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The Perceptions of Green Buildings amongst occupiers of Commercial Buildings in South Africa

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A research report submitted to the Faculty of Commerce, Law and Management, University of the Witwatersrand, in partial fulfilment of the requirements for the degree of Master of Business Administration

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ABSTRACT

Green buildings are becoming more prevalent within the South African commercial property market. As it is a relatively new concept within the market, there is a need to understand what the commercial user perceives as a benefit derived from occupying a green building and what the barriers to entry are for occupying these green buildings. An online survey was emailed to 500 occupants of commercial buildings within Gauteng to gauge their perceptions on the above problems. 131 Functional responses were obtained from the survey and indicated that benefits can be derived in five main areas notably: environmental sustainability, economic benefits, competitiveness compared to non-certified buildings, an increase in the level of workforce productivity and increased branding benefits. The biggest barrier to entry was that the occupiers of commercial buildings are not really interested in green buildings and do not perceive it necessary to change their ways. The conclusion that can be drawn from the research is that there are definite benefits that can be derived from occupying green buildings, but that a significant increase in the marketing of the green building movement is required, to inform commercial occupiers and the general public of the benefits of green buildings to ensure the sustainability of the earth's environment.

DECLARATION

I, **Oliver Jason Reeves**, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in this or any other university.

Oliver Jason Reeves

Signed at ……

On the …… day of …… 2016

DEDICATION

Thank you to my parents for all their love, support and guidance prior to and during the MBA course and in every aspect of my life.

Thank you to my wife Ansuri for looking after our two wonderful kids, Luke and Anika every Saturday for the last two years while I was at class. Thank you for being a sounding board and allowing me to grow as a person during this process.

To my little angel Leya, you are always in my thoughts.

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CHAPTER 1. INTRODUCTION

This chapter will clarify the objectives, framework and purpose of the study. The summarised contents will thereafter contain a brief explanation of the guidelines and principles around which this study is based.

1.1 Purpose of the study

Over the past few decades the world has changed, acknowledging that we cannot continue to consume natural resources without dire environmental consequences. This has led to an increase in the development of green buildings as the awareness of the consequences of climate change begins to influence decision makers seeking new office accommodation (C. Warren, 2010).

With the increase in the development of green buildings worldwide, various international projects from around the world have documented the costs, return on investment and the benefits derived by utilising green initiatives on the building (World Green Building Council, 2013). It must be noted though that within the property industry there are still many challenges and barriers that lead to green buildings not being implemented, despite a strong case for their implementation (The Green Building Council Australia, 2006). It is imperative that we have an understanding of the commercial user's perception and acceptance of green buildings, to ensure that sustainable development is a success and is in itself 'sustainable'.

The research problem that will be resolved by the time I have finished my research report, is to establish the perceived benefits of green buildings to existing users of commercial buildings within the South African commercial property market and what the barriers to entry are for occupying green buildings within the South African commercial property market.

1.2 Context of the study

In recent decades there has been an ever increasing acknowledgement by people across the world that humans cannot continue to use natural resources without facing devastating environmental consequences (C. M. Warren, Bienert, & Warren-Myers, 2009, p. 2). The built environment has reacted slowly to this changing view

of the world, even though since the time of the Industrial Revolution, people have been aware that their actions are negatively affecting the environment.

C. M. Warren et al. (2009, p. 2) notes Engles' quote of 1876:
'Let us not, however, flatter ourselves over much on account of our human victories over nature. For each such victory, nature takes it revenge on us. Each victory, it is true, in the first place brings about the results we expected, but in the second and third places it has quite different, unforeseen effects which only too often cancel the first.'

Al Gore's documentary "An Inconvenient Truth' has awakened the world to the fact that should the quest for the 'good life' continue, which causes the depletion of the world's resources at a faster rate than they can be replenished, then the existence of the world as we know it could be in serious jeopardy (Addae-Dapaah, Hiang, & Sharon, 2009). Environmental issues have created the need for significant green building investment within the commercial property industry. United Nations Environmental Programme (2013, p. 8) states that, "the construction and on-going operation of buildings is responsible for 40% of total energy usage worldwide, 25% of fresh water usage, 40% of global resource usage, and a third of all global carbon emissions".
Due to the above reasons it is now more than ever necessary, to ensure that all new buildings that are being developed and refurbishments that are happening within the built environment, are undertaken using green building design principles.

1.3 Problem Statement

1.3.1 Main problem statement

The decision to move into "green buildings" within the South African property market has been a difficult choice for commercial building users. This is as a result of there being limited perceived value derived from green building initiatives. These values are further impaired as there are no tools to confirm and measure the benefits of occupying a green building. The purpose of the research is to identify the perceived benefits of a green building from a commercial building user's perception within the South African property market. This report will also look at the

barriers to occupying green buildings within the South African property environment. Overcoming the barriers to such entry should create an environmentally sustainable future for the property industry within South Africa.

1.3.2 Sub-problems

The first sub-problem is to identify the perceived benefits of **occupying** a green building from a commercial building user's perception.
The second sub-problem is to identify the perceived **barriers** of occupying a green building over a non-certified building from a commercial building user's perception.

1.4 Significance of the study

From a property investors perspective it has become imperative that they prioritise sustainability as part of the broader strategy of the business. It is imperative to invest responsibly to ensure that the increased environmentally sustainable needs of their clients are met. This study is intended to give South African property developers insight into the perceptions that potential commercial green building clients have of green buildings. This research aims to identify what potential commercial users think are the benefits of occupying a green building, so that developers are aware of these touch points when pitching a green development to a new client. This study will also identify the barriers to occupying green buildings from a commercial occupier's perspective within South Africa, which may give insight to developers on what to overcome to ensure that new green developments are approved and built.

Secondly it will give commercial property brokers insight into the perceptions of the benefits and barriers of green buildings from a commercial user's point of view, which could help in the finalising of a green building deal.

Thirdly, South Africa has become an important financial centre within the African continent and a leader of green building initiatives on the continent. Prospective multi-national companies wanting to invest in the South African market may like to know what initiatives are being taken to promote green commercial buildings, before deciding to invest in South Africa.

Sustainable property development is all important for the survival of mankind, ensuring that the earth's natural resources will not be unnecessarily depleted. The success of sustainable property development will make a significant contribution to the fight against global warming (Addae-Dapaah et al., 2009). Therefore it is necessary that we understand all the benefits and barriers to green buildings as a way of promoting the green building movement.

As this study is based on commercial users in South Africa, which is still a developing green building arena, any insight in this market may appeal to a wider audience in the global green building arena.

1.5 Delimitations of the study

Delimitations have been applied to this study to document the elements that the researcher may not have completed and to scope the study into a more manageable task (Leedy & Ormrod, 2005). The following delimitations provide the bounds of this study:

- This study will take place within the South African green building arena, still considered fledgling by world green building standards.
- The majority of the data and literature for this report comes from American, Australian and European sources.
- The study is limited to the commercial building users of office and industrial buildings within the Gauteng region.

1.6 Definition of Terms

Commercial occupants: juristic persons and persons that do not use buildings and structures as 'a form of dwelling or shelter'. This could either be in the form of an office, industrial or retail building occupier.

Green Building: A building that uses carefully integrated design strategies that minimise energy use, maximise daylight, has a high degree of indoor air quality and thermal comfort, conserves water, reuses materials and uses materials with recycled content, minimises site disruptions, and generally provides a high degree of occupant comfort (Kozlowski, 2003, p. 26).

Life Cycle Costing: A cost analysis that compares the cost effectiveness of alternative investments of business decisions from the perspective of an economic

decision maker such as a manufacturing firm or a consumer. It is an evaluation technique that provides a consistent framework for evaluating alternative systems to determine their life cycle performance and cost effectiveness (Circo, 2007).

Sustainable Development: Development which meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland et al., 1987, p. 11).

1.7 Assumptions

Assumptions are facts within the study that have not been validated but are accepted by the person doing the research as being true (Leedy & Ormrod, 2005). For the purpose of the study, I will assume that the respondents of the study have a clear understanding of the meaning of green buildings and have a basic understanding of the benefits and barriers to occupying a green building. Coupled with this fact, I have assumed that the respondents have answered truthfully and honestly as their anonymity have been guaranteed and they had the opportunity to withdraw from the survey at any time. I have assumed that the importance of the green building movement will not decrease and that the industry will continue to growth due to the ever increasing pressures that are being placed on the natural environment and new environmental legislation that is being implemented promoting a greener environment.

CHAPTER 2. LITERATURE REVIEW

2.1 Introduction

This chapter will utilise literature to clearly define what a green building is and outline the perceived benefits and barriers of occupying green buildings.

The rate of increase of green building certifications has increased rapidly in South Africa. The first green building certification was awarded by the GBCSA in 2009 and in April 2014 the country celebrated its 50th Green Star rated property. A year later in April 2015, the 100th green star building was certified with 25 certifications occurring in the first quarter of 2015 alone (The Green Building Council of South Africa, 2015). From the above, one can see the exponential growth of the green building market in South Africa. But in order for this growth trend to continue within the South African property market, the financial and business case for occupying green buildings needs to be clear, as well as marketing the benefits of green buildings to potential commercial occupiers. These users also need to be aware of the perceived barriers to occupying a green building in order to ensure that informed decisions are made. This will ensure that the growth of the green building market in South Africa is sustainable.

2.2 Background Discussion

2.2.1The Concept of Green Buildings

The Green Building Council of South Africa has defined a green building as a building that incorporates construction, design and post-construction operational practices that will significantly reduce or eliminate the negative impact of development on the environment and its occupants with strategies addressing the following concerns:

- Improved energy efficiency of the property plus the adoption of eco-friendly equipment;
- Reduction in greenhouse gas emission;
- Water conservation through waste avoidance, reuse and recycling;
- Pollution prevention – noise, water, air, soil and light;
- Reduced natural non-renewable resource consumption;
- Productive and healthier work environments; and

- Flexible and adaptive work spaces.

From the above points one can see that the ultimate aim of green buildings is to ensure that the design, construction and operation of the building reduces the impact of the building on the environment and improves the work performance of the occupant to promote the sustainability of life (Milne, 2012). Green buildings therefore promote the sustainable consumption of the earth's resources which will ensure that the needs of future generations are not jeopardised and help in the reduction of global warming (Addae-Dapaah et al., 2009).

Worldwide there are hundreds of tools that focus on the different areas of sustainable development and are designed for different types of projects. By March 2010, there were 382 registered building rating systems for evaluating energy efficiency and building sustainability (Nguyen & Altan, 2011). The most well know systems utilised world-wide are:

- The British Research Establishment Environmental Assessment Methodology (BREEAM) developed in 1990;
- The Leadership in Energy and Environmental Design (LEED) Green Building Rating System developed by the U.S Green Building Council in 1998;
- Green Star, which was initiated in 2003 by the Green Building Council of Australia, is a voluntary environmental rating system; and
- South Africa's own Green Star SA rating developed in 2008

Green Star SA is based on Australia's Green Star system, but has been customised for the South African context and conditions. These rating systems have been developed to create a uniform language and standard of measuring green buildings. This will assist in identifying the impacts of the lifecycle of a building and create an understanding of the integrated whole building design (The Green Building Council Australia, 2006). At this point in time, all Green Star rating tools are voluntary and aim to drive best practice within the construction industry and not merely to duplicate building regulations across the world (Milne, 2012).

The above rating systems have comparable objectives, which foster green principles by driving social and environmental building techniques. Furthermore, the rating systems differentiate between sustainable ‘green buildings’ and non-certified buildings (Addae-Dapaah et al., 2009, p. 205).

2.3 The Perceived Benefits of Green Buildings

Green buildings provide an economic benefit to the investors and occupants of the green buildings. Numerous studies have been completed across the world to determine the possible link between developing green buildings and the increased returns provided on the asset and the resulting increased value (Addae-Dapaah et al., 2009). The evidence of the above can only be obtained by investigating the more mature property markets, where there is a significant mass of buildings to create a meaningful sample size (Milne, 2012). At the centre of the issue over the linkage between green buildings and asset value, is the central question of what the definition of ‘value’ actually is. Warren-Myers and Reed (2009, p. 3) have noted that a vast amount of time has been spent researching the value of sustainability and this is leading to a level of confusion in the market as it uses different concepts of value interchangeably in an attempt to promote sustainability and make it seem more viable.

Davis (2005, p. 4) goes onto say that ‘this is the gap in the understanding and knowledge that exists between the green industry and financial industry. Both the green and the financial industries have their own definitions of value, and neither may be appropriate in quantifying the impact on asset value. Many on the green side refer to the value of green buildings but are actually referring to cost savings. These are not necessarily the same as value, nor can cost savings be certain to add directly to building value as some have claimed.’

It is therefore imperative that the level of communication improves between the green building industry and the financial industry to ensure that they both get a better understanding of how the other party values building and the language that they speak.

Davis (2005) conducted various interviews with the developers and owners of green buildings across Canada, the United Kingdom and the United States. The report

found that green buildings can in time enhance value of the property by doing the following:

- Secure tenants more quickly;
- Command higher rents or prices;
- Enjoy lower tenant turnover;
- Cost less to operate and maintain;
- Improve business productivity for occupants, affecting churn, renewals, inducements and tenant installation costs.

Miller, Spivey, and Florance (2008) conducted multiple studies on Energy and LEED certified buildings. They deduced from the studies that certified buildings performed better in terms of rental levels and occupancy rates and had superior exit prices (per square foot), compared to non-certified buildings over a period of two years between 2005 and 2007. The paper also confirmed that over this time period these differentials increased.

Fuerst and McAllister (2008) presented a paper at the ARES Annual Meeting of their analysis of 3 600 buildings from the Co Star database. This price analysis based on hedonic principles took a number of factors into consideration such as location, size, height, and age and occupancy rate and confirmed a price premium for Energy Star and LEED rated buildings. They discovered that with all things being equal, a rental premium of 11.8% could be achieved for green buildings. In terms sales, a premium of 31% could be achieved for LEED buildings and 11% for Energy Star rated properties. The analysis also stated that there was evidence that pointed to the fact the price premium increased for buildings with a higher level of certification.

Eiholtz, Kok, and Quigley (2009) conducted a study of approximately 10 000 buildings of which 900 buildings were green star certified. The study was conducted to understand the achievable difference in value between certified (LEED and Energy Star) and non-certified buildings and also get an understanding of what within the certification was driving the premium. Evidence supported a rental premium of 3% for buildings that were designed using green principles and 6% for

properties that had green accreditation. The results however noted that only Energy Star rated buildings could command a premium, suggesting that reduced energy consumption and not overall sustainability is critical for the end user.

P. Eichholtz, N. Kok, and J. Quigley (2010) furthered the above investigation which examined a sample size of 21 000 rental properties and 6 000 sales for Energy Star and LEED rated buildings, taking into consideration the differences for building types, quality, size, location and age of the asset. The investigation concluded that the effective rentals achieved for these properties as well as the sales price obtained for the property were markedly higher for the green certified buildings.

Table 1: Premiums comparing certified Energy Star and LEED rated buildings to non-certified properties (Milne, 2012)

	ENERGY STAR CERTIFIED BUILDINGS (ENERGY EFFICIENCY GRADING)	LEED CERTIFIED BUILDINGS (GREEN BUILDING GRADING)
Rental Premium	2.1%	5.8%
Effective Rental Premium (Effective rent = rentals multiplied by occupancy rates)	6.6%	5.9%
Transaction Price Premium (Market Value)	13%	11.1%

Newell, McFarlane, and Kok (2011) conducted a report which assessed 40% of the office buildings in Sydney and Canberra. This report supported all the above evidence and showed clear evidence that Green Star certified buildings produced green rental and values premiums as follows:

Table 2: Green Premium of Green Star Certified buildings in Sydney and Canberra (Milne, 2012)

	GREEN STAR CERTIFIED BUILDINGS
Rental Rates 'Green Premium'	5%
Market Value 'Green Premium'	12%

A summary of the above points provide real evidence that green buildings provide an asset class capable of providing increased rentals within the market place. The following points should be noted in relation to the evidence provided:

- The studies refer to first world countries that have mature green building environments that will not necessarily apply to the South African property market.
- They are based on metrics such as LEED and Energy Star which are only principles for sustainability and are not consistent with each other over an extended time period. It must be noted that these rating systems do not test sustainability over an extended period of time, and once a property has achieved a certain rating, this rating cannot be reversed. (Sayce, Sundberg, & Clements, 2010).
- The results do not differentiate between the various green level ratings, but merely between certified and non-certified buildings. This has led to the authors making adjustments to their analysis in various ways to ensure the validity thereof. This ultimately means that the data collected is not entirely comparable and that the level of comparison is not completely constant.
- The analysis was only completed where there were enough buildings to provide a meaningful sample size of the rental levels in the various locations chosen.

The above literature suggests higher net rentals for occupants of green buildings; therefore a further review of the economic benefits needs to be addressed to identify the economic benefits of green buildings.

2.3.2 Economic benefits due to grants and rebates from government incentive schemes

It is becoming more prevalent around the world, that city councils are adopting mandates that all new commercial buildings that are being developed will require a level of green building certification.

The city of Cincinnati in the United States is providing a tax rebate of $500 000 over a 15 year period to newly LEED certified buildings and 10 years to existing buildings that have been retrofitted. Along with the tax rebate, the council ensures that these buildings receive priority with passing the building plans thereby ensuring earlier occupancy of the property. Earlier occupancy of the property will lead to a lower initial net rental for the occupier of the property and the tax rebates should result in a lower cost to occupy, for the occupant of the property.

In Nevada, all construction materials that are utilised in the construction of a green building are tax exempt. Materials relating to the construction of the buildings that are deemed as ‘inseparable parts’ such as concrete and drywalls qualify for this exemption, resulting in a lower initial rental for the occupier of the building.

Pivo and Fisher (2010, p. 4) go on to say that energy efficient properties may also benefit from the following incentives from government, namely;

- Tax deductions;
- Utility rebates;
- Low interest loans; and
- Expedite permitting of building applications.

While all the above factors will lead to a benefit to the occupants of green buildings, he does not put a value or a city as to where these benefits can be obtained.

According to Circo (2007), several states and local governments across the United States, have developed strategic initiatives aimed at promoting green buildings standards and an increase in the development of green buildings. A common feature of these green building programmes is a commitment by government to invest in green public buildings. In 2008, the State of Maryland passed the High Performance Building Act that requires all public buildings over 7 500 square feet to have a minimum LEED Silver standard. Therefore change in government regulations has meant a boost to public spending and a benefit to the local construction companies in the area.

As per Cannon et al. (2008), the city if Connecticut has committed to ensure that all properties with a development commitment over $5m and have attained green certification, will receive priority attention towards the approval of the development permits ensuring that these buildings can commence with construction earlier and therefore the occupiers will receive a lower initial rental.

In Singapore, the Building and Construction Authority has created a $20million Green Mark Incentive Scheme to incentivise private sector developers to building

green buildings (Addae-Dapaah et al., 2009). This fund can be utilised when a building has achieved the Gold Mark Rating and the financial incentives will translate into lower initial rentals for the occupiers of the property.

From the above it can be deduced that the occupants of a green buildings benefit from accelerated municipal approval processes, resulting in earlier occupation of the building which results in lower initial net rentals. Owners of green buildings are more likely to receive grants and rebates from government incentive schemes which will be passed onto the occupiers of the buildings resulting in an economic benefit to the occupier.

2.3.3 Lower Operating Costs benefit from Green Buildings

As the benefits of decreased operating costs like lower energy and water prices usually accrue to the tenant, this major benefit of occupying a green building is of outmost importance to the tenant. This is becoming more prevalent every day with the looming electricity tariff increases which are consistently above inflation within the South African energy market (Milne, 2012).

There is now conclusive evidence from a financial point of view, that green buildings provide greater financial benefits than conventional buildings (G Kats & Capital, 2003). The benefits include water and energy savings, reduced creation of waste and lower operational and maintenance costs.

When interpreting the energy savings made by a building, these savings come primarily from reduced electricity purchases and secondarily from reduced peak demand. On average, green buildings are 28% more energy efficient than conventional buildings and generate 2% of their power from photovoltaics (PV). Although in the majority of the cases there is a higher initial set up cost to ensure a thermally efficient envelope. The purchase of modern lighting and ventilation equipment that are energy efficient will ensure operational savings over time which will offset the initial costs and ensure savings to the occupier (Milne, 2012).

From a water usage point of view, water savings can be made by harvesting rain water; treating and re-using grey water and implement low flush fixtures to

decrease the water consumption on site. This will therefore ensure long term savings for the occupant of the property (Miller et al., 2008).In summary, green buildings will create a beneficial cost saving for the occupant due to reduced water and electricity consumption and thereby reducing their exposure to the volatility in increased utility prices from the relevant suppliers.

In terms of the initial site development of the project, by reducing site disturbance and using the natural drainage of the site, the initial upfront costs of the development will be less. By ensuring the building is effectively orientated on the site, will lead to less energy being consumed and hence long terms savings relating to energy consumption (Miller et al., 2008). In terms of the finishes of the building, products that are durable must be selected that will decrease the life cycle maintenance cost of the building and any other unnecessary products that do not add value to the building must be eliminated. It is advisable to reuse the existing shell of a property if possible and use salvaged or refurbished materials which mean that green buildings consume fewer resources and therefore create less pollution. By doing the following, lower monthly running costs will be achieved as superior durable products are used on site which in the long term will lead to the lower depreciation of the asset (Milne, 2012).

2.4 The Perceived productivity gain benefits of occupying a Green Building

From the evidence above, a clear link is emerging that economic value is being created for the occupiers of green buildings due to reduced monthly operating expenses relating to lower utility and maintenance costs. It is essential that we also have a clear understanding of what the benefits are for the employees who work in those green buildings.

The past twenty years has seen a shift in thinking from perceiving buildings as a mechanism of housing employees to a strategic value add that creates a competitive advantage to the company (Horgen, 1999). CEO's are beginning to think of the spaces that they occupy as a way of achieving the strategies of their companies. The sustainable design of the interior of green buildings, is now seen as a way of improving the interior environmental quality of spaces that companies occupy which will lead to better human health within the premises and produce

higher levels of work productivity within the building (Weinberg, 1998). The features of a green building that will improve indoor environmental quality include:

- Improved ventilation and mechanical systems that will increase air flow within the building
- Building materials and fixtures and fittings within the building that have low levels of toxicity.
- The improved use of natural light that will lead to a reduction in energy consumption and improve the interior lighting within the building. Increased contact with the natural environment through the design of better views and inclusion of indoor plants will improve the physiological being of the occupants of the building (Heerwagen, 2000).

The occupants of green buildings therefore benefit from improved indoor air quality, which results in fewer complaints on comfort related issues and higher user satisfaction of the building.

One method of conceptualising the benefits that the above building features provide to the organisation is to evaluate its performance using the 'Balanced Scorecard' approach (Kaplan & Norton, 1996). The scorecard assesses various aspects of the business which include: financial, business process, customer relations and human resource development. It is clear from the makeup of this scorecard that non-financial benefits are important to business and must be thought of as important benefits of green buildings. Table 3 identifies the possible links between sustainable building design and organisational performance outcomes.

Table 3: The Potential Links between Green Buildings and Organisational Performance (Heerwagen, 2000)

Financial outcomes	Business Process Outcomes
• Reduced resource utilisation • Reduced operating / maintenance costs • Reduced risks and future costs relating to legislation changes • Improved overall productivity • Increased resale value of the property • Reduced absenteeism	Process innovation Increased work process efficiency

Stakeholder Relations	Human Resource Development
• Improved public image • Increased ability to sell to pro-environmental customers • Community outreach and education • Improved ability to work with community stakeholders	• Improved quality of work life • Improved personal productivity • Improved well being • Reduced turnover due to increased staff morale and • Increased ability to attract high quality workers

From a human resource development perspective, two of the most important factors to note from Table 3 as provided by (Heerwagen, 2000), are that employers of green buildings have the ability to attract better talent than their competitors in non-certified buildings. Occupants of green buildings also experience higher levels of staff morale which leads to lower work force turnover. Paevere and Brown (2008) have stated that companies that occupy green buildings can use this as a tool to attract and maintain high quality staff members.

Miller, Pogue, Gough, and Davis (2009, p. 1) note that 'Productivity is an important success factor for all organisations. Improvements in productivity have been recognised to have a major impact on many economic and social phenomena, e.g. economic growth and a higher standard of living and companies must continuously improve productivity in order to stay profitable. There are many different methods of measuring productivity and most of these methods are based on the quantitative data of operations. In many cases it is quite difficult and sometimes impossible to collect data for productivity measurement.'

From this statement it is clear that increased productivity for a business is critical for the business to remain competitive, but on the other hand measuring productivity seems to be a rather onerous task.

Kemppilä and Lönnqvist (2003) agreed with the above sentiment that productivity is a challenge to measure because the measurement of professionals in the office environment requires the ability to measure things like:

- How the individual focuses, thinks and synthesizes information in a manner that adds value to the company.,

- How the individual contributes to the team in the work environment. The ability to monitor the quality and efficiency of the output of the work produced.

(Miller et al., 2008) provided the following summary relating to the gains in productivity of green buildings. The benefits are derived due to reduced absenteeism at work with fewer headaches from the occupants of these green buildings. These productivity benefits are estimated to be as much as 10 times the savings made from energy reductions received at the building.

Leaman and Bordass (1999) conducted extensive surveys within the UK property market and claim that improved productivity of 20% can be obtained through the improvement of the conditions in the natural environment such as heating, cooling, ventilation and noise. It is further noted that the ability to control the natural environment is a key factor in the improved performance. From the above it can be deduced that occupants of green buildings who invest in green building technologies which helps them to have more control over their work environment, will achieve an increase in the productivity of the employees.

Heschong and Commission (2003) conducted a study of employees in the United States and reached the following conclusion with regards to worker productivity:

- An increase of daylight lumination levels up to 7m, ensured an improvement in productivity of 13%;
- Better quality ventilation within the building reduces sickness by between 9% – 50%;
- Increased ventilation ensured an increased performance of between 4% – 17%;
- Glare from windows decreased productivity by 15% – 21%;
- An improved view was found as the common thread associated with better office performance. Employees with adequate views were found to perform 10% – 25% better at mental tasks that employees that had no view at all.

In the majority of commercial buildings, payroll is known to overshadow all other monthly expenses by an excessive margin. Persram, Larsson, and Lucuik (2007) found that salaries represent about 88% of commercial costs, rent 9% and

maintenance, utilities and other taxes account for 1% of expenses. It can clearly be seen that productivity increases as mentioned above that are associated with green buildings will have a major impact on the profitability of the business, especially companies that have a very high salary bill. The salary bill in relation to the increase in productivity will therefore quickly show payback towards monies spent on green initiatives within buildings. P. Eichholtz, N. Kok, and J. M. Quigley (2010) note that due to this increase in productivity, corporates may be willing to pay a higher rental for buildings that have better indoor quality for their staff members.

Sustainability of an organisation is achieved through ensuring a balance between inter-dependent social, environmental and economic factors. In order for a building or company to be deemed sustainable, its management and operational practices must be financially viable, detrimental environmental practices must be minimised or completely eliminated and social issues and stakeholder engagement must be enhanced (McCartney, 2007). Sustainable design has been defined as an approach to progress that meets the needs of the present without compromising the ability of future generations to meet their needs (Burton, 1987). From the occupant's perspective, it is widely believed that sustainable building design strategies improve internal environment quality and should thus lead to improved health, comfort and wellbeing of the building occupants. The above improvements should lead to an improvement in the performance of the occupants and an increase in the level of productivity leading to greater levels of productivity within the business (Heerwagen, 2000).

The occupation of a sustainable building can enhance an organisations image, corporate reputation and community profile, as it demonstrates that it is concerned about the social impact on the environment and the health of its workers (McCartney, 2007). Piet Eichholtz et al. (2010) agree with this comment and state that occupying a green building will positively affect the corporate image of the occupant as it sends out a strong signal to the market that it is socially aware and has a high level of social responsibility. Green buildings create a differentiated product in the market as there are only 100 Green Star rated buildings in South Africa. These properties are viewed as technologically advanced and environmentally and socially responsible. These attributes can be positively

associated with the brand of the company and help market the company (Milne, 2012, p. 10).

By building green now and incorporating green elements into potential building upgrades, decreases the necessity for expensive upgrades in the future. Inefficient properties could face the risk of obsolescence over time as they will be less competitive in the market place against other hi-tech properties. They will also be ill-equipped to deal with the resource constrained environment leading to a decrease in the productivity of the occupants of the property (Milne, 2012).

It can therefore be concluded from the above, that buildings with improved utility consumption and a high level of indoor environmental quality will benefit from lower operating costs, high net operating income and increased productivity levels in relation to non-certified buildings which can be perceived as a definite benefit to the occupiers of the building Roper and Beard (2006).

2.5 The Environmental Benefits of occupying a green building

The property sector adds to the destruction of the natural environment via the consumption of electricity, air pollution, resource depletion and the creation of waste material that is not biodegradable. In Singapore, it is noted that commercial and industrial buildings contribute 15% towards the total carbon emissions created via the consumption of electricity at the buildings Addae-Dapaah et al. (2009).

Green buildings reduce the carbon footprint of the property industry on the natural landscape thereby reducing the level of environmental risk. The rational and reduced usage of natural resources and the improved management of green buildings will ensure reduced energy consumption, improved environmental quality and contribute towards the saving of the earth's natural resources (Roper & Beard, 2006).

2.5 The Perceived barriers of occupying a green building

2.5.1 Initial construction costs and associated rents

One of the major barriers to the greening of the property industry and the take up of the newly constructed green buildings is the perception that the initial development

costs of these buildings are much higher than those of non-certified buildings. Therefore if the perception of the initial capital costs from the developers point of view is higher, the initial net rentals required to make the project feasible are also higher which tends to make occupants of green buildings remain in non-certified buildings (Morris, 2007). Greg Kats (2013) conducted a study of 180 green buildings around the world in relation to the capital premium thereon and the public's perception of this premium capital. From this report it was noted that the public perceived an additional 17% capital cost to develop a green building, whilst the true average capital premium cost was in fact only 1.5% above normal construction costs. The majority of the premiums were reported to be between 0% and 4% above normal construction costs.

Within the US property market, it is reported that premiums related to green buildings range from between 0% and 4%. Whilst in Australia, a report compiled by (Davis Langdon, 2013) indicates that developing a 4 Star Green Star building is actually cheaper to build than a non-certified building of similar comparison. In terms of a 6 Star Green Star building, which signifies world leadership in construction, a premium of only 6% was found in the initial capital costs of the property.

Table 4: Capital Cost impact in relation to developing Green within the Australian Property Market (Davis Langdon, 2013)

Level of Green Building Certification	Capital Cost Impact (%)
4 Star Green Star	-5% to -2%
5 Star Green Star – Australian Excellence	0%
6 Star Green Star – World Leadership	6% and more

Within the South African green building market, which is still in its relevant infant stage, not many broad empirical studies have been completed. The GBSA has commenced a pilot study with the Association of South African Quantity Surveyors to study the impacts of going green within the South African property market. Initial indications of the study show that a premium of between 1% and 10% can be

expected for a new commercial green building, as per table 5 below. It must be noted though, that in relatively immature green buildings markets like South Africa, the premium incurred to build green is above the normal cost of construction and as the market matures, developers will find a way to construct buildings at similar costs to non-certified properties (Milne, 2012).

Table 5: Summary of Cost Premiums of Green Star SA Case Studies (Milne, 2012)

Building Name	Rating	Capital Premium
Aurecon Century City	5 Star Design	5% -8%
Nedbank Phase 2	4 Star Design	3.3%
Mayfair-on-the-Lake	4 Star Design	5%
24 Richmond Circle	4 Star Design	10%
Aurecon Lynwood Bridge	4 Star Design	2.6%
Forty on Oak	4 Star Design	< 1%
ABSA Towers West	5 Star Design	<2%

It is clear from the above that the initial cost of construction is not as high as the public's perception. This perception must be cleared up with the occupants of green buildings to ensure a greater take up of green buildings within the South African property market.

2.5.2 Insufficient Life-Cycle Costing Information

When a property is developed, insufficient information is provided to the occupants of the building regarding the real whole of life cost of the building under their occupancy (The Green Building Council Australia, 2006). Information relating to energy efficiency, water reduction and waste management are not conveyed to the occupier with regards to the monthly savings that he will gain, in comparison to occupying a non-certified building. As energy and other municipal costs continue to increase, the competiveness of green buildings should increase ensuring a lower cost of occupancy for the tenants over the duration of the lease period. By conducting a comprehensive life cycle costing evaluation of the building and the additional investments made in the property, both the developer and occupant will be well aware that all future costs and expenses related to the property and the relevant savings, will be made in today's terms. Should the tenant have this information, it will be much easier for him to make a decision to occupy a green

building as he will be well aware of his future liabilities and all of the savings that he will make (Milne, 2012). By advising the occupant of the above, we are forcing the occupant not only to think of the 'short-term' financial position of the business, but to take a long-term view relative to the savings that can be made on the green feature investments.

2.5.3 The Green Lease

In order to achieve the green star rating of a property, a green lease needs to be concluded between the landlord and occupant of the property, which will guide the relationship between the parties. The objective of the green lease is to promote sustainable property operations by providing specific landlord and tenant obligations and requirements to ensure the continued first class operation of the building (Pivo, 2010). This lease is used as the starting point of all negotiations relating to the building and it incorporates guidelines which are intended to promote water and energy efficiency, environmental reporting and complete disclosure of how the building is performing which in the long term protects the environmental rating of the property. The green lease encourages the parties to work together and share all data relevant to the building concerning electricity, fuel consumption, water management, maintenance of plant and equipment and any other information relevant to the running of the property. It also encourages the parties to set up a building management committee to continuously review the environmental performance of the property to ensure that targets relating to the reduction of electricity, water, carbon and other resources are met. The tenant will also share information regarding hours of occupancy, lighting, heating and cooling with the landlord (Pivo, 2010).

The above process has not always been effectively communicated with the occupants of the green buildings advising of the benefits of the green lease and the relationship that it creates. This lack of clarity into the entire concept of green buildings has created a barrier for the acceptance of green buildings in the South African property market.

2.5.4 Supply of green buildings to the South African property market

According to Jarrod Lewin, who is the business development manager at the Green Building Council of South Africa (GBCSA), the green building within the South African property market has grown tremendously over the past decade. He states that 'The green building movement is about seven years old. We started with one to four green buildings and we have grown exponentially year-on-year to about 60 this year' (Matsilele, 2015, p. 1). He goes on to say that there is currently 1 000 000m² of green building space within the South African property market. In November 2015, the GBCSA announced the 100th certification of a green building being the Kirstenhof Office Park in Paulshof which received a 5-star green rating. From the above, it can be seen that between February 2015 and November 2015, approximately 40 new green star rated properties came onto the South African property market and there are an additional 50 green buildings in the pipeline waiting for certification.

At this point in time, the growth of the green building market within the South African property industry eclipses that of more established markets such as Europe, Australia, United States and the United Arab Emirates. South Africa is playing catch up to its more developed and developing counterparts. In terms of a survey conducted by Bernstein (2013), the take up of green buildings should increase three fold 16% in 2012 to 52% in 2015. A total of 60% of the firms in the survey noted that they had green developments in the pipeline to be concluded by 2015.

In a survey conducted by the South African Property Sector Council in 2013, it was noted that the South African property sector was worth an approximate R4.9 trillion. The study noted that approximately two thirds of property owned in South Africa, estimated at R3 trillion, is residential and commercial property has a value of approximately R780 billion. The report indicated that corporate property accounts for approximately R600 billion, which includes investment property of approximately R120 billion which is held by the South African listed property sector (The South African Chamber of Entrepreneurs, 2015). Should one compare the value of the commercial property market as mentioned above, with the value of the existing 100 green buildings that are currently available in South Africa, it is clear that there is

still huge potential to develop more green buildings in South Africa and create a bigger market for green buildings within the country due to the current limited options available to commercial users.

2.5.5 The effectiveness of green features of a green building

The justification of adding green features to a building and the additional related capital costs lies in the occupant realising benefits from these features, which are reduced running costs and an improvement in productivity and health of the employees. The major benefits that directly accrue from occupying a green building are a reduction in the costs of electricity consumed relating to the heating, cooling and lighting in the building as well as a reduction in the volume of water consumed. The benefit of reduced operational and maintenance costs will require that effective green building management procedures be put in place prior to the company taking occupation of the building (The US Green Building Council, 2015).

G Kats and Capital (2003) noted that a minimal additional upfront investment of 2% over and above the normal construction costs of a building, ensures a savings of 10 times the initial investment over a 20 year period. Although this figure does include increases in productivity and health to the employees, should one look at operational costs alone, these savings will exceed the costs premiums associated with developing a green star rated property. It must be noted though that the degree of savings will depend on the relevant energy prices that will differ from location to location.

Energy savings is one of the most important aspects of a green building that can achieve significant savings in relation to the running costs of the property. As electricity prices are currently rising globally, energy efficiency is becoming an extremely important driver for the acceptance of green buildings. It is estimated that the reduction in energy use of a certified building compared to a non-certified building ranges from between 25% to 30% (based on LEED-certified buildings in the United States). This study further indicated that higher levels of certification equate to better financial savings to the occupant due to improved energy consumption at the property. (G Kats & Capital, 2003).

Table 6: Energy Savings for LEED certified buildings (G Kats & Capital, 2003)

Level of certification	Reduction in energy use compared to non-certified building (%)
LEED Certified	23%
LEED Silver	30%
LEED Gold	38%

Greg Kats (2013) goes on to say that the estimated level of water saving that can be made by implementing strategies such as grey water systems and water reducing plumbing systems, as being 39% compared to that of non-certified buildings. The above information, points to the fact that green features of commercial buildings are effective and create a cost saving for the occupant. It must be noted though that as per (Frej, 2003), a number of real estate advisers and commercial property brokers are incorrectly advising their clients that the initial costs and running costs or certified building are more than that of non-certified buildings. This is resulting in potential occupiers of green buildings not being interested in the green building movement as they do not believe that green buildings are cost effective.

More recent independent studies commissioned by the Green Building Council of South Africa have confirmed that certified buildings consume 85% less electricity, 65% less potable water and send 69% less waste to landfill sites than non-certified buildings. (Letsoalo, 2013).

Evidence has been generated that demonstrates that the most well-designed buildings with high servicing requirements do not perform as predicted in the original modelling in terms of energy saving. In order to ensure that this does not occur, a detailed building commissioning process must be undertaken to train the occupant on how to maximise the energy efficient features of the property and to minimise malfunctions at the building. Proper commissioning at the building will reduce running costs and ensure that the specifications of the building are correctly utilised to ensure that the stated energy savings are made.(World Green Building Council, 2013).

Aside from energy savings, another focus of green buildings is the longevity and durability of its finishes and systems within the building. All materials that are considered in the construction of a green building are considered in terms of a lifecycle approach using the cradle to cradle approach. A green building that has properly specified certified materials will gain financial benefit in the long term through reduced running costs over the life cycle of the property World Green Building Council (2013). Further to this, materials that are indeed cradle to cradle will have a further cycle of recycling at the end of their lifespan which creates the opportunity of an additional income stream for the owner of the property.

Future proofing a building is the process of anticipating the future and developing methods which minimise the shocks and stresses in conjunction with taking advantage of positive events which may occur in the future. By incorporating sustainable design features into the properties, property owners are future proofing the building against future business and regulatory issues that may have negative financial effects on the property (Rich & Ochsner, 2014). Items to consider in terms of the future proofing of buildings are considered below:

- Flexible design will allow for the facility to be used despite changes in operational requirements of the user. It will include features such as moveable partitions, multi-use spaces, large floor to ceiling heights and the adoption of open plan spaces as opposed to cellular offices.

By decreasing a building reliance on utility services provided by the local municipality via the incorporation of utility conservation and other efficiency measures, the building is future proofed against future utility increases and the inability of the municipality to provide that service to the building (The Green Building Council Australia, 2006). Planned carbon taxes and mandatory energy efficiency disclosure by landlords will be implemented by policy makers in the near future. By greening the building, owners of the property will minimise the negative financial impact of future regulatory requirements (Milne, 2012).

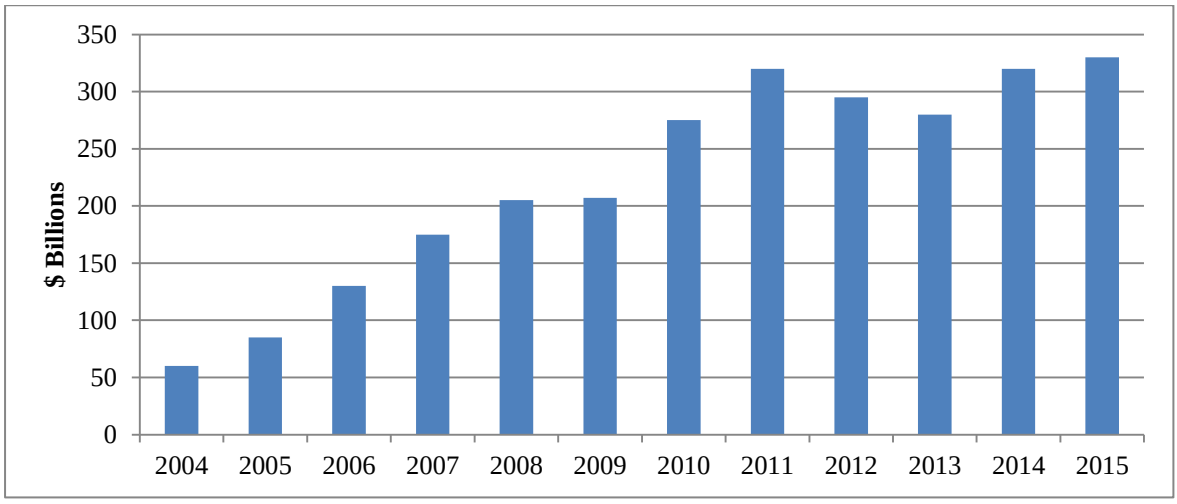
2.5.6 The effectiveness of green technologies

In terms of green technologies that are associated with green buildings, questions have been raised about the efficacy of these technologies (Cannon et al., 2008). Wind and solar technologies suffer from the lack of reliability and intermittency

which is associated with the natural processes that they using. If it is cloudy or not windy, technologies may not be able to provide the required power to supply the properties. At this point in time, it is not feasible for renewable energy sources to be the primary source of power to the building, but can merely act as a supplementary supply to the main council supply. The payback period is still in doubt for a majority of the renewable energy systems that have been implemented at green buildings. An economically viable solution may be just around the corner, but until such time a large proportion of the solutions require subsidies and tax incentives to ensure their viability. It should be noted though, that globally the renewable energy and energy efficiency industry is growing at a substantial rate. With this growth it is hoped that the pricing and efficacy of the energy efficient products will become more viable and lead to more effective and efficient green buildings (Cannon et al., 2008).

The recent slump in the oil price has brought up cost cutting and a certain amount of upheaval in the traditional energy sector. The renewable energy sector which primarily consists of solar and wind, raked in a record $329.3billion of investment in 2015.

Figure 1: Global clean energy investment in 2015 (Bloomberg Business, 2016a)

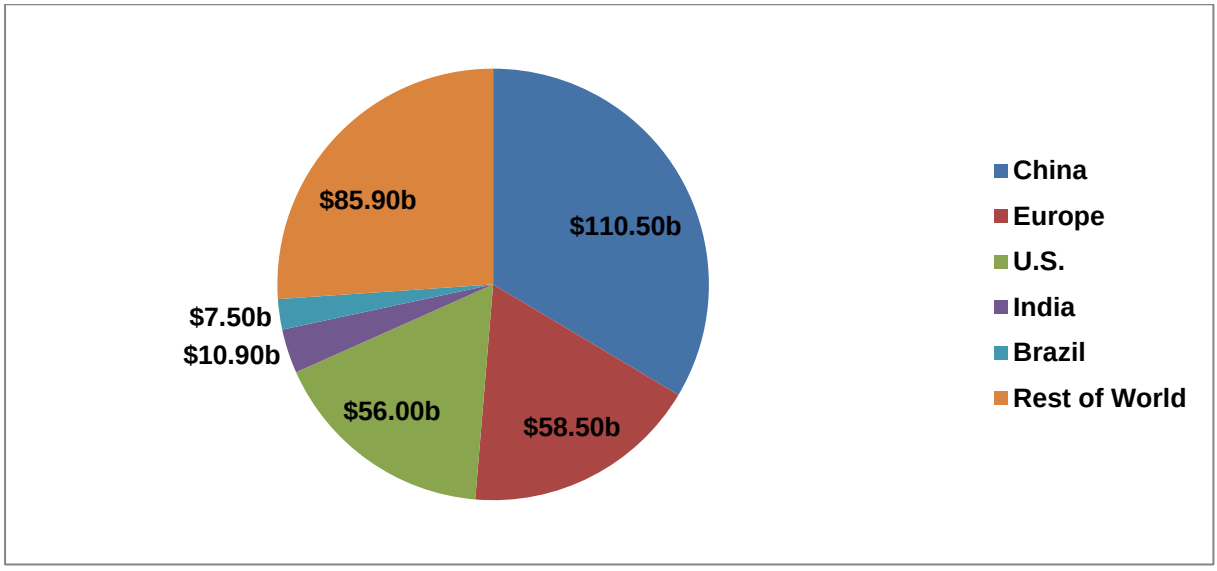


Angus Mc Crone chief editor of Bloomberg New Energy Finance predicts that 2016 will be another record year for investing in renewable energy, despite predicted

lower returns on investment and lower tax incentives provided by various governments (Bloomberg Business, 2016a).

China was the biggest market for renewable energy in 2015 and it increased its investment into this sector by 17% to $110.5 billion which was almost double that of the United States which invested $56 billion. India invested approximately $10.9 billion dollars and new markets which included Mexico, Chile and South Africa attracted tens of tens of billion dollars of investments (Bloomberg Business, 2016a).

Figure 2: Geographical renewable energy investment in 2015 (Bloomberg Business, 2016b)



It is noted now that wind and solar energy have been adopted as a natural and substantial part of the energy supply in developing countries. They can now in many cases be produced more cheaply that traditional energy and reduce the country's exposure to the possible increase in fuel prices. Further to the above, it is noted that in 2015, more than half of the world's investment in clean energy was done so by countries in the emerging markets who invested $126 billion in clean energy and for the first time ever is adding more power capacity from renewable energy that form coal, gas and oil combined (Bloomberg Business, 2016b).

In 2010 the South African government released its Integrated Resource Plan which high lights the country's energy building out plan to 2030. In this plan it aims to

increase its power supply from 43GW to 89.5GW with renewable energy contributing 20% of this figure. Solar PV and wind are the largest contributors to this figure, and it is hoped that they will contribute 8.4GW and 9.2GW respectively. By 2014, in terms of the role out of the Renewable Energy Independent Power Producer Programme, the capacity achieved from renewable energy exceeded 1.3GW with solar PV contributing 774MW and wind contributing 570MW (Climatescope, 2015).

From the above it can be seen that there is a substantial amount of investment that is going into renewable energy. With this increase in investment into this market, the technology in the market will improve and costs will reduce making this a more cost effective and secure source of energy.

2.6 Propositions

The above literature review has identified a number of factors from various studies that identify both the perceived benefits of occupying a green building from a commercial building user's perception and the barriers to occupying a green building. The object of this study is to analyse these factors and establish the most important factors within the South African property context.

Proposition 1: The principle benefits of occupying a green building are perceived to be:

- Green buildings consume fewer resources and therefore create less pollution;
- Occupants of green buildings benefit from reduced exposure to volatility in utility prices e.g. Eskom electricity price increases;
- Occupants of green buildings experience higher levels of staff morale which leads to lower work force turnover;
- Being the occupant of a green building will increase the image of the business;
- Occupants of green buildings attract better talent than their competitors in conventional buildings.

This proposition is supported by the following literature:Horgen (1999); Heerwagen(2000); Kats & Capital (2003); Heschong & Commission (2003);

McCartney (2007); Miller, Pogue, Gough & Davis (2009) and Milne (2012).

Proposition 2: The principle barriers to occupying a green building are perceived as follows:

- Commercial occupiers of green buildings would not occupy green buildings as they think that all green features are generally ineffective;
- Commercial occupiers of green buildings would not occupy green buildings as there are only limited options in the local property market;
- Commercial occupiers of green buildings do not clearly understand the principles of green buildings.

This proposition is supported by the following literature: Kats and Capital (2003); Morris (2007); Pivo (2010); Greg Kats (2013); Construction (2013); Matsilele (2015); Limited (2015) and The US Green Building Council (2015).

CHAPTER 3. RESEARCH METHODOLOGY

The following chapter provides a guide of the proposed methodology to be adopted in this study. The method of analysis that has been proposed for the study is a quantitative analysis and shall be discussed in terms of research and green building literature. This chapter will focus on the research instrument to be utilised in the study, as well as the method of collecting data and the method of analysis shall be discussed. Further to the above, we shall also clarify the limitations; reliability and validity of the research proposed and describe the demographics of the sample achieved.

3.1 Research Paradigm

In this research, a quantitative research strategy will be adopted to identify the perceived benefits of occupying a green building from a commercial building user's perception and rank the perceived barriers of occupying a green building within the South African property market. The information shall be collected by conducting an online survey and the structure of the survey will be a cross sectional survey.

(Creswell, 2009) supports the use of quantitative research, and notes that research conducted via surveys provides a quantitative or numeric description of a population by studying the sample of the population. The data that is gathered is then utilised to test objective theories or propositions by examining a relationship amongst the variables. Quantitative methods in general use predetermined, instrument based data that is collected via the online survey and is thereafter statistically analysed post collection of the data. The study is based on a post-positivism approach, which (Ryan, 2006) says is research that focuses on the meaning and creation of new knowledge and that the causes are analysed to determine effects or outcomes.

In this study, the aim is to collect data on the perceived values of a green building from a commercial building user's perception and how this perception will influence their decision to occupy a green building. Creswell (2009) mentions that the approach that is adopted by utilising the post-positivism philosophy, begins with a theory, thereafter data is then gathered that either supports or refutes the theory

and post this, further revisions and tests are conducted to ensure that the outcome of the tests are correct.

In carrying out this research, the study will seek to gather data which can be analysed statistically. Quantitative data will be obtained in the form of a non-experimental mode of enquiry which in this case is the on-line survey (Creswell, 2009). The reason for adopting the quantitative method and not the qualitative method lies in the final desired outcome of the study. Creswell (2009) notes that quantitative studies test objective theories by analysing relationships amongst variables, while qualitative research is a means of understanding why a group of individuals think about social issues in a specific way. Qualitative research can be construed as a research strategy that prefers to place emphasis on words rather than the quantification in the collection and analysis of data (Bryman, 2012).

Bhattacherjee (2012) states that quantitative studies have less subjectivity of the observed behaviour due to the fact that there is no subjectivity of the researching affecting or influencing the answers. He goes on to say that due to the numerical nature of quantitative analysis, the information obtained may be more accurate than qualitative data when analysing a social occurrence.

3.2 Research Design

Bhattacherjee (2012) states that surveys are fundamentally stronger than other research methods. The clear benefits of data collection using a survey in relation to this study are; surveys serve as a fantastic tool to measure a range of inappreciable objects which includes people's preferences, attitudes, behaviours and perceptions. It also provides the researcher with a method to collect data from a large sample of people which may not be achievable through direct contact. Thirdly, it is generally the preferred data collection tool of respondents, as it allows them the option of completing the survey in their own time when it is convenient to them. Lastly, it is a relatively cost effective method in terms of both time and money when compared to other research methods.

This method does has a few disadvantages for researchers though, says (Bhattacherjee, 2012). The primary concerns of surveys is systemic bias, this could

be in the form of research bias, sampling bias, social desirability bias, recall bias and response bias etc.

The questionnaire that I utilised was broken up into 3 different sections namely:

1. The perceived benefits of Green Buildings
2. Potential Barriers to the Occupation of Green Buildings
3. Demographic Profile

Sections 1 to 2 will adopt a 7 point Likert Scale, with 1 being 'strongly disagree' and 7 'strongly agree' that they attach to the benefit of occupying green buildings.

3.3 Population and Sample

3.3.1 Population

The target population are occupants of green buildings within the South African property market. The aim here is to collect the information from individuals participating in the South African property market in order to make conclusions relating to perceptions of green buildings within this market.

3.3.2 Sample and sampling method

There are two types of sampling classifications, namely non-probability and probability sampling (Bryman, 2012). Bryman (2012) notes that the biggest difference between the two different techniques is that non-probability sampling allows for human perceptions to guide which people take part in the study, while probability sampling utilises a random sampling method where there is no human influence on choosing the participants. Due to the format of this study's data collection technique (online study sent via email), a non-probability sampling method will be used, emails will be sent to random commercial occupiers of space within the Gauteng province.

The study shall be based on key data gathered through a survey sent to 500 occupiers of commercial property within South Africa property market. The sample size is directly related to the method of analysis (factor analysis) used for the study. As a general rule, there should be a minimum of at least five times as many respondents as there are variables to be analysed in the survey with the more acceptable range being a ten-to-one ratio (Hair, Black, Babin, Anderson, & Tatham, 2006). According to Fabrigar, Wegener, MacCallum, and Strahan (1999),

recommendations of sample size vary considerably. A minimum sample size of 300 has been suggested, however in reality about 150 is sufficient and as few as 100 samples can be utilised when one is dealing with a small sample size. Addae-Dapaah et al. (2009) utilised 400 respondents when executing their analysis in researching the users perceptions of the benefits of green buildings within the Singapore property market.

3.4 The Research Instrument

A survey in the form of an online questionnaire will be used to gather data for this study.

Section 1: The perceived benefits of Green Buildings – Statements S1 to S17

This section asked the respondents to rate how salient each of the benefits of green buildings are to them. This method will ensure that evaluation categories can be compared and that the responses that are obtained from the respondents can be collapsed into negative and positive groupings with a neutral category between the two poles.

Section 2: Potential Barriers to the Occupation of Green Buildings – Statements S18 to S23

This section will focus on the barriers holding commercial building user's back from choosing green buildings over non-certified buildings. In line with Bhattacherjee (2012), all respondents that agree to participate in this study will need to complete a consent form, validating their voluntary involvement in the study. Furthermore this document shall also note the confidentiality and anonymity of their participation in the study.

3.5 Procedure for Data Collection

The instrument to be used to conduct the research was an online based structured survey and respondents were emailed a link to be completed. The link was opened by the respondents who completed the survey on the website. As mentioned previously, although this is a relatively inexpensive manner to collect data, it is necessary be cognisant of survey bias while conducting this research which could have been in the form of research bias, sampling bias, social desirability bias, recall bias and response bias etc. (Bhattacherjee, 2012). Therefore when employing a survey questionnaire as a method of gathering data as an alternative to an

interview survey, there were a few key issues that were addressed when compiling the questions. The questions needed to be clear and very unambiguous; not too detailed or too general and without bias or value-laden words (Bhattacherjee, 2012). However Bickman and Rog (2008) have noted that due to the restricted and partisan access to the internet, online surveys are inappropriate and unconsciously create a bias of the representative sample. To protect the quality of the data and multiple submissions being received, the data was password protected.

Research participants were contacted via email, the email addresses are a sub-set of users from participants randomly chosen between the office and industrial divisions within the Growthpoint Properties portfolio. An email was sent out to all the participants advising them of the purpose, methodology and author of the study, as well as how their email and contact details were obtained (Bickman & Rog, 2008). The study had an interactive multipage delivery which ensured that responses were uniform and it also ensured that the response conditions were controlled which reduced question order effects. Respondents also had the choice to 'log off' and return when it suited them, as well as prompting the respondent if certain critical information in completing the survey had been omitted (Bickman & Rog, 2008).

3.6 Data Analysis and Interpretation

The respondents' ratings for the benefits of green buildings will be factor-analysed using exploratory factor analysis for statements S1 to S17 of the survey. Factor analysis is a multivariate statistical procedure that has a multitude of uses. Firstly is can be used to reduce a large number of variables into a smaller sub-set of variables. Secondly it has the ability to establish underlying dimensions between measured variables and latent constructs and lastly it has the ability to provide construct validity evidence of self-reporting scales (Williams, Brown, & Onsman, 2012). This will help to make the data easy to explore and visualise. This form of factor analysis does not discriminate between variables on whether they are independent or not, it is an interdependence technique that does not specify any formal hypothesis (Hooper, 2012). The unobservable factors will not be measured directly but are in essence hypothetical constructs that can be used to represent and group the various statements (Cattell, 1988). This will then be followed by a rotation of the data which will maximise the high item loadings and minimise the low

item loadings. Oblimin rotation was used to produce factors that are correlated (Williams et al., 2012).

These analytical tools were employed once the appropriateness of the dataset for factor-analysis has been verified. The Kaiser-Meyer-Olin measure of sampling adequacy and Bartlett's test of sphericity was utilised to measure the appropriateness of the dataset. A Kaiser-Meyer-Olin value of between 0.5 and 1 is considered as adequate for the survey and any value below 0.5 shall be considered as not appropriate for the analysis (Addae-Dapaah et al., 2009). They further note that according to Bartlett's test of sphericity, a value less than 0.05 and a determinant of correlation matrix close to 0 will indicate that the factor analysis is appropriate.

A Cronbach alpha analysis will be conducted on the factors identified post the exploratory factor analysis as a measure of consistency of the scale that was adopted (Addae-Dapaah et al., 2009). A Cronbach alpha of 0.70 is generally the lowest limit of reliability accepted (Hair et al., 2006)

In terms of S18 – S23, the analysis of the statements was done via an average mean analysis. The mean was the average of the factor and was calculated by adding up the values and dividing by the number of values (Johnson & Wichern, 1992). The aim of the analysis was to rank the identified factors from the biggest perceived barrier to the smallest perceived barrier.

3.7 Limitations of the Study

As this is a non-probability cross sectional survey, there is a certain amount of bias within the sample. Furthermore due to the non-probability nature of the study, it is not reasonable to infer the results of the study onto the complete available study population. The sample of the survey will be taken from commercial building users of Growthpoint Properties within the Gauteng area that occupy offices and industrial buildings. The sample has not been increased to other provinces and has not taken the views of other commercial users of other property funds within the Gauteng area. Due to the infancy of greening within the retail environment and the complexity of green retail centres, this will not be considered as part of this study.

Another limitation of the study could be the respondent's familiarity to the topic. As green buildings are still in the infancy stage within the South African property market, not all the respondents know what a green building is and what the benefits associated with green buildings are. A further limitation to this study was that the naming of the various factors was quite problematic. In certain instances, a factor name that was applied to the variables did not accurately reflect the exact variables of that factor.

As per Yong and Pearce (2013), the study must be conducted using a large sample of data at a specific point in time to ensure that the factors are reliable. Results cannot be pooled from results from several samples held at different points in time as this will obscure the findings. Therefore the findings achieved from factor analysis are relatively difficult to replicate.

3.8 Validity and reliability

In the research context, the term 'validity' refers to the truthfulness of the conclusions that are created from a particular study; it is the ability to measure what is intended to be measured and how correct the results are (Zikmund, Babin, Carr, & Griffin, 2012). The term 'reliability' refers to the degree to which a concept is stable and whether the results of the study can be repeated under similar conditions (Bryman, 2012).

3.8.1 External Validity

External validity aims to identify whether a measure actually achieves the initial goal of measuring what it is supposed to measure (Partington, 2002) and whether the results can achieved again under similar conditions.

As we are dealing with a non-probability cross sectional survey, the validity of the results could be impeded. To ensure that the data collected is robust and valid, further repetition of the study should be done to ensure accurate results (Creswell, 2009). (Bryman, 2012) notes the following threats to external validity which must be taken into consideration during the gathering of data process:

- Interaction of selection and treatment: Can the study be generalised to a wide variety of individuals who might be differentiated by ethnicity, social class, gender and type of personality?
- Interaction of setting and treatment: Can the results of the study be applied to other setting?
- Interaction of history and treatment: Can the results be generalised in the past and into the future?
- Reactive effects of experimental arrangements: People are generally aware of the fact that they are in an experiment and this may influence the truthfulness of their answers.

3.8.2 Internal Validity

Internal validity is concerned with the question of whether a finding that incorporates a causal relationship between two or more variables is sound (Bryman, 2012). Internal validity threats are typically experienced by respondents at taking the tests, changes in the instrumentation that may affect results, ambiguity about the direction of causal influence and the selection of the experimental and control groups if not done randomly could have any effect on the internal validity of the results (Bryman, 2012).

Within the study that will be conducted, the structured questionnaire will ensure consistency when respondents are completing the survey. It may be important to further test the integrity of the data by further testing it with a convergent validity test. Bhattacherjee (2012) notes that convergent validity is acknowledged when conceptual correlation measures are practically demonstrated. In terms of this study, to achieve an adequate convergent validity, a factor loading of 0.60 or higher should be obtained.

3.8.3 Reliability

Reliability is defined as the extent to which results are consistent over time and an accurate representation of the total population under study. If the results of a study can be reproduced under a similar methodology, the research instrument is considered to be reliable (Joppe, 2000).

In order for the results to be considered reliable, the respondents must complete the survey online without the interference of the researcher. Researcher subjectivity must be avoided when analysing the results and ambiguous questions must be removed from the survey as they may lead to unreliable answering of questions (Bhattacherjee, 2012). To ensure that this does not happen, a pilot study will be utilised on a few individuals to get feedback on the quality of the questions and the format of the questionnaire.

(Mathison, 1988) suggests that the triangulation of results be adopted, to ensure that bias is controlled and that valid propositions have been established. This will lead to an improvement of the validity and reliability of the research and evaluation of the findings..

3.9 Demographics

This section describes the demographics of the sample (131 commercial occupiers) in relation to gender, age group, level of education and monthly income. The samples are illustrated with a table and series of graphs for each of the characteristics.

Table 7: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	100	76.3	76.3	76.3
	Female	31	23.7	23.7	100.0
	Total	131	100.0	100.0	

There were more males respondents (76.3%) than female respondents (23.7%) as depicted in table 7.

Table 8: Age Groups

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-29 years	5	3.8	3.8	3.8
	30-39 years	58	44.3	44.3	48.1
	40-49 years	39	29.8	29.8	77.9
	50-59 years	24	18.3	18.3	96.2
	60-69 years	4	3.1	3.1	99.2
	70+	1	.8	.8	100.0
	Total	131	100.0	100.0	

The sample was categorised into 6 age categories as depicted in Table 8. 74.1% of the respondents were aged between 30 – 49 years.

Table 9: Level of Education

	Frequency	Percent	Valid Percent	Cumulative Percent
Matric	10	7.6	7.6	7.6
Diploma	24	18.3	18.3	26.0
Degree	55	42.0	42.0	67.9
Masters	40	30.5	30.5	98.5
Other	2	1.5	1.5	100.0
Total	131	100.0	100.0	

The sample was categorised into 5 levels of education categories as depicted in Table 9. 72.5% of the respondents either had a degree or master's degree.

Table 10: Monthly salary bracket

	Frequency	Percent	Valid Percent	Cumulative Percent
< R10 000	1	.8	.8	.8
R10 001 - R30 000	13	9.9	9.9	10.7
R30 001 - R50 000	31	23.7	23.7	34.4
R50 001 - R75 000	38	29.0	29.0	63.4
> R75 001	48	36.6	36.6	100.0
Total	131	100.0	100.0	

The sample was categorised into 6 salary brackets as depicted in Table 10. 65.6% of the respondents earn R50 000 per month or more.

CHAPTER 4. PRESENTATION OF RESULTS

4.1 Introduction

The previous chapter focused on describing the data sample, statistical techniques and the various assumptions used during the research process. The aim of this chapter is to focus on the results of the research which will be described using descriptive statistics and tables for each of the propositions. The data was collected from 131 occupants of commercial buildings within the Gauteng property market.

4.2 Results pertaining to the perceived benefits of occupying a green building from a commercial building user's perception

4.2.1 Descriptive results for the overall sample

The data from the 131 respondents was collated, sorted and analysed using the SPSS statistical programme. A set of 17 statements were utilised to identify the perceived benefits of green buildings as can be found in table 11. Out of the 17 variables that were identified, all variables had significant loading factors and were all included in the subsequent analysis. In order to reduce the subjectivity, only variables with factor loading of greater than 0.3 were considered significant and used as a loading factor. The Principle Axis Factor method was used to extract the data. The factors were then rotated using the Direct Oblimin method for better interpretation of the results as unrotated factors are ambiguous. When analysing the results to interpret the various factors, the loadings were analysed to determine the strengths of the various relationships between the variables. The factors were identified by identifying the largest loadings achieved, but the low loadings were also noted as they assisted in confirming the identification of the factors. It is also noted that there are two cross loadings in the analysis that are shared between two different factors.

Table 11 is a summary of all the statements that were included in the questionnaire to note the perceived benefits of green buildings.

Table 11: Statements posed to respondents relating to the perceived benefits of green buildings

S1 Being the occupant of a green building will increase the image of the business.

S2 Occupants of green buildings attract better talent than their competitors in conventional buildings.

S3 Green buildings will create a cost saving for the occupant due to reduced water and electricity consumption.

S4 Green buildings will create a cost saving for the occupant due to lower monthly maintenance costs.

S5 Occupants of green buildings are more likely to receive grants and rebates from government incentive schemes, resulting in lower initial rentals.

S6 Occupants of green buildings benefit from accelerated municipal approval processes, resulting in earlier occupation of the building.

S7 Occupants of green buildings benefit from reduced exposure to volatility in utility prices e.g. Eskom electricity price increases.

S8 Occupants of green buildings have a better experience at work leading to reduced absenteeism and higher work productivity.

S9 Occupants of green buildings experience higher levels of staff morale which leads to lower work force turnover.

S10 Occupants of green buildings benefit from improved indoor air quality, which results in fewer complaints on comfort related issues and higher user satisfaction.

S11 The occupants of green buildings invest in green building technologies which helps them to have more control over their work environment.

S12 Green buildings promote the sustainable consumption of the earth's resources which does not to jeopardise future generation's needs.

S13 Green buildings consume fewer resources and therefore create less pollution.

S14 By occupying a green building, the occupants are contributing to the fight against global warming"

S15 I am happy to pay a premium for the green features of a green building.

S16 I would recommend green buildings to other potential users.

S17 The higher rental rates of green buildings exceed the benefits of the green features of a green building.

The Principle Axis Factor method was used to extract the data. From this process 5 different benefit factors were identified as having an impact on the perceptions of green buildings amongst occupiers of commercial buildings in Gauteng.

Table 12: The Factor Analysis Pattern Matrix

	Factor				
Statement	**Environmental Benefits**	**Competitive Benefits**	**Economic Benefits**	**Branding Benefits**	**Productivity Gain Benefits**
S14	.899				
S13	.827				
S12	.707				
S2		.537			

S3		-.447		.405	
S17		.340			
S6			.969		
S5			.713		
S4			.351		
S7			.340		
S1		.330		.712	
S16				.575	
S15				.565	
S9					-.903
S8					-.806
S10					-.712
S11					-.396
Eigenvalues	5.94	1.57	1.14	0.81	0.61
% of variance	34.94%	9.23%	6.68%	4.74%	3.57%

The correlation matrix was utilised to ensure that we have correlation coefficients greater than 0.3 in magnitude. In our sample it is noted that there are quite a number of correlations greater than 0.3 which suggests that factor analysis is appropriate as noted in table 13. There are no factors above 0.9; therefore the issue of collinearity does not exist.

Table 13: Factor Correlation Matrix

Factor	1	2	3	4	5
1	1.000	-.270	.389	.475	-.423
2	-.270	1.000	.023	-.042	-.065
3	.389	.023	1.000	.345	-.388
4	.475	-.042	.345	1.000	-.381
5	-.423	-.065	-.388	-.381	1.000

Extraction Method: Principal Axis Factoring.
Rotation Method: Oblimin with Kaiser Normalization.

Table 14: Diagnostic tests for factor analysis: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.844
Bartlett's Test of Sphericity	Approx. Chi-Square	1065.870
	df	136
	Sig.	.000

The Kaiser-Meyer-Olkin Measure of Sampling Adequacy is a statistic which indicates the proportion of variance in the variable which is a common variance, i.e. which might be caused by underlying factors. The value of 0.844 indicates that a factor analysis will be useful with this data set. Bartlett's Test of Sphericity indicates whether the correlation matrix is an identity matrix, which will indicate that the variables are not related to each other. The significance level provides the result of the test and with a very small probability value (0.000); it indicates that there is a high probability of significant relationships amongst the variables.

Total Variance Explained

Seventeen statements were included in the data set and therefore there are seventeen Eigenvalues. The Eigenvalues that are linked to each factor represent the variance explained by each factor. In the table below, one can see that the first 5 factors in the initial Eigenvalues column accounts for approximately 70.02% of the variance and the extraction sum of the squared loadings accounts for 59.18% of the variance.

Table 15: Output for the total variance explained for extracted factors

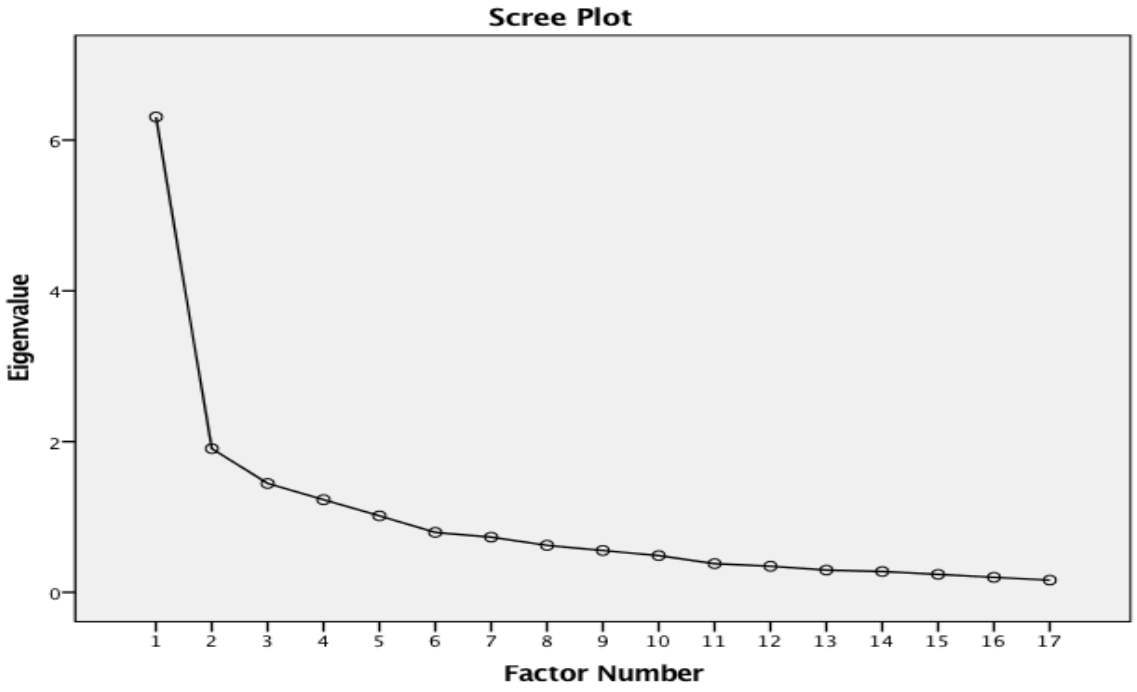
Statement	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
S1	6.308	37.105	37.105	5.941	34.947	34.947
S2	1.907	11.218	48.324	1.570	9.237	44.184
S3	1.445	8.499	56.822	1.137	6.686	50.869
S4	1.229	7.231	64.053	.807	4.746	55.615
S5	1.015	5.969	70.022	.607	3.573	59.187
S6	.796	4.682	74.704			
S7	.733	4.309	79.013			
S8	.624	3.670	82.683			
S9	.555	3.265	85.948			
S10	.488	2.869	88.817			
S11	.381	2.239	91.056			
S12	.347	2.040	93.096			
S13	.296	1.741	94.838			
S14	.277	1.631	96.468			
S15	.239	1.406	97.874			

S16	.199	1.172	99.047
S17	.162	.953	100.000

The Scree plot analysis

The Scree plot analysis is conducted to find the point of inflection. In the graph below, the point of inflection occurs at factor 5, which suggests a five factor solution.

Figure 3: Scree plot analysis indicating that the data has five factors



The above information can be summarised as follows. Data was subjected to factor analysis using principle Axis Factoring and Oblimin rotation. All KMO values for the individual items were >0.90. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy was 0.844 indicating that there is sufficient data to conduct an exploratory factor analysis. The Bartlett's Test of Sphericity x^2 (136) = 1065.870, p<0.001showed that there were patterned relationships between the items. Using an eigenvalue cut-off of 0.06, there were 5 factors after extraction that explain a cumulative variance of 59.18%. The scree plot in figure 3 confirms the findings. Table 17 shows the factor loadings after rotation using a significant factor criterion of 0.3. Accordingly there were no factors that were removed from our study as all the variables complied with the above. The percentage of variance after rotation

cannot be calculated because the oblique method is used which allows for correlations between the factors.

4.3 Results pertaining to the perceived barriers to occupying a green building from a commercial building user's perception.

In terms of the literature review, various barriers to occupying a green building were identified. The aim of the analysis is to rank the identified factors from the biggest perceived barrier to the smallest perceived barrier via a mean analysis of the data. In terms of the literature review, various barriers to occupy a green building were identified and put forward to the respondents of the survey. The scale of the individual statements which forms the basis of the proposition is stated as follows: 1 - Strongly disagree, 2 – Disagree, 3 - Somewhat disagree, 4 - Neither agree nor disagree, 5 - Somewhat agree, 6 – Agree and 7 - Strongly agree. All statements as posed to the recipients for statements S18 to S23 are reverse statements. When they were captured, they were unreversed to ensure the correct results. Table 16 reflects the statements presented to the respondents relating to perceived barriers to occupying a green building.

Table 16: Statements relating to the perceived barriers to occupying a green building

Statement	Factor
S18	I would not occupy a green building because I am not really interested in the green building movement.
S19	I would not occupy a green building because I think that all green features are generally ineffective.
S20	I would not occupy a green building because I don't really think it is necessary to change from conventional buildings.
S21	I would not occupy a green building as there are only limited options in the local property market.
S22	I would not occupy a green building as current renewable energy sources are unreliable.
S23	I would not occupy a green building as I do not clearly understand the principles of green buildings.

Table 17: Questionnaire results – Statement Means

	N	Minimum	Maximum	Mean	Std. Deviation
Statement	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Statistic**
S18	131	1	6	2.04	1.018
S19	131	1	6	2.12	1.164
S20	131	1	5	1.96	.940
S21	131	1	7	3.10	1.508
S22	131	1	7	2.66	1.363
S23	131	1	6	2.32	1.248

Table 18: Full frequency table for Proposition 2

	Strongly Agree		Agree		Somewhat Agree		Neither		Somewhat Disagree		Disagree		Strongly Disagree	
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %
S18	46	35.1%	50	38.2%	21	16.0%	13	9.9%	0	0.0%	1	0.8%	0	0.0%
S19	43	32.8%	57	43.5%	12	9.2%	11	8.4%	7	5.3%	1	0.8%	0	0.0%
S20	46	35.1%	56	42.7%	19	14.5%	8	6.1%	2	1.5%	0	0.0%	0	0.0%
S21	16	12.2%	39	29.8%	32	24.4%	16	12.2%	19	14.5%	6	4.6%	3	2.3%
S22	21	16.0%	58	44.3%	18	13.7%	20	15.3%	9	6.9%	3	2.3%	2	1.5%
S23	34	26.0%	57	43.5%	19	14.5%	8	6.1%	11	8.4%	2	1.5%	0	0.0%

It is noted that there is only 1 statement that has a mean (average) below 2, indicating that the respondents ‘strongly agree’ and ‘agree’ with the statement. This statement is:

- I would not occupy a green building because I don’t really think it is necessary to change from conventional buildings.

The response with the highest mean (average), has a mean above 3, indicating that the respondents ‘somewhat agree’ to ‘neither agree nor disagree’ with the statement. This statement is:

- I would not occupy a green building as there are only limited options in the local property market.

The four remaining statement all lie within the ‘agree’ and ‘somewhat agree’ category. It is noted that there is not a substantial variance in the standard deviations and that the standard deviation decreases from the biggest perceived barrier to smallest perceived barrier to occupying a green commercial building. This means that the respondents were very clear about the biggest perceived barrier but less clear about the smallest perceived barrier. Environmental benefits are noted as the most important benefit to be derived from the occupation of green buildings.

4.4 Summary of Results

The results for both propositions were presented using descriptive statistics and applying the relevant statistical testing technique.

For proposition 1, an exploratory factor analysis was conducted on the first 17 statements and 5 factors were noted to be significant benefits of occupying a green building. The five significant factors identified as benefits of occupying a green building are noted as follows:

- Environmental Benefits
- Competitive Benefits
- Economic Benefits
- Branding Benefits
- Productivity Gain Benefits

For proposition 2, descriptive statistics were utilised to analyse the 6 factors that were noted as barriers to occupy a green building. These factors were then ranked from the most significant barrier to the least significant barrier.

CHAPTER 5. DISCUSSION OF THE RESULTS

5.1 Introduction

The purpose of this study is to identify the perceived benefits of occupying a green building as well as identifying the relevant barriers of occupying a green building from a commercial occupant's perception.

The analysis included:

- Identifying the various factors that can be perceived as benefits of occupying a green building;
- Ranking the perceived barriers to occupying a green building from the most important barrier to the least important barrier.

This chapter will discuss the findings of the research in the previous chapter and will be explained and discussed in conjunction with the literature review.

5.2 Discussion pertaining to perceived benefits of occupying a green building from a commercial building user's perception

After extraction, factor 1 accounted for 34.94% of the total variance and has high loadings for statements S14, S13 and S12. All of these factors relate to the environmental benefits provided by green buildings and how they contribute to the fight against global warming. By consuming fewer resources and generating less pollution and waste, the real estate sector will reduce its carbon foot print. This result affirms that the respondents clearly believe that the environmental benefits provided by green buildings are very important. In line with the study conducted by (Addae-Dapaah et al., 2009), it also noted the benefits accruing to environment as the strongest factor of the survey. This also confirms the writing of (Roper & Beard, 2006), occupiers of commercial properties believe it is important to reduce the usage of natural resources and improve the management of green buildings to ensure reduced energy consumption, improved environmental quality and contribute towards the savings of the earth's natural resources

The next most important factor noted relates to the competitive benefits created by occupying a green building. After extraction, this factor represents a further 9.24% of the variance and represents statements S2, S3, and S17. It will allow the employer of green buildings to attract better talent than their competitors in non-

certified buildings and will ensure a cost saving for the occupant due to reduced water and electricity consumption. Statement S3 is also shared with factor 4. In line with the tough global economic trading environment that is affecting many businesses at the moment, it can be perceived from the above that businesses will go the extra mile to achieve a competitive advantage over their competitors. The provision of comfortable and pleasant working environments has become a key differentiator in the pursuit of attracting the best talent within an ever increasingly challenging labour market (Paevere & Brown, 2008).

After extraction, factor 3 accounts for 6.67% of the variance, representing statements S6, S5, S4 and S7 and relates to the economic benefits of occupying a green building. It notes that occupants of green buildings benefit from accelerated municipal approval processes, resulting in the earlier occupation of the building which should result in a reduced initial net rental due to the time factor of money. Occupants of green buildings are more likely to receive grants and rebates from government incentive schemes, resulting in reduced cost to occupy the building at more favourable rates that non-certified buildings. Green buildings will create a cost saving for the occupant due to lower monthly maintenance costs and they will benefit from reduced exposure to volatility in utility prices which is in agreement with the factors note by (Miller et al., 2008) This factor is especially prevalent within the South African market as the Eskom electricity price over the past three years has seen double digit escalations, which has been above inflation.

Factor 4 is characterised by statements S1, S16 and S15 and accounts for 4.74% of the variance after extraction. These statements relate to the branding perceptions of occupying a green building and what benefits can be obtained from an improved brand. Statement S1 is also shared with factor 2. This finding is in agreement with the paper by (Piet Eichholtz et al., 2010) who notes that the effect of occupying a green building will positively affect the corporate image of the occupant as it sends out a strong signal to the market that it is socially aware and has a high level of social responsibility. As there are currently only 100 Green Star rated buildings in South Africa, these properties will be viewed as technologically advanced and environmentally and socially responsible. The green attributes of the

building can be positively associated with the brand of the company and help market the company (Milne, 2012).

Factor 5 which accounts for 3.57% of the variance after extraction relate to statements S9, S8, S10 and S11. This factor relates to the benefits achieved from productivity gains due to the business occupying a green building e.g. better staff morale, a higher quality work environment and a healthier working environment which leads to reduced absenteeism. Should maximum productivity not be achieved at a business, it could have a detrimental effect on the profitability of the business. It is therefore imperative that employers investigate all avenues to improve employee productivity and by occupying a green building this would lead to a better working environment and staff with a higher morale. This concurs with the literature review, as the respondents perceive the sustainable design of the interior of green buildings as a way of improving the interior environmental quality of spaces, which will lead to better human health within the premises and produce higher levels of work productivity within the building (Weinberg, 1998).

5.3 Discussion pertaining to the perceived barriers to occupying a green building from a commercial building user's perception

Table 18 reveals the perceived barriers to occupying a green commercial building. From this frequency table, it is evident that the majority of the responses from the respondents lie in the 'agree' category of responses. The barriers are ranked below in level of importance of the perception from the biggest perceived barrier to smallest perceived barrier to occupying a green commercial building.

The mean of statement S20 is 1.96 with a standard deviation of 0.940. This would mean that '*I would not occupy a green building because I don't really think it is necessary to change from conventional buildings'* scores between 'strongly agree' and 'agree'. About 78% of the respondents would not consider occupying a green building because they don't think it is necessary to change from conventional buildings. This is noted as the greatest deterrent of occupying a green building and I believe that it is in some way a contrast to the exploratory factor analysis where the perceived environmental benefits are noted as the most important factor. In my opinion if the respondents believe that benefits relating to the reduction of the

exploitation of the environment are perceived as the most important benefit of green buildings, I would have assumed that there would be a greater willingness to change from conventional buildings as this has a great potential to benefit the environment.

The mean of statement S18 is 2.04 with a standard deviation of 1.018. This would mean that '*I would not occupy a green building because I am not really interested in the green building movement'* scores between 'agree' and 'somewhat agree'. Similarly, 75% of the respondents noted that they would not occupy a green building because they have no real interest in the green building movement. From this result, I think it is clear that both the GBCSA and developers of green buildings in South Africa should go on a huge drive to increase the awareness of the green building movement and the benefits that can be derived from occupying a green building to change this perception amongst commercial building occupiers. Occupants of green buildings are also aware of the 'greenwashing' that is occurring within the green building industry. This relates to the unsubstantiated product claims that are being made by suppliers of products to the industry (Frej, 2003). Until this issue has been resolved I believe that interest in the green building movement will not improve. Lastly, the financial benefits must clearly be quantified and marketed worldwide. As mentioned in the literature review, many CEO's only consider the initial cost to occupy a property and do not consider the entire cost of occupation over the entire lease period. Should this be achieved, I believe that the interest in the green building movement will increased substantially.

The mean of statement S19 is 2.12 with a standard deviation of 1.164. This would mean that *'I would not occupy a green building because I think that all green features are generally ineffective'* scores between 'agree' and 'somewhat agree'. Therefore a large majority of the respondents (73%) have no faith in the effectiveness of the green features attached to green buildings. This perception is in contradiction to the literature review.

The mean of statement S23 is 2.32 with a standard deviation of 1.248. This would mean that '*I would not occupy a green building as I do not clearly understand the principles of green buildings'* scores between 'agree' and 'somewhat agree'. 69% of

the respondents do not clearly understand the principles relating to green buildings. There is a clear opportunity here to educate commercial occupiers about reduced consumption expenses, the adoption of the green lease and the management process of green buildings and the general benefits that these will give to the occupant of the green building. Further to this, education must be provided regarding government subsidies and how that may result in lower rentals as well as all the productivity benefits that can be achieved from the occupation of a green building.

The mean of statement S22 is 2.66 with a standard deviation of 1.363. This would mean that '*I would not occupy a green building as current renewable energy sources are unreliable'* scores between 'agree' and 'somewhat agree'. This statement is in agreement with the literature review which notes that current renewable energy sources are unreliable and can be improved. In light of the literature review, as technology in the field of renewable energy resources progress, I believe that this factor will become less important as the efficiency of all the features used will be improved and all these improvements will be marketed to the occupants of the green buildings. Cannon et al. (2008) note that 'the green collar industry' has grown in leaps and bounds globally and has created substantial economic opportunities around the world. With an increased level of investment into energy efficient features, the efficiency of these features has increased but at the same time the pricing structures have reduced.

The mean of statement S21 is 3.10 with a standard deviation of 1.508. This would mean that *'I would not occupy a green building as there are only limited options in the local property market'* scores between 'somewhat agree' to 'neither agree nor disagree'. The least number of respondents being 42% perceived the number of green buildings in the local South African property market as a barrier to occupying green buildings. Even though this is a relatively immature market within the green building environment, there is a perception that the stock levels of green buildings within the market are adequate to meet the demands of the consumer at this point in time. This attests to the comments made by Jarrod Lewin from (Matsilele, 2015) that the green building industry within the South African property market has grown tremendously over the past decade. Although considered a relatively immature

environment, there is a sense from the commercial occupiers that the choice of green buildings is sufficient, as this was considered the least important barrier.

Table 19 ranks the barriers in level of importance, from the biggest perceived barrier to the smallest perceived barrier in relation to occupying a green commercial building.

Table 19: Ranking of the perceived barriers to occupying a green building

Ranking	Factor
1	I would not occupy a green building because I don't really think it is necessary to change from conventional buildings.
2	I would not occupy a green building because I am not really interested in the green building movement.
3	I would not occupy a green building because I think that all green features are generally ineffective.
4	I would not occupy a green building as I do not clearly understand the principles of green buildings.
5	I would not occupy a green building as current renewable energy sources are unreliable.
6	I would not occupy a green building as there are only limited options in the local property market.

.

5.5 Conclusion

The first proposition relating to the benefits of occupying a green building was fully confirmed in terms of the literature review and research that was conducted. All of the 17 statements that were noted as perceived benefits to occupying a green building were noted as perceived benefits of green buildings and none of the statements had insignificant factor loadings and were all included in the subsequent analysis. The environmental benefits achieved that contribute to the fight against global warming and the utilisation of fewer resources was noted as the principle benefit of green buildings. The competitive benefits that green buildings give to their occupiers relating to the fact that they help attract better talent and produce a cost saving of utilities relative to non-certified properties was also noted as an important factor.

The second proposition relating to the perceived barriers to occupying a green building had six different statements relating to that proposition. In general all the respondents ‘strongly agree’ and ‘agree’ with all the statements that were posed relating to this proposition. Therefore the barriers to occupy a green building must be taken seriously by all parties in the property industry and processes and procedures must be put in place to curb these negative connotations within the industry.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This chapter discusses the final conclusions and recommendations from this research paper. The recommendations made are for the benefit of property developers, commercial leasing consultations and property managers that operate in the real estate environment globally. The conclusions and general findings are noted below.

6.2 Conclusions of the study

This paper investigates the commercial occupier's perceptions of green buildings within the South African property environment in relation to the benefits that they provide and the barriers to occupying green buildings. The results from the research clearly indicate that the respondents are very conscious of the benefits derived from occupying a green building. Certified buildings have the potential to significantly reduce the amount of energy consumed and greenhouse gases produced, because approximately 30% of the world's greenhouse gases are produced by buildings. As mentioned earlier in the research, 40% of the world's energy is consumed by buildings via 'embodied energy' which relates to products which consumed energy in production and transport and through direct energy consumption. Green buildings therefore have the opportunity to reduce consumption by between 30% and 70% by addressing issues relating to resource depletion, the pollution of land, air and water and addressing the existing unsustainable pattern of developing non-certified buildings. Therefore if buildings which consume approximately 40% of the world's energy supply can cut that amount by 85% as mentioned earlier in the report, it is clear that a huge benefit can be obtained on both climate change and reducing the already under strain electricity supply in South Africa (Letsoalo, 2013). The building sector has been identified as an area where cost effective, quick and easily obtainable cuts in CO can be achieved.

The next challenge to resolve is to get the property industry and the occupants of green buildings to buy into the concept of green buildings and break the barriers to entry into the green building market. The more conservative views of the traditional

building industry must be challenged and explanations and arguments must be provided explaining why the sector needs to go green to provide a sustainable environment going forward. It therefore requires lobbying and investment by the likes of the Green Building Council of South Africa and the listed property sector which have the funds to promote this new trend. The perception that a green buildings cost substantially more to develop than a non-certified building also complicates this issue. As documented in the literature review of this research, that is not true in all circumstances and must be made known to occupants that intend on occupying green buildings. Green buildings ensure reduced costs over the entire lifecycle of the building as well as ensuring reduced operating costs in comparison to non-certified buildings. The real estate sector also has the opportunity to retrofit older buildings with new technologies and greening elements to ensure that the environmental damage that is created by these buildings is reduced.

All of these benefits that have been identified above need to be marketed to all commercial consumers of real estate in South Africa to let them know what the benefits of green buildings are.

6.3 Recommendations

It is critical that both the real estate industry and users of commercial property are educated about the numerous benefits of certified buildings in order to ensure an increased demand and investment into the green building economy. I believe that it is critical that information sessions be set up by the South African Property Owners Association (SAPOA), to advise both property investors and commercial property brokers of all the identified benefits and barriers to occupying green buildings within the South African property environment. These sessions can be based on all the factors that have been noted on benefits and the training course must be based on how these benefits can be utilised as ‘sales tools’ of green buildings to potential occupiers.

Further to the above, it is also important to indicate to property investors and commercial property brokers what the commercial occupiers perceive as potential barriers to occupying green buildings are. Should they be aware of this information

they will be able to ensure that their sales presentation include sufficient information relating to these barriers, to ensure to ensure that any questions relating to these barriers can be answered.

In terms of international investors they may want to occupy property within the South African, I would recommend that an international road show is conducted by SAPOA advising all international investors that South Africa is now a leading player in the green building field on the African continent and that we can be used as a gateway to the continent. During this road show, it is once again imperative that all the questions relating to the benefits and barriers to green buildings are clearly identified and any questions relating to green buildings are suitably answered. I would suggest increasing this road show to all the CEO's of major businesses in South Africa. It is important to advise them of all the above information and the size of the South African green building market, to show that should they not currently occupy a green building, when their current lease expires a green building solution is a financially and socially viable option going forward.

Within the South African real estate industry, it is now an ideal time for both the government and private sector to embark on retro fitting programmes to ensure increased environmental sustainability of the older buildings. This will ensure the longevity of these buildings and bring green buildings onto the market which will be most cost effective than newly constructed buildings.

I believe that government should also be more vocal about their support of the green building environment. Government must clearly state what tax reforms it will provide to the occupants and owners of green building within the South African property industry. Legislation enforcement requires trained, motivated building inspectors and government must therefore address the understaffing at all levels of government. This will ensure that the approving of the building plans and issuing of occupancy certificates can happen timeously and ensure the speedy occupation of green buildings.

6.4 Suggestions for further research

In order for green buildings to be the first choice of occupiers of commercial buildings within the South African property environment, I believe that it is important to show that green buildings are an economically viable choice. I would therefore suggest that further studies are conducted relating to the possible economic benefits of green buildings and a further study that determines an occupants' willingness to occupy and invest in green buildings. Until a convincing argument is made in favour of green buildings, there will continue to be a disconnect between the advocates of green buildings and the remainder of the property industry.

The literature review has noted that increased productivity by occupying a green building is an important benefit of green buildings. It is noted though that this benefit although clear, has not been clearly quantified into a 'rands and cents' benefit. I therefore suggest a further study that quantifies these increased productivity benefits provided by occupying a green building, to suggest a mechanism that will be able to financially quantify the productivity gains that can be achieved by occupying a green building.

One of the perceived benefits of occupying a green building has also been noted as the improved branding relating to the corporate image of the company due to occupying a green building. I believe that a further study relating to the value attached to this improved image would be an important tool in the selling of green buildings to potential commercial occupiers.

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APPENDIX A: INTRODUCTORY LETTER

Dear Participant,

I am completing my MBA studies at the Wits Business School. My research topic is "The Perceptions of Green Buildings amongst occupiers of Commercial Buildings in South Africa". I would be very grateful if you could spare 10 - 15 minutes of your time to answer the questionnaire below, which would constitute the data gathering phase of the research. The purpose of the research is to ascertain the perceptions that occupiers of commercial buildings have of green buildings within the South African property environment. The research questionnaire is anonymous and all information that you provide shall remain confidential. You are most welcome to contact me should you wish to see the final results of my research. My contact details are either 072 7254553 or jreeves@growthpoint.co.za. Alternatively if you would like to validate this survey, feel free to contact my supervisor, Prof Anthony Stacey on either 011 717-3587 or ***anthony.stacey@wits.ac.za***. Please note that you are under no obligation to complete this survey and can discontinue the survey at any time. By continuing with the survey, it is deemed that you have given informed consent to participate in the survey.

Thank you in advance for your time and participation.

Yours sincerely,

Jason Reeves

- Click this circle to choose to not proceed and end the survey (1)
- Click this circle if you agree to continue with this survey (2)

APPENDIX B: QUESTIONNAIRE

Please indicate the extent to which you agree or disagree with the following statements regarding the occupancy of green buildings. Click on the option that best represents your level of agreement / disagreement.

	Strongly Disagree (1)	Disagree (2)	Somewhat Disagree (3)	Neither Agree nor Disagree (4)	Somewhat Agree (5)	Agree (6)	Strongly Agree (7)
Being an occupant of a green building will increase the image of the business (1)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings attract better talent than their competitors in conventional buildings (2)	❍	❍	❍	❍	❍	❍	❍
Green buildings will create a cost saving for the occupant due to reduced water and electricity consumption (3)	❍	❍	❍	❍	❍	❍	❍
Green buildings will create a cost saving for the occupant due to lower monthly maintenance costs (4)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings are more likely to receive grants and rebates from government incentive schemes, resulting in lower initial rentals (5)	❍	❍	❍	❍	❍	❍	❍
Occupants of a green building benefit from accelerated municipal approval processes, resulting in earlier occupation of the building. (6)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings benefit from reduced exposure to volatility in utility prices e.g. Eskom electricity price increases (7)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings have a better experience at work leading to reduced absenteeism and higher work productivity (8)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings experience higher levels of staff morale which leads to lower work force turnover (9)	❍	❍	❍	❍	❍	❍	❍
Occupants of green buildings benefit from improved indoor air quality, which results in less	❍	❍	❍	❍	❍	❍	❍

complaints on comfort related issues and higher user satisfaction (10)							
The occupants of green buildings invest in green building technologies which helps them to have more control over their work environment (11)	❍	❍	❍	❍	❍	❍	❍
Green buildings promote the sustainable consumption of the earth's resources which does not to jeopardize future generation's needs (12)	❍	❍	❍	❍	❍	❍	❍
Green buildings consume less resources and therefore create less pollution (13)	❍	❍	❍	❍	❍	❍	❍
By occupying a green building, the occupants are contributing to the fight against global warming (14)	❍	❍	❍	❍	❍	❍	❍
I am happy to pay a premium for the green features of a green building (15)	❍	❍	❍	❍	❍	❍	❍
I would recommend green buildings to other potential users (16)	❍	❍	❍	❍	❍	❍	❍
The higher rental rates of green buildings exceed the benefits of the green features of a green building (17)	❍	❍	❍	❍	❍	❍	❍
I would not occupy a green building because I am not really interested in the green building movement (18)	❍	❍	❍	❍	❍	❍	❍
I would not occupy a green building because I think that all green features are generally ineffective (19)	❍	❍	❍	❍	❍	❍	❍
I would not occupy a green building because I don't really think it is necessary to change from conventional buildings. (20)	❍	❍	❍	❍	❍	❍	❍
I would not occupy a green building as there are only limited options in the local property market (21)	❍	❍	❍	❍	❍	❍	❍
I would not occupy a green building as current renewable energy sources are unreliable (22)	❍	❍	❍	❍	❍	❍	❍

I would not occupy a green building as I do not clearly understand the principles of green buildings (23)	❍	❍	❍	❍	❍	❍	❍

Q2 What is your gender?

❍ Male

❍ Female

Q3 What age group do you fit into?

❍ younger than 19

❍ 20-29

❍ 30-39

❍ 40-49

❍ 50-59

❍ 60-69

❍ 70 +

Q4 What is the highest level of education you have attained?

❍ Matric

❍ Diploma

❍ Degree

❍ Masters

❍ Doctorate

❍ Other

Q5 Please state your current occupation:

Q6 Please indicate what monthly salary bracket you fall into?

❍ < R10 000

❍ R10 001 - R30 000

❍ R30 001 - R50 000

❍ R50 001 - R75 000

❍ > R75 001

APPENDIX C: CONSISTENCY MATRIX

The purpose of the research is to identify the perceived benefits and barriers to occupying a green building from a commercial occupiers perspective within the South African property market					
Sub-problem	**Literature Review**	**Proposition**	**Source of data**	**Type of data**	**Analysis**
The first sub-problem is to identify the perceived benefits of occupying a green building from a commercial building user's perception.	Horgen 1999; Heerwagen 2000; Kats & Capital 2003; Heschong and Commission 2003; McCartney, 2007; Miller, Pogue, Gough, and Davis 2009; Milne 2012.	Proposition 1 The principle benefits of a green building are perceived to be: • Increased work performance • A higher level of staff morale • An economic benefit due to the cost saving of utilities • An economic benefit due to the cost savings related to maintenance • By occupying a green building, the occupants are contributing to the fight against global warming" • Green buildings promote the sustainable consumption of the earth's resources which does not to jeopardise future generations needs	On-line survey	Ordinal Data	Exploratory factor analysis followed by an Oblimin Rotation KMO and Bartlett's Test Scree plot analysis Factor Analysis Pattern Matrix

The purpose of the research is to identify the perceived benefits and barriers to occupying a green building from a commercial occupiers perspective within the South African property market					
Sub-problem	**Literature Review**	**Proposition**	**Source of data**	**Type of data**	**Analysis**
The second sub-problem is to identify and rank the perceived barriers to occupying a green building from a commercial building user's perception.	Gregory Kats and Capital 2003; Morris 2007; Pivo 2010; Greg Kats 2013; Construction 2013; Matsilele 2015; Limited 2015; (The US Green Building Council, 2015)	Proposition 2 The principle barriers to occupying a green building can be perceived as follows: I would not occupy a green building because I think that all green features are generally ineffective. I would not occupy a green building as there are only limited options in the local property market I would not occupy a green building as current renewable energy sources are unreliable I would not occupy a green building as I do not clearly understand the principles of green buildings	On-line survey	Ordinal Data	Descriptive statistics - Average mean score analysis