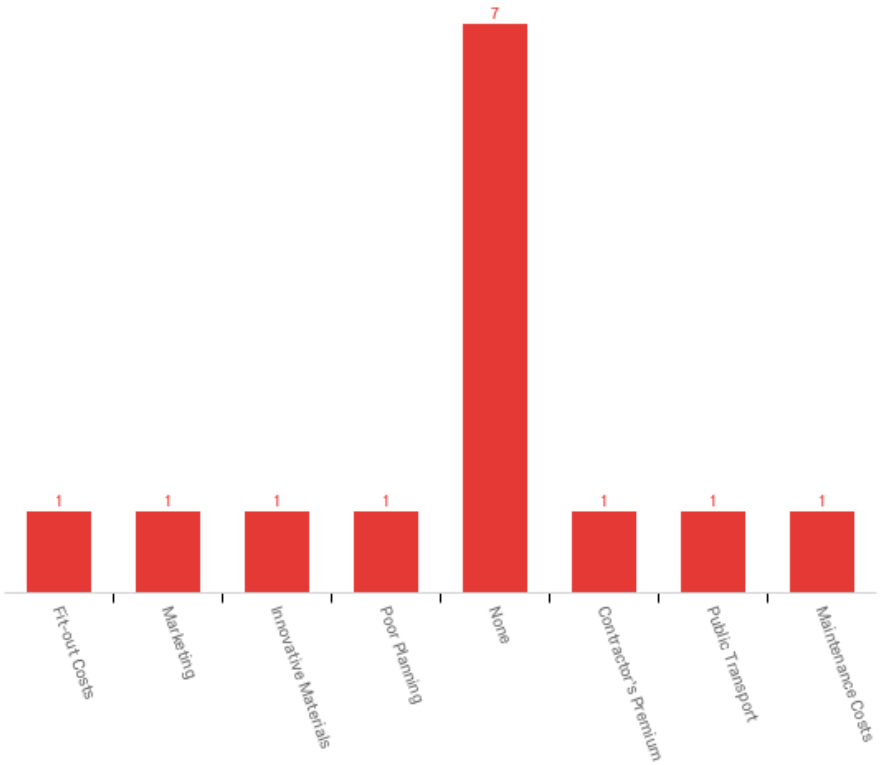


Figure 13. Other cost factors

There were a total of 8 reasons as to what other cost related factors respondents found influential for the project involved in. The majority of responses were for 'none' while the rest of the responses

had one response each. There was no reason (Question 8.2) attached to the major response of 'none', hence there was no result to display.

4.4.8. Influential Non-cost Related Factors

Themes from the interview Question (9.1) were extracted using the word cloud option in 'Qualtrics' showed on Figure 14. The interview responses were then grouped into the themes and results displayed on Figure 15 in the form of a histogram.



Figure 14. Influential Non-cost Related Factors Themes

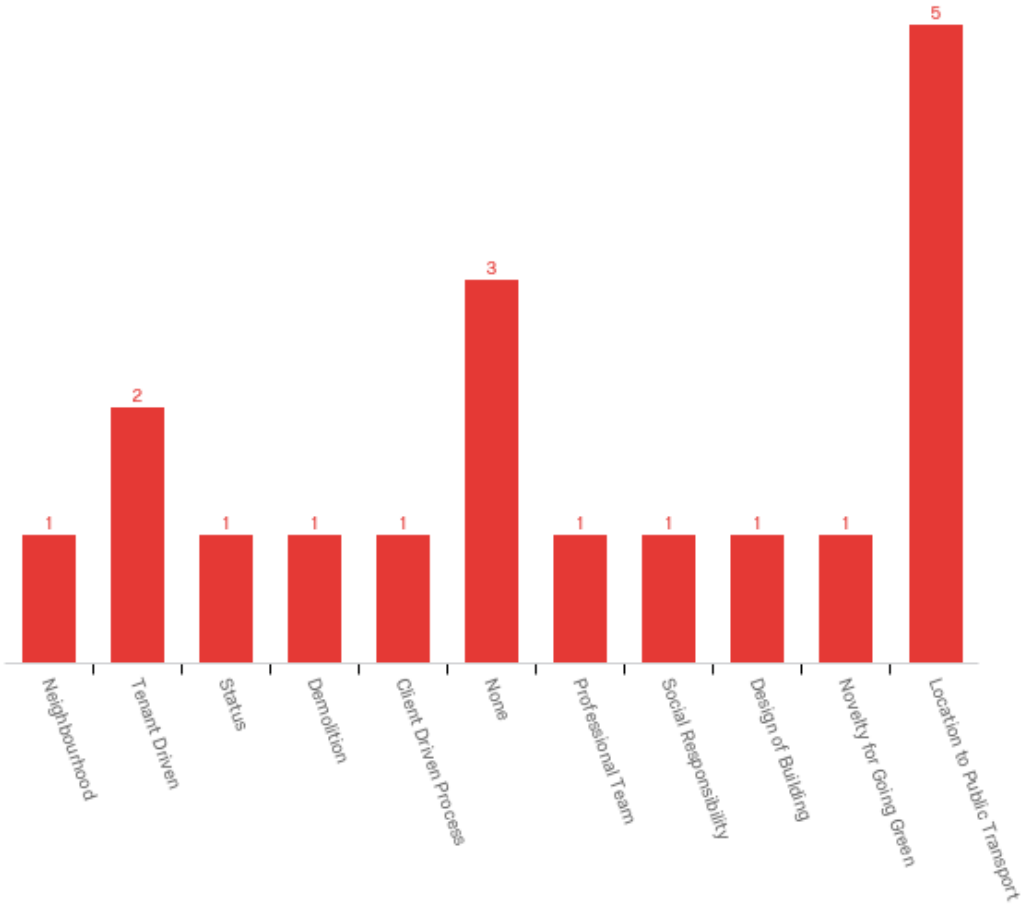


Figure 15. Other non-cost related factors

There were a total of 11 reasons as to what non-cost related factors respondents found influential for the project involved in. The majority of responses were for 'Location to public transport' and 'None' while the rest of the responses had one response each.

Respondents were then required to state reasons as to the decision for their response to Question (9.1). The themes of Question (9.2) were extracted using the word cloud option in 'Qualtrics' showed on Figure 16. The interview responses were then grouped into the themes and results displayed on Figure 17 in the form of a histogram. The x-axis of the histogram represents the 11 choices of responses from Question (9.1). The bars with colours represent the reason for each response from Question (9.1).



Figure 16. Reason for Influential Non-cost Related Factor Themes

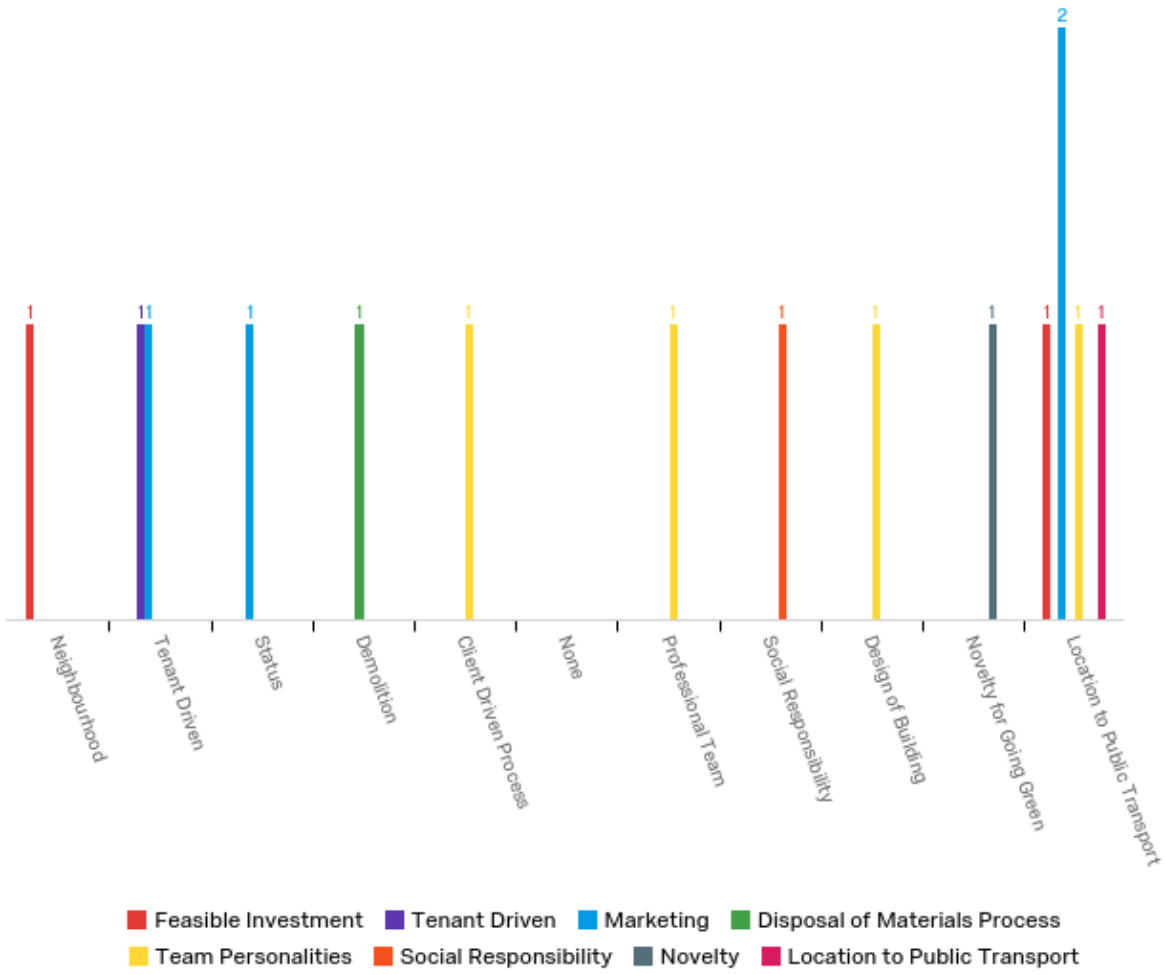


Figure 17. Reason for non-cost related factors being influential

The main reason for respondents identifying ‘Location to public transport’ as the main non-cost related factor towards investment decisions for green commercial projects was ‘Marketing’, while the other reason had the same number of responses.

It must be noted that the total of responses between Question (9.1) and (9.2) are not the same, the reason for this discrepancy was due to some respondents finding two or more reasons for the same driving factor nature identified in Question (9.1).

5. FINDINGS AND DISCUSSION

Results from the research are discussed in depth in this section of the report. Links are created between the results and findings from the literature survey. These findings are specific to green commercial buildings in South Africa, Gauteng.

The summaries of results from the cost factor table and interview open-ended questions are presented on Table 6 and Table 7 respectively. The cost factor table summarise the categorisation of all extracted cost factors and ranks them according to the respondent's answers. The first two questions (6.1) and (6.2) were of utmost importance as they determined if the respondent was aware of the cost factor (6.1) and if it influenced the decision making process (6.2). Since question (6.2) requested respondents to state whether it influenced the decision making process for the project, it was therefore used as the determinant of whether to exclude results due to a low response rate (low level of influence on the decision making process). Factors which scored 30% and lower for question (6.2) were deemed irrelevant and highlighted in red. These factors were 5, 7, 17, 18, 19, 20 and 26.

The cost factor result table was sorted from highest to lowest percentage for question (6.2). Based on this sorting of the table, the top five factors were identified as factor 8, 21, 6, 9, and 2. Based on the results the top and third factors 8 and 6 'Lower operating costs' and 'Occupying cost saving' were found to be highly influential which agreed with literature findings by (Bond & Perret, 2012), (Windapo, 2014), (RICS, 2010) and (GBCSA, 2012) whereby lower operating costs and occupying cost savings were regarded as one of the top drivers to adoption of green buildings. In the literature review it was noted that factors 6 and 8 were essentially the same factor, this was confirmed by the interview responses and confirmed by the results as the rankings for both are almost the same for each question. The results for these two factors should therefore be combined into one factor by eliminating one of the factors, allowing the next factor on the table as the 6th ranked factor namely factor 'increased property value'. The new top five factor list therefore reads as factors 8, 21, 9, 2 and 4. These factors can be directly attributed to a cost or financial aspect of the project except for factor 21 'Water use reduction' which is attributed to the environment. It was deduced from comparing percentages between results from question (6.1) and (6.2), that the difference in percentage was derived from the factor not being applicable to South Africa. Examples of this observation can be found in factors 5, 17, 18, 19, 20 as these factors influenced green projects in other countries but not in South Africa

The top five factors were rated by respondents with mean scores ranging from 2.38 to 2.70 for the frequency of occurrence of factor. It must be noted that there was a small difference between all the cost factors with respect to frequency of occurrence, hence, showing that respondents considered the majority of the cost factors regularly. However based on the results from question (6.2), some were less significant than others in influencing the decision-making process. Three of the top five factors were considered to affect costs in the operational stage of the project while factor 2 and 4 were identified to affect cost in the inception and residual value stages respectively. The top five factors were all categorised as enablers to investment decisions. This finding agreed with the literature from which the factors were extracted. All of the cost factors were found to have a low impact on time, quality of the project with mean scores of between 1.13 and 1.85. However impact on client satisfaction, sustainability and overall project were significantly higher with mean scores ranging from 1.7 to 2.86. When reviewing the results of the cost factor table from a holistic point of view, it was noted that the results from questions (6.3), (6.6 to 6.10) directly related to the percentage of awareness and level of influence (question 6.2). The higher the scale for question (6.2) the higher the scale assigned for questions (6.3) and (6.6 to 6.10).

Results from the interview open-ended questions indicate to 'client' and 'tenant requirements' as the main reason for respondents becoming aware of the factors which influenced the decision to invest in the green commercial building project. The inception stage was identified as the most important life cycle stage of the project as planning and control was done during this stage. Respondents confirmed there were no other cost related factors which were influential outside of those presented by the researcher; however 'location to public transport' was identified as a highly influential non-cost related factor for marketing reasons. One of the most interesting findings from this study was that respondents were of the opinion that environmental factors were more influential to the adoption of green buildings than cost related factors, due to the fact that clients want to be more environmentally conscious. This result does not agree with findings from the literature review, specifically referring to the outcomes concluded from South African research by (Windapo, 2014) and (Zenios & Allen, 2016) which indicated that financial factors were more influential than environmental. However, before conclusions can be drawn on this finding, the nature of the projects and the reason for initiating the projects must be understood. Respondents' perspective's of their respective projects made the researcher aware that such projects were predominantly geared to meet the requirements of the tenant (usually a large business entity), whose primary marketing brief was to be environmentally conscious. The tenant would therefore request owners to build a green commercial building to a specific green star rating in order to meet

such requirements within a specific rental range. The goal for the owner was then to secure a long term lease while trying to reduce building costs to maximise on their return. Respondents further explained that owners would have invested in a green commercial building no matter what the costs. Reasons for this are that there was demand from the large corporate tenant and upfront costs would be recovered within the long lease period through a rental premium. The onus would then be on the owners to minimise the costs of the construction and secure the tenant by offering the lowest rental and the best green benefits, while being able to recuperate the high upfront cost by increasing the rental through a green premium. This specific response and explanation can be attributed to marketing aspects of the project. It can, therefore, be assumed that marketing factors are also important and can influence the decision-making process to invest in green commercial buildings.

The finding are discussed in detail below and grouped based on the three research objectives.

5.1. Nature and Occurrence of Cost Factors

The nature and occurrence of cost factors are attributed to the respondent's awareness of the factor, where the awareness originated from, the frequency of occurrence of the factor and which life cycle stage the cost factor affected. The nature and occurrence of cost factors was designed to be addressed in this research through questions (5), (6.1), (6.2), (6.3) and (6.4) as per Table 5. The results pertaining to the nature and occurrence of cost factors for each attribute are discussed below.

5.1.1. Awareness of Factors

The majority of respondents from the interview process identified two main reasons on how they became aware of factors which influenced the stakeholders' decision to invest in the green commercial building they were involved in, namely: 'client requirements' and 'tenant requirements' see Figure 3. This finding agrees with literature which concludes that tenants and clients are driving adoption of green buildings in South Africa by (Hoffman & Cowie, 2014). The same finding was made based on other developing countries such as the study by (Bohari, Skitmore, Xia, & Zhang, 2016). Contrary to driving green development (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) found that clients and tenants were also found to impede the adoption and growth of the green commercial building industry due to a lack of request by them.

From the results on the cost factor table on Table 8, respondents were found to be aware of most of the factors in the table. Respondents were however unaware of factors 18 and 19 'FIT (feed-in tariff

systems)' and 'external funding or incentives available from government for implementing green technology on a small-scale' respectively. The reason for this lack of awareness can be attributed to the factors not being available in South Africa or not being experienced by the respondents. Interestingly respondents were aware of most of the other factors which agree with findings from the literature review. Respondents were also found to be aware of the factors added by the researcher namely factors 26 and 27 'Fuel price' and 'Exchange rate' respectively. However respondents found these factors to be minimally influential towards the investments in green projects in South Africa. Factor 20 'Lack of understanding from clients regarding the actual benefits from going green' showed a 50% of awareness by respondents as respondents did not agree with this factor and were of the opinion that clients were indeed aware of the benefits from green buildings. Interestingly, multiple references such as (Ahn, Pearce, & Wang, 2013), (Ametepey, Aigbavboa, & Ansah, 2015), (Emuze, Ntoi, & Isa, 2015), (Hakkinen & Belloni, 2011), (Pitt, Tucker, Riley, & Longden, 2009), (Simpeh & Smallwood, 2015) and (Williams & Dair, 2007) concluded that this factor was a major barrier to green building adoption in other countries. However this is clearly not the case for this study as the results showed that the client was well aware of the benefits of going green. Factor 7 'Minimizing the costs and impacts of churn' also showed similar results where a 50% level of awareness resulted which could be attributed to the fact that most of the projects analysed were tenant driven. Hence, all the specifications of the buildings, including the green technology, were requested by the tenant, thus eliminating the impact of churn. Factor 7 can, therefore, be associated to projects not built specifically for tenants, but rather without a specific tenant's requirements in mind. This lack of awareness for factor 7 was confirmed by (GBCSA, 2012) research; this corresponds, therefore with the findings in the literature.

5.1.2. Frequency of Occurrence

The frequency of occurrence of each cost factor was recorded for each respondent with the results presented on Table 9. From the results it was shown that 21 out of 27 factors were frequently mentioned in the project and were given a mean score of between 2.18 and 2.88. The top five factors were 23, 1, 24, 6 and 9 which were 'Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future', 'Renewable technology costs reducing as more people start implementing the green technology', 'Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future', 'Occupying cost saving' and 'Rising energy costs'. This result does not imply the factor/s was influential, but can be described as the factor was discussed during project

meetings. The mean scores were compared with the median and modal calculations for each factor and most were found to have received a score of 3 on the median and mode analysis. The standard deviation and variance were relatively high and could be attributed to the low level of responses for from the small sample size.

5.1.3. Cost Factor Life cycle Stage

Understanding the nature of each cost factor means understanding where the factor comes from and how it relates to a green commercial project. The factor's relevant life cycle stage was found to be important to the research in order to achieve the objectives. Respondents identified the inception stage to be the most influential stage of the project with regards to investment decisions as shown on Figure 5. In contrast, the top four factors with the highest percentage of influence in the decision-making process of the project were related to the operational stage of the project. .

5.2. Stakeholders Perception of Cost Factors

Stakeholders' perception of cost factors can be attributed to the classification of factors as enablers or challenges, the driving factors' nature with respect to promoting green buildings in South Africa and its reason. The stakeholder's perception on cost factors was designed to be addressed in this research through questions (6.5), (7.1), (7.2), (10.1) and (10.2) as per Table 5.

The study by (Bond & Perret, 2012) on the New Zealand construction industry described and identified enablers and challenges for the development and implementation of sustainable commercial buildings and shared light on the classification of such factors. The factors used in this study were multi-disciplinary in nature (environmental, financial and social) which differ from this research whereby it focused on cost related factors only based on the South African construction industry. Similar studies based in South Africa by (Windapo, 2014) and (Zenios & Allen, 2016) also categorised factors as enabler or challenges and also identified the financial nature of factors as being the most influential when referring to investment decisions for green buildings, however these studies were again focused on rating multi-disciplinary factors and identifying which nature of factors were perceived as most important. Table 11 summarises the classification of all the cost factors as enablers or challengers from this study.

The results pertaining to the stakeholders' perception of cost factors for each attribute are discussed below.

5.2.1. Enabler or Challenge

The factors listed on Table 11 represent the factors categorised as enablers or challenges by respondents. Intuitively the results seem to correlate to what was expected and what was identified in the literature review. Factors 2, 3, 4, 6, 8, 9, 21, 23, 24, 25 were defined as enablers, while factors 12, 13, 14, 22 and 27 as challenges. Some respondents categorised factors as either an enabler or challenge, based on the percentage of responses factors 1, 10, 11, 15 and 16 were classified as being either an enabler or challenge.

All factors defined as enablers concur with the intuitive nature of the factors as well as the literature review findings; however certain factors and their findings need to be discussed in more detail. The point-of-view taken by respondents plays a significant role on the outcome of this question. For example, factor 3 'Increased rental amount' was identified by respondents as an enabler which concurs with the research by (Bond & Perret, 2012), (Eichholtz, Kok, & Quigley, 2010) and (RICS, 2010). However, this positive influence was perceived as an enabler to the owner because the higher rental would be used by owners to recover the additional costs of the green technology integration as the tenant reaps the benefits (Bond & Perret, 2012). When viewed from the tenant's point-of-view it would be perceived as a challenge. Factor 4 'Increased property value' was defined as an enabler who concurs with research by (Hakkinen & Belloni, 2011) and (WGBC, 2016). This factor can also be directly linked to factor 3 'increase in rental amount 'and factor 2 'higher return on investment' as both factors influence the value of the property as found by (Yudelson, 2010), (GBCSA, 2012) and (RICS, 2010).

Most factors defined as challengers concur with the intuitive nature of the factor as well as the literature review findings; however some special cases were identified and discussed further. Factor 13 'Costs to achieve green star status is relatively high...' concurs with research by (GBCSA, 2012) and (Zenios & Allen, 2016) as being identified as a challenger, however it was noted from interviews that the amount to certify a building becomes an almost insignificant amount when looking at a large sized building hence could be ignored. Factor 27 'exchange rate' was not extracted from literature, but made intuitive sense to being classified as a challenger as the costs of importing technology and materials from overseas can be severely affected by an unfavourable exchange rate. This view was shared with respondents in the study however; they were of the opinion that this could be resolved by mitigating and fixing the interest rate for the duration of the project.

Interestingly some factors were identified by respondents as either an enabler or a challenger such as factor 1 'renewable technology costs reducing as more people start implementing green

technology', Intuitively this factor would be regarded as an enabler; however some respondents were of the opinion that it could be both. Research on this factor does not categorise the factor as an enabler or challenger. However studies by (ISE, 2016) and (Ho, Wong, Iyer-Raniga, & Yang, 2017) viewed the factor as an enabler, as costs decrease as more people implement green technology which drive costs down and directly affect the lowering of rental premium on green buildings. Lower renewable technology costs would drive competition between owners which would further lower prices making it a challenge to the owner but an enabler to the tenant.

Factor 10 'Challenge with split between capital expenditure and operating cost savings' was also identified as either an enabler or challenger by respondents. This was most likely due to respondents linking the factor to the need to recover the additional rental emanating from operating cost savings and the additional capital expenditure for the green technology. This factor was extracted from literature by (Bond & Perret, 2012), (GBCSA, 2012) and (McGraw-Hill, 2013) where the factor was regarded as a challenger

Factor 11 'Current cost of coal energy is less than renewable energy in South Africa' was also found to be either an enabler or challenger. Respondents believed that, by effectively cutting out the national energy supplier through renewable energy producing technology, the upfront costs for this technology could be recovered easily through rental premiums. For this reason, the factor was viewed as an enabler. The factor was extracted from (GBCSA, 2012) and (Lloyd, 2017), but only GBCSA categorised the factor as a challenge.

Factor 15 'Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology' was identified as either an enabler or a challenge. This outcome did not agree with research by (Bond & Perret, 2012), (Eichholtz, Kok, & Quigley, 2010) and (RICS, 2010) where it was classified as an enabler. Respondents were of the opinion that, if this factor was viewed from the tenant's perspective, this factor would not be an enabler but a challenge. In the literature review it was mentioned that factor 3 and 15 would be similar. However, the results and outcomes differed.

Factor 16 'Cost associated in introducing a green building professional to the professional team', would, intuitively, be seen as a challenge, as costs incurred are higher and, thus, unwanted. However, respondents found this factor to be an enabler as well; respondents regarded as a requirement of green projects, the green professional fees to be included in the project costs. Findings in the literature concurred with the factor being a challenge only (Bartlet & Howard, 2000),

(GBCA, 2008), (GBCSA, 2012), (Hydes & Creech, 2000), (Shariffudin & Abidin, 2015), (de Villiers, 2011).

5.2.2. Most Influential Life cycle Stage

Respondents identified the inception stage of the project as the most influential when referring to investment decisions for projects. Research by (Zenios & Allen, 2016) stated that the design phase was regarded as the most cost intensive. However if decisions were made in the inception stage, then costs could be cut in the costly design phase of the project. This made intuitive sense as the entire project should be initially discussed in detail in the inception stage before it commences. This would, potentially, lead in the inception stage to cost-reduction, spending being curbed, and searching for the correct design to suit the needs of the client.

It was also found that the three of the top five factors affected the operational life cycle stage of the project, which highlights the need for investors to focus on this stage of the project to maximise on investment returns. Research by (Abidin & Azizi, 2016) suggested further research was to be carried out in order to determine which stage of the project each cost factor influenced the decision making process and what was the importance of the decision made. However the results from open-ended questions and the questionnaire did not coincide with each other, one pointed to the inception stage and the other to construction stage of the project. Both are therefore concluded to be important to the cost of a project.

5.2.3. Nature of Main Driving Factor

Figure 9 shows that the outcome respondents regarded as most influential with respect to the nature of factors influencing the decision to invest in green buildings, as environmental and not cost-related. Three times the number of respondents identified the environmental nature of factors to be the major driving force rather than the financial nature of factors. This finding contradicts the essence of the research and the general consensus revealed in the literature review that financial factors are the main driving force behind the adoption of green buildings. The findings suggest that the reason for this shift towards environmental factors was that clients/tenants/owners are required to be more environmentally conscious, as shown on Figure 11. This finding contrasts with the research findings by (Windapo, 2014) and (Zenios & Allen, 2016) in South Africa, which found the main driving factors to green building investments were financial and not environmental. This result and results from question (9.1) and (9.2),indicated to marketing factors, all pointed towards the conclusion derived in research by (Bond & Perret, 2012) that a combination of environmental, social

and financial factors were found to be the driving factors, favouring the adoption of green commercial buildings in New Zealand. However, before conclusions can be drawn from these findings, the nature of the building projects must be understood. Respondents specified that, the projects they were involved, featured building agreements between the owner and tenants of the building. The tenant, usually a large business entity, had a marketing brief towards being environmentally-conscious bias, who, in turn, requested the owner to build a green office building to a specific green star rating in order to meet the tenants' environmental requirement. The ultimate goal for the owner was a long term lease for the building ensuring the payback on the initial investment, while the tenant's goal is to be more environmentally conscious as an entity. Respondents expressed the view that owners would have invested in a green building no matter what the costs as there would be a long-term tenant available, thus enabling the recovery of the upfront costs within that time period. The onus was, therefore, on the owner to try and minimise the costs of the construction in order to charge the tenant the lowest rental in order to secure the deal. This would, in fact, render cost factors most important to owners, and environmental and marketing factors important for the tenant who concurs with the findings shown on Figure 9 and Figure 11.

The results from the quantitative data could not be used to triangulate to a common answer for the nature of main driving factors, as there were no questions related to this in the cost factor table.

5.3. Influence of Cost Factors to Investment Decisions

The influence of cost factors to the investment decisions by stakeholders can be attributed to the level of influence on the decision-making process, the impact on aspects of the project (time, quality, client satisfaction, sustainability and overall project), and the determination of other cost and non-cost related factors, influencing the project. The influence of cost factors was designed to be addressed in this research through questions (6.2), (6.6), (6.7), (6.8), (6.9), (6.10), (6.11), (8.1), (8.2), (9.1) and (9.2) as per Table 5. The results pertaining to the influence of cost factors to investment decisions for each attribute are discussed below.

5.3.1. Influence on Decision Making Process

Table 12 represents one of the most important findings from this study. The table presents the percentage of respondents agreeing with the factor, exerting an influence on the decision-making process to invest in the green project. The table was sorted from highest percentage to lowest and forms the basis of the overall ranking for the factors. Respondents found factor 8 'lower operational

costs' as the most influential factor, which agrees with findings from studies by (Bond, 2010) and (Windapo, 2014). Lower operating costs were identified as a key factor in green buildings, in New Zealand and South Africa respectively. Factors 6 and 8 were found to have similar results, and observed, essentially, to be the same factor from the literature review. Hence, factor 6 results were omitted and result for factor 8 was used. Interestingly Factor 9 'rising energy costs' which was identified as the second highest factor was also regarded as highly influential in the study and in the research by (Windapo, 2014) based in South Africa and by (Bond & Perret, 2012) and (Smith & Baird, 2007) based in New Zealand. Although factor 21 'water use reduction' could be categorised, primarily, as an environmental factor, it's importance was confirmed as it was ranked as the third highest factor by respondents, which also concurred with research findings by (Hoffman & Cowie, 2014) on South African developers stating that, reducing water usage adds value to the property. Factor 2 and 4 'higher return on investment' and 'increased property value' was found to also be highly influential and was ranked as the 4th and 5th factors respectively. Both factors exerted the same level of influence to the decision-making process and as they are related to each other. Studies by (RICS, 2010), (GBCSA, 2012), (GBCA, 2008) and (Hwang & Ng, 2013) point to these two factors as key drivers to the adoption of green buildings in their respective countries. However a study by (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018) also suggested they were drivers but did not rank them as highly as the other studies which concurred with the results from this study.

Interestingly factor 20 'Lack of understanding from clients regarding the actual benefits from going green' was found to be one of the most influential factors to the adoption of green buildings in studies conducted by (Ahn, Pearce, & Wang, 2013), (Hakkinen & Belloni, 2011), (Pitt, Tucker, Riley, & Longden, 2009) and (Emuze, Ntoi, & Isa, 2015). However, in this research, it was one of the factors not included in the results, due to a low influence rate. Respondents from interviews were of the opinion that clients were actually well aware of the benefits from green buildings, hence deemed to not be aware of the factor. In the same light, factors 5, 17 and 19 encompassing incentives from government, private and general funding, were also found to be one of the most influential factor to the adoption of green buildings from studies by (Bond S & Perret G, 2012), (Bohari, Skitmore, Xia, & Zhang, 2016), (Durdyev, Zavadskas, Thurnel, Banaitis, & Ihtiyar, 2018), (Olubunmi, Xia, & Skitmore, 2016) and from South Africa (Simpeh & Smallwood, 2015). However, in this research these factors were not included in the results due to a low influence rate. The reason for this exclusion could be that in South Africa there are currently no forms of policies or legislations to incentivise green buildings. It could also be due to the nature of the research as respondents were required to answer questions based on the actual project they worked on and not on their opinion and experience in

the industry as a whole. The same applies for factor 18 'FIT (feed-in tariff) system' which was found to be the most influential tool to promote green buildings in Denmark and Germany (Rolf W, 2006), (Judith, 2007), and in this research the results were again excluded due to low response.

5.3.2. Impact on Aspects of Project

The level of influence for each cost factor was recorded for specific aspects of the project. Table 13, Table 14, Table 15, Table 16 and Table 17 present these results and illustrate the impact of each cost factor against the time, quality, client satisfaction, sustainability and overall project. The summarised results on Table 6 illustrate that most cost factors partially or do not influence the time and quality of the project with mean scores between 1.13 and 1.85 which can be considered as non-influential. With regards to client satisfaction, sustainability and the overall project the top five of cost factors were found to impact highly on these aspects with mean scores between 1.80 and 2.94. These results tied in with the general consensus reached in the literature study, that cost factors are most influential when trying to promote investments in green buildings.

The top five factors received high mean scores for the various aspects of the project which correlate to the high influence percentage on the decision making process question (6.2) for the same factors

5.3.3. Other Influential Factors

Respondents were requested to state any other cost related factors they considered to be influential to the decision making process. The majority of respondents were of the opinion that there were no other cost related factors which were influential apart from the list of factors in the cost factor table, as shown on Figure 13.

Respondents were also required to give their opinion on what non-cost related factors they considered to be influential when investing in a green commercial building. As shown on Figure 15, respondents found 'location to public transport' to be an influential non-cost related factor, the reason expressed by respondents was due to marketing reasons (see Figure 17) as the location to public transport was seen as a major marketing strategy for attracting tenants. Findings from the literature review do not specify 'location to public transport' as an influencing factor. Interestingly results showed that respondents were of the opinion that marketing was also a nature of influence on investments in green commercial buildings which could be a contradiction when compared to the outcomes from Question (10.1). However, before drawing conclusion on the influence of such nature of factors to investments in green commercial buildings, the level of influence between the marketing nature, environmental nature and financial nature should be investigated.

In the literature review numerous factors were identified which relate to market and financial factors as well as between environment and cost. The results obtained from the open-ended questions (9.1), (9.2), (10.1) and (10.2) were justified according to this finding. Factors 3, 4, 22, 23 and 24 were identified in the literature review as potential market related factors. Factors 4, 23, 3 and 24 were ranked 6th to 9th in the overall ranking which agrees with the outcome defined by respondents that market related factors are also important.

Environmental factors, according to the respondents for the open-ended questions (10.1) and (10.2), were found to be the most important nature of influencing factors. Despite the fact that most factors extracted from literature were related to cost, factor 21 'water use reduction' was included in the list of factors for this research. From the summary of results shown on Table 6, factor 21 was ranked 2nd as the most influential and important which suggests that the environmental nature of factors is as important if not more than cost related factors to the decision-making process to invest in green buildings.

5.4. Validity and credibility of research

Validity and credibility of the research was tested using various tests namely: sample population size, Cronbach alpha test and qualitative tests. They are discussed in detail below.

Mention must be made of the literature review which was conducted. The literature review explored various literatures from across the world on green commercial buildings and the relevant factors associated to costs were extracted. The results obtained from the interviews and questionnaires were cross-referenced with the literature review findings. Triangulation of results was not only achieved through comparing and converging results from qualitative data and quantitative data, but also through convergence from the literature review and results from the data.

5.4.1. Sample Population Size

The sample population was small to being with, a maximum of 78 candidates which fitted within the research criteria were identified to be potential respondents for the cost factor table questions. The combined sample size made up of interview and questionnaire respondents, specific to the cost factor table, were 26. Based on the calculation defined in section 3.3.4 and using the sample size of 26, standard deviation of 0.5, a 90% confidence level (Z-score of 1.65), a margin of error of 13.5% was calculated. The typical minimum margin of error for a quantitative research is 10% which this study superseded however, the following must be noted:

There also exists evidence that small sample size actually becomes less of an issue of statistics but rather judgement of the researcher (Norman, 2010) If this was the case then statistics can be applicable to small sample sizes provided the robustness of the tests performed was illustrated.

A restricted population size

The population size was restricted to 13 projects which conformed to the stipulated criteria for the projects. It was an oversight by the researcher's to assume more respondents would have participated in the study, hence, the method of gathering data and sampling techniques could have been optimized to ensure a higher percentage of responses.

The population size however, could not have been increased by simply adding more 4 green star rated commercial buildings in Gauteng as the maximum available number of projects was only 13 projects. In order for the population size to have been increased, the criteria stipulated for the green commercial buildings would have to have been changed to include project from other provinces in South Africa. The total pool of 4 green star rated commercial green buildings in South Africa was limited at the time of the study, even by including other regions, the only way to have effectively increased the population size was via the inclusion of 3 or 5 green star rated commercial buildings. This however, would have added a significant level of complexity to the study by adding more variables. The cost factors associated to 4 star green rated buildings could be different to 3 or 5 star green rated buildings as the requirements and capital outlay are different across the rating systems.

From the small population size it must also be noted that respondents who could not be contacted to participate for various reasons, could not be substituted by another person within the same company as that new person would not have been directly involved in the project which was a requirement of this study. This provided further difficulty in increasing the sample size.

5.4.2. Cronbach Alpha Test

Likert Type Data

The Cronbach alpha test was calculated for each of data sets for each individual cost factor. The coefficients for the Likert type data varied from 0.1 to 0.8 which was not acceptable as defined by (Cortina, 1993). The low alpha coefficients calculated were most likely due to the sample data size being too small.

Dichotomous Data

The Cronbach alpha test was also calculated for each of the dichotomous (Yes/No) data from the cost factor table. The lowest alpha coefficient was 0.97 which showed a high internal reliability in data and was higher than the specified 0.7 as defined by (Cortina, 1993).

5.4.3. Open-ended Questions

As defined in section 3.3.2, the following four stages need to be met in order to increase credibility of results obtained from qualitative data.

1. Thick Description: The research illustrated concrete details of the cost related factors of green commercial buildings in South Africa and used significant knowledge to show results and compare them to literature. Each question and cost factor was designed from literature and had a significant history of where it originated from

2. Crystallisation and Triangulation: The researcher used multiple sources of data, namely literature to conduct the literature survey, interviews and questionnaires with stakeholders directly involved in the selected green projects. The different data was collected and analysed using the respective methods and techniques. These were then used to converge to the same or similar conclusion which was used to answer the research question.

3. Multivocality: The researcher ensured that during the interview process, all open-ended questions written by the researcher in the presence of the respondent were first approved by the respondent. The viewpoints of each respondent were kept specific.

4. Member reflection: The researcher consistently requested input from peers and supervisor on the research and the data derived from the various means.

Through the explanation of the four stages derived by (Tracy, 2010), credibility of the qualitative data was achieved.

6. CONCLUSION

Literature on green commercial buildings has pointed toward the categorisation and ranking of environmental, social and financial factors, however it has been shown that there exists a consensus indicating to the financial nature of factors as the most important driver when adopting green buildings. This study examined factors perceived as challenges or enablers for green commercial buildings in South Africa, Gauteng, specifically focusing on cost related factors. The study was regarded as an exploratory study and designed to form a baseline for further studies. The study aimed at investigating the nature and occurrence of cost related factors, and how they influence the investment decisions by stakeholders to invest in green commercial buildings. The aim was designed to be achieved through three objectives namely: to determine the nature and occurrence of cost factor, to determine perception of stakeholders regarding the nature and occurrence of cost factors and to determine the level of influence for each cost factor. The level of awareness of respondents for each of the cost factors corresponded to the nature and occurrence of cost factors.

The research adopted a mixed method approach, using triangulation and a data convergence model to validate results. By means of triangulation between the literature review, qualitative and quantitative surveys data was analysed and convergence of results was recorded. The qualitative and quantitative data was analysed separately using qualitative and quantitative analysis to achieve convergence in results The qualitative data (open-ended questions) was collected by means of interviews, while the quantitative data (cost factor table) through questionnaires and interviews. Stakeholders involved in the selected projects conforming to the stipulated criteria, were the target sample population for the research. Questions from the questionnaire and interview were designed to address and achieve each of the objectives of the study. The primary data collection tool used for the questionnaires and interviews consisted of a cost factor table with questions designed to rate each cost related factor based on certain aspects of the project. The list of cost related factors was compiled by extraction of the cost related factors from literature based on green buildings from developed and developing countries. The interviews were conducted face-to-face with respondents and consisted of the cost factor table questions (closed ended questions) and open-ended questions. The interviews were conducted prior to the questionnaire as a pilot study to ensure readability and understanding from respondents on how to complete the cost factor table questions. Using feedback from the interviews on the cost factor table questions, an explanatory letter was created and added to the questionnaire documents to be sent to respondents. The aim of the letter was to

address problems faced in completing the cost factor table experienced during the interviews, hence assisting respondents in answering the cost factor table correctly so that data was not distorted or lost. The data from the interview cost factor table questions was merged with data from questionnaires on the cost factor tables.

The research aimed to achieve the objective of determining the occurrence of cost related factors by determining the 'frequency of occurrence' and the 'life cycle stage' which the factor affected. It aimed to achieve the objective of the stakeholders' perception on cost related factors through the categorisation of factors into 'enablers' or 'challenges', determining which was the most influential 'life cycle stage' of the project and what was the 'nature of the main driving factor towards investments in green commercial buildings'. It then aimed at achieving the objective of determining the level of influence of cost factors through the categorisation and ranking of the influence on the decision-making process, impact on the overall project, and determining other influential factors not covered in the literature review.

The findings from the research concluded that stakeholders were mostly aware of the cost related factors presented by the researcher. However, only some factors were found to influence the decision for stakeholders to invest in the green commercial building project.

The cost factor 'lower operating costs' was found to be the most influential factor when it comes to investment decisions in green commercial projects. It was also deduced that some factors were not applicable to the South African green industry hence did not apply to the research. This deduction was established through the level of awareness and the ability to affect the decision-making process of factors 17 'No private financial incentives available', 18 'FIT', 19 'External funding or incentives available from government', and 20 'Lack of understanding from clients regarding the actual benefits from going green', all of which reflected a low number of responses, and these results, therefore, were excluded Conversely the literature review findings pointed to these factors as being highly influential, this difference between results and literature was most likely due to the factors playing a significant role in the countries where the literature originated. For example the feed in tariffs factor was not applicable to South Africa as at the time of the study was not implemented.

The results showed that the following factors had a high level of influence on the decision making process to invest in green commercial buildings, namely:: 'lower operating costs', 'rising energy costs', 'water use reduction', 'higher return on investment' and 'increased property value'. These

factors were found to be frequently thought about by stakeholders in project meetings and were all regarded as enablers towards investments in green commercial projects

All of the cost factors within the table were found have low levels of influence on time and quality of the project however were found to have high levels of influence on client satisfaction, sustainability and the overall project. The low level of influence on the quality of the projects can be attributed to the quality of the project being pre-defined by the client or tenant, hence making the cost factors insignificant towards influencing the quality of the project.

The time of the project was also found to not be affected by the cost factors as additional time for green technology integration would have already been incorporated into the project schedule, so it would not encumber additional time to the project

The high level of influence exerted by the top five factors, attributed to client satisfaction, can be directly related to the factors impacting and influencing the client and tenant requirements such as reduced operational costs.

The high level of influence exerted by the top five factors on the sustainability of the project can be attributed to the factors relating directly to the financial aspect of the project and sustainability being understood by respondents as the financial sustainability of the project.

The high level of influence exerted by the top five factors, on the overall project, was determined by respondents as a combination of the impact on other aspects of the project. The top three factors were found to affect the operational life cycle stage of the project, while the 5th factor affected inception stage of the project.

It was also found from the literature review that client and tenant requirements were important in driving a green project. . Interview results supported this, as respondents became aware of the factors which influenced the investment decision through the client and tenant requirements.

Results pointed towards the inception stage as the most important life cycle stage of the project, where planning and control takes place. This stage was regarded as important by respondents as strategies can be devised on how to reduce operational costs related to such factors for this stage.

Results on the categorisation of factors into enablers or challenges concurred with literature findings, with some special cases established by respondents as either enablers or challengers, depending on whether the perspective was that of the owner or tenant. The top five factors were all

defined as enablers to investment decisions by stakeholders; this provides opportunities for strategies to be developed to exploit such factors in order to make the project more marketable and profitable. An important question presented by the research was the 'level of influence' the factor had on the decision making process to invest in the green building. This question was used to sort the cost factor table and presented an overall ranking for each factor.

Results from interviews identified that environmental factors and marketing factors were also influential to the adoption or investment in green commercial projects, with the main marketing reason being 'location to public transport'. This result contradicts the consensus outlined from the literature review that financial factors are the nature of the main driving factors for investments in green commercial projects

Before any further research in respect of this knowledge gap is attempted, the business model for these green projects needs to be understood. . It was found in this research that client and tenant requirements drive green commercial projects, hence results point towards marketing and environmental factors as being just as important as the financial factors. This contradiction has created a gap in the knowledge which presenting an opportunity determine and study the influence and effects of multi-disciplinary factors on green commercial projects.

6.1. Implications of Findings

By defining the life cycle stage at which the majority of costs are incurred, stakeholders can focus efforts to reduce such costs by devising strategies to exploit the cost factors influencing that stage of the project. The operational stage was found to be the most critical, and would required more attention from the stakeholders when trying to reduce project costs, taking into account the complete life cycle costing of the project.. The inception stage was also identified to be important and should be considered in order to reduce costs and maximise the business case for green commercial buildings as all planning and feasibility studies start from this stage. During the inception stage the entire project is taken into account, hence it is the best opportunity to devise strategies to capitalise of the enabling factors and the overcoming of issues and obstacles such as the challenges.

Findings from the research also suggest that investors of green commercial buildings in South Africa should be mindful of the top five influential cost factors, which will guide investors to minimise costs through strategies devised to capitalise on these factors. The study concluded the top five factors as being influential on client satisfaction, sustainability and the overall project, thereby showing their importance towards driving investments on green commercial buildings in South Africa, Gauteng.

The factors 'Lower operating costs' and 'occupying cost savings' were within the top three factors and were defined as enablers. The findings on these factors concurred with in the literature review findings as being highly influential and important by stakeholders. By reducing operating costs through the use of green technology demand for green buildings would increase which will drive growth in the green commercial building sector. .

'Water use reduction' was ranked as the 2nd most influential factor and could be linked to lower operating costs. However, due to the high sensitivity of water conservation this factor was found to be highly influential. This factor can also be used as a marketing tool for attracting tenants to occupy the building by exploiting the tenant's environmental bias. Findings from interviews point to environmental factors as the main driving factors towards driving investment in green commercial buildings. The need to conserve water has become a marketing tool; hence by finding new ways in which to reduce water consumption within a building, the owner is essentially gaining a marketing edge on competitors.

'Occupying cost savings' was the 3rd ranked factor and found to significantly influence the drive investments towards green commercial projects. This factor can be linked to lower operating costs as the tenant is saving operational costs from occupying the building.

'Rising energy costs' was the 4th ranked factor and found to significantly influence the drive towards green buildings in South Africa as higher costs of energy drive stakeholders to find alternate ways to produce or reduce energy consumption for buildings. This in turn drives research and development in these areas producing local technology and products which will reduce the green building costs.

'Higher return on investment' was ranked as 5th factor and it can be deduced from results of the study that the South African green building industry has become well aware of the higher returns on investments in green buildings when compared to conventional buildings. This factor drives more investment towards green commercial buildings by stakeholders, hence ensuring the growth of the green building industry.

From the literature review it was determined that the lack of understanding from clients on the benefits of going green was a major challenge towards the adoption of green buildings however, this research contradicted the literature as clients were well aware of the benefits associated from going green. This finding could be specific to the three case studies. However, based on the vast amount of literature pointing to the importance of educating clients with respect to the benefits of green technology and the costs associated with that technology to drive green buildings, it should not be

overlooked. Indeed, it should be improved. Through education, more awareness will be created, which should result in driving costs of green buildings down, as experienced in other countries.

6.2. Recommendations

The small sample size could render the research results as irrelevant or not credible size. The sample population should be increased in further research by adding 4 star rated green commercial buildings in other South African provinces. Should the population of projects remains limited then a full qualitative study is suggested rather than a mixed method approach until such time as the number of 4 star rated green commercial buildings increases in South Africa. Further research using this study as a platform to identify and rank cost factors for green commercial buildings in South Africa should compare results gathered from this research to the future research. This will help determine if the stakeholders' perceptions have changed with time, especially if government incentives and FIT systems become available at the time of the future research. This research should be revisited and expanded once the population of green commercial buildings has grown in South Africa, Gauteng so that a full quantitative research can be undertaken as this will yield more substantial and valid results.

Data collection techniques should allow responses to be based on the respondent's experience and opinion, derived from the South African green building industry and not specifically for the project they were involved. Stakeholders and more specific professionals who were not necessarily involved in the project from inception could be added to the sample population to increase the size. This would also allow respondents to comment on factors such as FIT systems and government or private incentives for going green and even though they are not available in South Africa yet, and how they would affect the drive towards green buildings.

In order to increase the response rate of respondents, it is recommended that interviews are conducted only to gather the data required, instead of interviews and questionnaires. A combination of closed and open-ended questions should be used in the interview which would result in qualitative and quantitative data. The use of mixed methods is encouraged as quantitative analysis is usually more credible and valid. In this suggestion, the researcher should be mindful of the time available to complete the interviews required for an acceptable sample size for mixed method research which quantitative analysis falls part of.

Since the influence level of each factor was identified as the most important category in this study, this question could be broken up into individual segments whereby respondents could rank each

segment using the same 3-point Likert-type scale so that results can be directly compared to this study results. A pilot study is suggested by researchers to fully determine the validity and reliability of the surveys before using them (Pather & Uys, 2008), this is suggested for any future work on this subject matter. The feedback from respondents on the questionnaire was that it was somewhat confusing and difficult to understand what respondents were required to answer. Item analysis, as defined by (Pather & Uys, 2008) could then be used on the outcomes of the pilot study in order to eliminate the factors deemed irrelevant by respondents which were found to be the case in this research. Further to this suggestion, it could be possible to use this research as a pilot study for a research on the same subject matter which would encompass a larger population. Item analysis could be applied to this study in order to minimize the number of factors which respondents are to give feedback on which through item analysis are irrelevant.

The definition of each cost factor in the survey should be generalised as some definitions used in this research lead the respondents to think of the enabler as an enabler or challenge. For example 'higher return on investment' could be more general and simply state 'return on investment'. The word 'higher' automatically implies that it enables investors to invest in green buildings as it is 'higher' than usual returns.

The cost factor table questions designed used in the questionnaire and interview was sometimes difficult for respondents understand and as a consequence took time to complete correctly, whereas some respondents did not answer it correctly and results had to be excluded. The questionnaire should be designed to be simple, quick to answer and be effective in extracting the required data from respondents, hence an online or 'app' friendly version of a questionnaire should be used rather than the traditional paper questionnaire as was used in this study. The interviews yielded the best percentage response and the best results, however were time consuming and logistically difficult to schedule with the respondents due to their busy work schedules. The same data collection techniques used in this study are recommended for further studies, however as mentioned, the questionnaire should be streamlined and made simpler and quicker to answer for respondents. There was a trade-off between time to conduct interviews and the quality and success of results obtained from undertaking interview instead of questionnaires via email. A researcher would need to determine which data collection technique was best suited for their research timeline.

6.3. Limitations

The literature review was mostly based on other countries and not primarily on South Africa, as information on cost factors in South Africa was lacking, this could be improved as more studies become available.

There are issues relating to the validity and credibility of the quantitative data and results from the research which stem from a small sample size. The sample size was low and could limit the validity of the research findings however, the sample population was restricted as the pool of 4 star green commercial buildings in Gauteng were limited at the time of the research.

The closed-ended questions designed for the cost factor table did not allow for respondents to give an opinion on factors which did not influence the project they worked on. Respondents were constrained to answer the questions based on the project they were involved with and not as a general statement to the South African construction industry.

The margin of error calculated was 13.5%, which is not ideal as most studies require a minimum of 10% of margin of error. However the sample population was small, total of 78 possible respondents, and at least 10 respondents from the small population could not be reached to answer the questionnaires as they were either retired, moved overseas or researcher could not obtain their new contact details as they had moved on from their previous work position. The calculation of the required sample size for a 10% margin of error would require the sample size to be 36 which was not obtained. Suggestions for further studies

A theme emerged from the interview results showing that tenants directly influence the outcome and decision in investing in green commercial buildings in South Africa, Gauteng; hence a study should include tenants as a crucial part of the study. Main contractors were found to be mostly unaware of factors as they were not part of the project during inception stage whereby most of these factors and issues are discussed. Depending on the type of contract used for a project, the main contractor can either be included from the start or only be involved in the construction phase of the project. This needs to be defined before the contractor is included as part of the stakeholders for such a study.

Environmental and marketing factors should be included in further studies on determining the level of influence of factors towards driving green commercial buildings in South Africa. In this study it was found that both environmental and marketing factors are influential through the tenant and their requirements. Since this tenant requirements and demand drives green commercial property

development in South Africa, a study is proposed to determine the nature and occurrence of factors and how they influence the tenant's decisions for going green.

6.4. Closing Statement

Continuous research on this subject matter will assist in building a significant knowledge base on cost related factors related to green commercial buildings, and will also assist in developing a sound business case for green commercial buildings in South Africa. As was found in the literature review, in order to promote green buildings there needs to be assistance to stakeholders from government which take the form of incentives, policies as well as systems. Research from other countries with developed green building industries suggest the major factor in driving green projects within a country was government assistance. This factor serves as an initial step towards promoting and adopting of green buildings within a country. This in turn reduces green building costs and helps to grow the industry further. This specific scenario was experienced in Australia over the last 12 years.

The South African construction industry seems to have the same challenges as other developing countries with a relatively new green building industry. Strategies need to be developed by the private and public sector to overcome such challengers and drive green construction. Based on the literature review conducted, several strategies to the promotion of green buildings emerged that have been proven to work in both developed and developing countries. The following strategies are proposed for South Africa to promote green buildings throughout:

- Government incentives;
- Legislation towards green building practise;
- Building codes which incorporate green building practises;
- Private financial incentives for going green,
- Effective communication of the benefits of green buildings to clients/investors by industry professionals.

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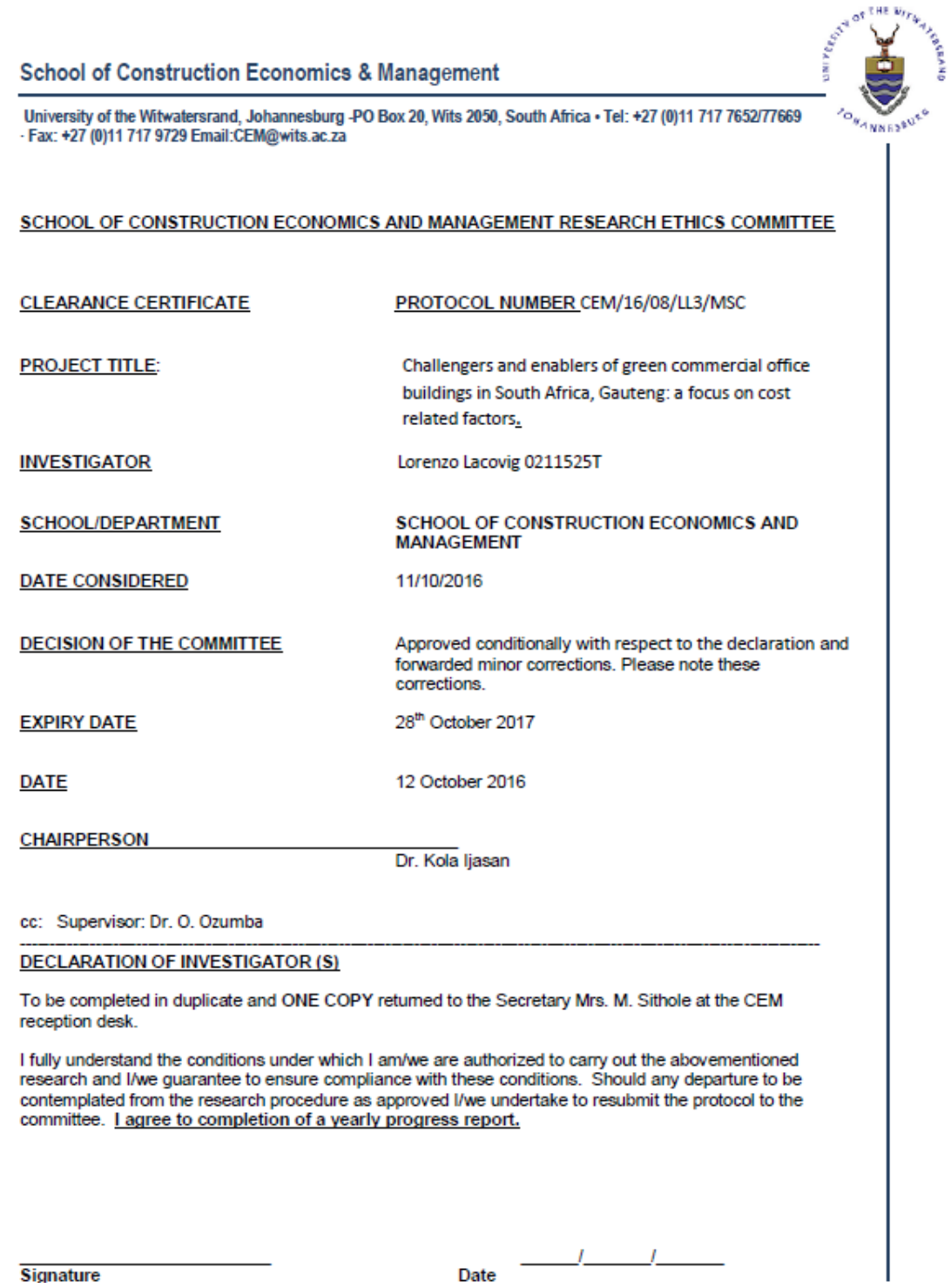
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APPENDICES

Ethical Clearance Certificate

The ethical clearance certificate was applied and approved in October 2016 from the University of the Witwatersrand as shown below.



School of Construction Economics & Management

University of the Witwatersrand, Johannesburg -PO Box 20, Wits 2050, South Africa • Tel: +27 (0)11 717 7652/77669 · Fax: +27 (0)11 717 9729 Email:CEM@wits.ac.za

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE	PROTOCOL NUMBER CEM/16/08/LL3/MSC
PROJECT TITLE:	Challengers and enablers of green commercial office buildings in South Africa, Gauteng: a focus on cost related factors.
INVESTIGATOR	Lorenzo Lacovig 0211525T
SCHOOL/DEPARTMENT	SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT
DATE CONSIDERED	11/10/2016
DECISION OF THE COMMITTEE	Approved conditionally with respect to the declaration and forwarded minor corrections. Please note these corrections.
EXPIRY DATE	28th October 2017
DATE	12 October 2016
CHAIRPERSON	Dr. Kola Ijasan

cc: Supervisor: Dr. O. Ozumba

DECLARATION OF INVESTIGATOR (S)

To be completed in duplicate and ONE COPY returned to the Secretary Mrs. M. Sithole at the CEM reception desk.

I fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the committee. I agree to completion of a yearly progress report.

Signature _____ Date _____/_____/_____

Interview Schedule

Study title:

Challengers and enablers of green commercial buildings in South Africa, Gauteng: a focus on cost related factors

Name:_____

Position:_____

Company:_____

Project:_____

Years of experience in field:_____

The research examines the nature and occurrence of drivers or challengers as perceived by stakeholders in green commercial building projects in South Africa, Gauteng. The research is specifically focusing on cost related factors and the aim is to determine whether the factors are enablers or challengers when looking to invest in a green project.

The findings of this interview and your input will be used for academic purposes only and your response will be confidential. Your participation is highly appreciated.

1. How were you involved in the green project?

   _____

   _____

   _____

2. How many years were you involved in the project?

   _____

3. Were you involved with the project from inception?

   _____

4. Were you aware of the factors which influenced the decision for owners to invest in a green building instead of conventional building?

_____

5. How did you become aware of these factors?

_____

_____

_____

6. Please complete the table below on cost related factors

Instructions:
Please only complete cells A-M

For A:
State Yes or No

For B:
Use the following scale (1-never, 2-seldom, 3-occasionally, 4-often, 5-always)

For C:
State Yes or No

For D and E:
D is a pre-determined list of stage where the factor influences the project
E is for respondent to confirm with a tick the pre-determined categorisation of the cost factor

		A	B	C	D	E
Factor Description	Is Factor cost related	Awareness of factor	Frequency of occurance of factor	Did factor affect decision making proc	Lifecycle stage	Confirmation of Stage
		(Yes/No)	(1-5)	(Yes/No)		Tick or no tick
Renewable technology costs reducing as more people start implementing the green technology	Yes				Construction	
Higher return on investment	Yes				Inception	
Increased rental amount	Yes				Operation	
Increased property value	Yes				Residual Value	
Payback period for investment is relatively good if incentives exist in country	Yes				Inception	
Occupying cost saving	Yes				Operation	
Minimizing the costs and impacts of churn	Yes				Operation	
Lower operating costs	Yes				Operation	
Rising energy costs	Yes				Operation	
Challenge with split between capital expenditure and operating cost savings	Yes				Operation	
Current cost of coal energy is less than renewable energy cost in South Africa	Yes				Inception	
Availability, cost and difficulty in identifying green products, materials and technologies	Yes				Construction	
Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Yes				Inception	
Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Yes				Operation	
Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Yes				Operation	
Cost associated in introducing a green building professional to the professional team	Yes				Inception	
No private financial incentives available for going green in South Africa	Yes				Inception	
FIT system	Yes				Operation	
External funding or incentives available from government for implementing green technology on a small-scale	Yes				Inception	
Lack of understanding from clients regarding the actual benefits from going green	Yes				Inception	
Water use reduction	Yes				Operation	
Client driven process, hence clients are mostly unwilling to pay additional costs for green	Yes				Inception	
Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Yes				Residual Value	
Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				Sale	
Increases worker productivity	Yes				Operation	
Fuel price	Yes				Inception	
Exchange rate	Yes				Inception	

For F and G:
State Yes or No

For H and I:
Use the following scale (1-not at all influencial, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential)

		F	G	H	I
Factor Description	**Is Factor cost related**	**Is factor an Enabler**	**Is factor a Challenger**	**Impact on time**	**Impact on quality**
		(Yes/No)	(Yes/No)	(1-5)	(1-5)
Renewable technology costs reducing as more people start implementing the green technology	Yes				
Higher return on investment	Yes				
Increased rental amount	Yes				
Increased property value	Yes				
Payback period for investment is relatively good if incentives exist in country	Yes				
Occupying cost saving	Yes				
Minimizing the costs and impacts of churn	Yes				
Lower operating costs	Yes				
Rising energy costs	Yes				
Challenge with split between capital expenditure and operating cost savings	Yes				
Current cost of coal energy is less than renewable energy cost in South Africa	Yes				
Availability, cost and difficulty in identifying green products, materials and technologies	Yes				
Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Yes				
Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Yes				
Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Yes				
Cost associated in introducing a green building professional to the professional team	Yes				
No private financial incentives available for going green in South Africa	Yes				
FIT system	Yes				
External funding or incentives available from government for implementing green technology on a small-scale	Yes				
Lack of understanding from clients regarding the actual benefits from going green	Yes				
Water use reduction	Yes				
Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Yes				
Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Yes				
Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				
Increases worker productivity	Yes				
Fuel price	Yes				
Exchange rate	Yes				

For J-L
Use the following scale (1-not at all influencial, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential)

For M:
This is an open ended question, in a few words please speficy how the factor affected cost for the project

		J	K	L	M
Factor Description	Is Factor cost related	Impact on client satisfaction	Impact on sustainability	Impact on overall project	How did factor affect the decision making
		(1-5)	(1-5)	(1-5)	
Renewable technology costs reducing as more people start implementing the green technology	Yes				
Higher return on investment	Yes				
Increased rental amount	Yes				
Increased property value	Yes				
Payback period for investment is relatively good if incentives exist in country	Yes				
Occupying cost saving	Yes				
Minimizing the costs and impacts of churn	Yes				
Lower operating costs	Yes				
Rising energy costs	Yes				
Challenge with split between capital expenditure and operating cost savings	Yes				
Current cost of coal energy is less than renewable energy cost in South Africa	Yes				
Availability, cost and difficulty in identifying green products, materials and technologies	Yes				
Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Yes				
Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Yes				
Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Yes				
Cost associated in introducing a green building professional to the professional team	Yes				
No private financial incentives available for going green in South Africa	Yes				
FIT system	Yes				
External funding or incentives available from government for implementing green technology on a small-scale	Yes				
Lack of understanding from clients regarding the actual benefits from going green	Yes				
Water use reduction	Yes				
Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Yes				
Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Yes				
Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				
Increases worker productivity	Yes				
Fuel price	Yes				
Exchange rate	Yes				

7. At what stages of the life cycle of the project are cost related factors most influential when referring to the investment decision in the project? Please give reason for answer

_____

_____

Reason_____

_____

_____

8. What other cost related factors can you describe from your experience in the project which are not stated in the table in question 2? (please note the factors need to have influenced the decision making of the stakeholders in the project) and why do you refer to these factors as influencing the decision to undertake the project?

_____

_____

Reason_____

_____

_____

9. What other non-cost related factors influenced the decision making of the stakeholders in the project? And how did you come to this conclusion?

_____

_____

Reason_____

_____

_____

10. In your opinion what type of factors (cost/environmental) were the main drivers in the ultimate decision to invest in this green project? And state why

_____

_____

Reason_____

_____

Questionnaire Schedule

Study title:

Challengers and enablers of green commercial buildings in South Africa, Gauteng: a focus on cost related factors

Name:_____

Position:_____

Company:_____

Project:_____

Years of experience in field:_____

Your participation in this research is highly appreciated.

Please complete the table on the next pages on green building cost factors, please follow the instructions set out on the top of each page.

Instructions:
Please only complete cells A-M

For A:
State Yes or No

For B:
Use the following scale (1-never, 2-seldom, 3-occasionally, 4-often, 5-always)

For C:
State Yes or No

For D and E:
D is a pre-determined list of stage where the factor influences the project
E is for respondent to confirm with a tick the pre-determined categorisation of the cost factor

		A	B	C	D	E
Factor Description	**Is Factor cost related**	**Awareness of factor**	**Frequency of occurance of factor**	**Did factor affect decision making proc**	**Lifecycle stage**	**Confirmation of Stage**
		(Yes/No)	(1-5)	(Yes/No)		Tick or no tick
Renewable technology costs reducing as more people start implementing the green technology	Yes				Construction	
Higher return on investment	Yes				Inception	
Increased rental amount	Yes				Operation	
Increased property value	Yes				Residual Value	
Payback period for investment is relatively good if incentives exist in country	Yes				Inception	
Occupying cost saving	Yes				Operation	
Minimizing the costs and impacts of churn	Yes				Operation	
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Rising energy costs	Yes				Operation	
Challenge with split between capital expenditure and operating cost savings	Yes				Operation	
Current cost of coal energy is less than renewable energy cost in South Africa	Yes				Inception	
Availability, cost and difficulty in identifying green products, materials and technologies	Yes				Construction	
Costs to achieve green star status is relatively high and could impact the financial viability of project depending on the size of the project	Yes				Inception	
Maintenance or tune-up costs are expensive and occur more frequently with green buildings, increase in life cycle costing with reference to maintenance costs	Yes				Operation	
Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Yes				Operation	
Cost associated in introducing a green building professional to the professional team	Yes				Inception	
No private financial incentives available for going green in South Africa	Yes				Inception	
FIT system	Yes				Operation	
External funding or incentives available from government for implementing green technology on a small-scale	Yes				Inception	
Lack of understanding from clients regarding the actual benefits from going green	Yes				Inception	
Water use reduction	Yes				Operation	
Client driven process, hence clients are mostly unwilling to pay additional costs for green	Yes				Inception	
Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Yes				Residual Value	
Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				Sale	
Increases worker productivity	Yes				Operation	
Fuel price	Yes				Inception	
Exchange rate	Yes				Inception	

For F and G:
State Yes or No

For H and I:
Use the following scale (1-not at all influencial, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential)

		F	G	H	I
Factor Description	**Is Factor cost related**	**Is factor an Enabler**	**Is factor a Challenger**	**Impact on time**	**Impact on quality**
		(Yes/No)	(Yes/No)	(1-5)	(1-5)
Renewable technology costs reducing as more people start implementing the green technology	Yes				
Higher return on investment	Yes				
Increased rental amount	Yes				
Increased property value	Yes				
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Rental request for commercial building needs to be higher to recover additional costs incurred by owner, tenant reaping benefits of technology	Yes				
Cost associated in introducing a green building professional to the professional team	Yes				
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Client driven process, hence clients are mostly unwilling to pay additional costs for green technology	Yes				
Implementation of green technology will ensure the value of the property will not depreciate rapidly in the future	Yes				
Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				
Increases worker productivity	Yes				
Fuel price	Yes				
Exchange rate	Yes				

For J-L
Use the following scale (1-not at all influencial, 2-slightly influential, 3-somewhat influential, 4-very influential, 5-extremely influential)

For M:
This is an open ended question, in a few words please speficy how the factor affected cost for the project

		J	K	L	M
Factor Description	Is Factor cost related	Impact on client satisfaction	Impact on sustainability	Impact on overall project	How did factor affect the decision making
		(1-5)	(1-5)	(1-5)	
Renewable technology costs reducing as more people start implementing the green technology	Yes				
Higher return on investment	Yes				
Increased rental amount	Yes				
Increased property value	Yes				
Payback period for investment is relatively good if incentives exist in country	Yes				
Occupying cost saving	Yes				
Minimizing the costs and impacts of churn	Yes				
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Future outlook on the resale and resale value of the property, by investing in green technology you are ensuring the reselling of the property in the future	Yes				
Increases worker productivity	Yes				
Fuel price	Yes				
Exchange rate	Yes				

Questionnaire Explanatory Email

Thank you again for accepting to participate in the questionnaire, your participation is greatly appreciated.

Please find attached the questionnaire, consent form and information document, please complete the consent form and questionnaire and send back to me. You will need to print the questionnaire and consent form and fill it in manually and scan it back to me once complete.

Please consider these points below as it will aid you in answering the table in the questionnaire.

The idea is to start on factor number 1 and follow through columns A to M, then move to number 2 and so on.

Starting from Column A to Column M:

- Column A states whether you are aware of the factor, even if it did not relate to Majestic Offices you need to answer Yes or No, if No then move to the next factor, if Yes move to Column B and C
- Column B and C needs to be looked at together. The question which must be asked is did the factor affect the decision making process in going Green instead of going for a conventional building, and how often did the factor occur in the decision making process on a scale of 1 to 5
- Column D and E are looked at together. I have assigned the factor to a life cycle stage of the project, you need to confirm if you agree with the pre-determined stage, if not then you need to state which stage it should be assigned to
- Column F and G are looked at together. You need to state if you think the factor was an enabler or a challenger
- Column H. You need to give a rating of 1 to 5 on how the factor impacted on the time of the project
- Column I. You need to give a rating of 1 to 5 on how the factor impacted on the quality of the project
- Column J. You need to give a rating of 1 to 5 on how the factor impacted on client satisfaction of the project
- Column K. You need to give a rating of 1 to 5 on how the factor impacted on sustainability of the project
- Column L. You need to give a rating of 1 to 5 on how the factor impacted overall on the project
- Column M. Please state exactly how the factor affected the decision making process for this project in a few short words, for example you can state “part of the tenant requirements”

Consent Form

CONSENT FORM - Interview

Study title:

Challengers and enablers of green commercial buildings in South Africa, Gauteng: a focus on cost related factors

	Please tick to indicate you consent to the following		
a	I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions	Yes ☐	No ☐
b	I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason	Yes ☐	No ☐
c	I understand there are no foreseeable risks to the company or myself by agreeing to take part in the study	Yes ☐	No ☐
d	I understand that there are no costs involved with this research	Yes ☐	No ☐
e	I understand that confidentiality and anonymity will be guaranteed for this study	Yes ☐	No ☐
f	I understand and agree that data is stored in a secure facility where no unauthorized access is available	Yes ☐	No ☐
g	If I have any queries I have been informed of who I need to contact	Yes ☐	No ☐
h	I understand that the data collected from my participation will be used for the purpose of this study, and I consent for it to be used in this manner	Yes ☐	No ☐
i	I agree to take part in the interview for the above study	Yes ☐	No ☐

Signed Date

_____ _____

Name (please print)

Information Document

INFORMATION DOCUMENT - Interview

Study title:
Challengers and enablers of green commercial buildings in South Africa, Gauteng: a focus on cost related factors

Greeting:
Hello, my name is Lorenzo Lacovig and I am conducting research towards a master's degree. I am researching factors which enable or challenge stakeholders in undertaking green commercial building projects in South Africa, Gauteng and would like to invite you to participate in the project.

Introduction:
I, Lorenzo Lacovig am conducting research on understanding the challengers and enablers of green commercial buildings in South Africa, Gauteng, with a specific focus on cost related factors. Research is the process whereby we learn an answer from specific questions on the topic we are looking to understand. The respondents should be or were directly involved in one of the three selected projects.

In this study I am aiming to learn and understand how and why certain cost related factors influence the decision making of stakeholders to invest in green commercial building projects in South Africa, Gauteng. The current lack of knowledge on green buildings and their associated costs and cost related factors in South Africa for green buildings leads to a perception and fear of cost overruns and unnecessary costs related to green buildings.

Invitation to participate:
I am kindly asking/inviting you or the organization which you employed to, to take part in this research study in order to gather relevant information on the subject matter.
Please note that only people who were directly involved in the project should be selected to answer interview questions.
If your job level is senior management and you were or are directly involved in the project, or if you are a stakeholder/investor/owner of the project, you will then be requested to participate in the interview.

What is involved in the study:
The study entails answering interview questions, stating your job title and years of experience.

The interview should take between 30-60min depending on the open question responses of the interviewee. If you are selected for the interview and cannot commit then an alternative arrangement will be made for you to answer the interview questions.

Interviews will need to be recorded for later analysis of the answers, hence I would require written consent from respondent and/or organization which you are employed before this can be done.

Risks:
The risks involved in this study are related to confidentiality of information and anonymity. This type of risk is mitigated by clearly stating in the consent form that all information is confidential.

Benefits:
There are no direct benefits of being involved in the study.

Alternative:
There are no alternative procedures for this study.

Participation is voluntary:
Participation in the research is fully voluntary and the refusal to participate will involve no penalty or loss of benefits to which the participant is otherwise entitled, the subject may discontinue participation at any time without penalty loss of benefits to which the participant is otherwise entitled. If you choose to participate, but wish to withdraw at any time, you will be free to do so without any negative consequence.

Reimbursements
There are no foreseen expenses which would need to be reimbursed.

Confidentiality:
Efforts will be made to keep personal information confidential. Absolute confidentiality cannot be guaranteed as personal information may be disclosed if required by law
Anonymity will be guaranteed even though your name will be asked.
Interview results will be disclosed and approved before any results are used in the study.
Organizations that may inspect and/or copy the research records for quality assurance and data analysis include groups such as the Research Ethics Committee.
If results are published, may lead to individual/cohort identification.
Data stored will be safeguarded and preserved from unauthorized access, and will be stored in a personal collection.

Report:
The study will be reported by means of a formal typed report which will be stored electronically and physically at the University of the Witwatersrand. The report will also be stored in a personal collection.
The report will be made available at any time should you require to review the information disclosed.

Termination/Postponement of study:
The study may be terminated in an extreme event such as fatality, serious injury, and serious illness.

Contact details of researcher/s – for further information / reporting of study related adverse events,

Name of researcher:	Lorenzo Lacovig
Cell	082 779 2801
Work	011 452 0795
Email	llacovig@gmail.com