

https://dspace.org/

The practice of green procurement in facilities management in higher education institutions

Nethengwe, Ndivhuwo

2020
https://hdl.handle.net/10539/31180

Downloaded from a DSpace repository. https://dspace.org/



THE PRACTICE OF GREEN PROCUREMENT IN FACILITIES MANAGEMENT IN HIGHER EDUCATION INSTITUTIONS

Ndivhuwo Nethengwe

A research report submitted to the Faculty of Engineering and Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Building

Johannesburg, August 2020

Declaration

I declare that this research report is my own, unaided work. I have duly acknowledged all the sources of information used in this research report. It is submitted for the partial fulfillment of the Degree of Master of Science in Building at the University of the Witwatersrand, Johannesburg. It has not been submitted for any degree at any other university previously.

_____

Ndivhuwo Nethengwe

_____day of _____20_____ at _____

Abstract

Applying sustainability principles in facilities management is vital as it assists in reducing and eliminating adverse impacts on the natural environment. Sustainability principles also have a significant impact in higher education institutions as they have numerous buildings on campuses. Several studies have confirmed that applying sustainability principles in facilities management can yield positive results such as water conservation, reduction of energy consumption and waste whilst increasing long term cost savings and producing green conducive environments. Green procurement is a vital aspect of sustainability as it focuses on purchasing of environmentally friendly products and services. Therefore, green procurement practices are key in achieving sustainable facilities management.

Even though literature exists regarding green procurement in facilities management, little is known about actual green procurement practices in facilities management in higher education institutions, the capacity to implement green procurement, knowledge of green procurement, readiness to implement green procurement and influencing factors faced in the quest to implement green procurement. The aim of the study was to identify the actual green procurement practices that are being implemented in facilities management in higher education institutions in South Africa.

This study was carried out in the interpretivist philosophical manner. An inductive reasoning approach was utilised through the multi-method of semi-structured interviews and direct observations that was used in a survey strategy. The sampling methods used, was non-probability sampling. The findings of the study reveal that the current green procurement practices in the participating South African universities include energy efficiency, water conservation, innovative building designs, sustainable landscaping, building management systems, recycling of waste and energy efficiency on heating, ventilation and air conditioning. However, financial constraints were highlighted as an important factor influencing the level and frequency of green procurement implementation.

Keywords: Environment, Facilities Management, Green Procurement, Higher Education Institutions, Sustainability.

Acknowledgements

I would like to thank my supervisor, Associate Professor Obinna Ozumba for the assistance, guidance and supervision he has provided me throughout this research project. I would also like to thank all the staff members from the South African Universities who participated in this research and for sharing their knowledge with me.

I give thanks to my family, friends and everyone who supported and encouraged me throughout this research project. Above all, I am sincerely grateful to the Lord who guided me through to the completion of this study.

Table of Contents

DECLARATION I

ABSTRACT II

ACKNOWLEDGEMENTS III

TABLE OF CONTENTS IV

LIST OF FIGURES IX

LIST OF TABLES X

ABBREVIATIONS AND ACRONYMS XI

CHAPTER 1: INTRODUCTION 1

1.1 Research background 1

1.2 Development of the problem 4

1.3 Main research problem 5

1.4 Main research question 5

1.5 Research aim and objectives 5

1.6 Significance of the research 5

1.7 Overview of the research design and methodology 7

1.8 Scope of the research 7

1.9 Structure of the report 7

1.10 Summary 8

CHAPTER 2: LITERATURE REVIEW 9

2.0 Introduction: Sustainability, procurement and facilities management in higher education institutions 9

2.1 Sustainability 9

2.2 Sustainable developments 10

2.3 Sustainable procurement 11

2.4 Sustainability and facilities management 12

2.4.1 Facilities management 12
2.4.2 Sustainable facilities management 12
2.4.3 Facilities managers responsibility towards sustainability 13
2.5 Sustainability and higher education institutions 14
2.6 The role of higher education institutions regarding sustainability 15
2.7 Sustainability in facilities management in higher education institutions 16
2.8 Sustainability and green procurement 17
2.9 Green procurement 18
2.10 Green procurement practices 18
2.10.1 Green procurement practices in facilities management 19
2.10.2 Green procurement practices in other industries 20
2.10.3 Green procurement practices in higher education institutions 22
2.10.4 Green procurement practices in facilities management in higher education institutions 23
2.10.5 Green procurement practices in South Africa 28
2.10.6 Green procurement practices in higher education institutions in South Africa 30
2.11 Challenges to green procurement practices 31
2.11.1 Financial constrains 32
2.11.2 Lack of expertise required to practice green procurement 33
2.11.3 Lack of support from the institution's management 34
2.11.4 Exclusion of facility managers from decision making teams 34
2.11.5 Lack of incentive for implementation of sustainability practices 35
2.11.6 Lack of organisational sustainability policies 35
2.11.7 Scarcity of green products 36
2.11.8 Human behaviour 37
2.12 Enablers of green procurement practices 38
2.12.1 Government Legislation 38
2.12.2 Organisational policies 40

2.12.3 Reporting, measuring and benchmarking 41

2.12.4 Support from management 42

2.13 Summary of findings from literature review 43

CHAPTER 3: RESEARCH METHODOLOGY 45

3.1 Introduction 45

3.1.1 Research philosophy 45

3.1.2 Approach to theory development 46

3.1.3 Methodological choice 46

3.2 Research strategy 47

3.3 Population selection 47

3.3.1 Justification of choice of sources 49

3.4 Research sample 49

3.5 Data collection method 50

3.6 Structure of data collection instrument 51

3.7 Reliability and validity 52

3.7.1 Reliability 52

3.7.2 Validity 53

3.8 Data analysis 53

3.9 Ethical considerations 55

3.10 Research limitations 56

3.11 Summary 57

CHAPTER 4: DATA PRESENTATION AND ANALYSIS 58

4.1 Introduction 58

4.2 Demographic information of the respondents 58

4.2.1 The roles of respondents with regards to green procurement practices 60

4.3 Analysis of green procurement practices in facilities management in higher education institutions: Interview data 61

4.3.1 Objective 1. To identify green procurement practices in facilities management at higher education institutions 62

4.3.2 Objective 2: To learn how the effectiveness of green procurement practices is monitored and measured. 73

4.3.3 Objective 3: To determine if the current green procurement practices are effective. 75

4.3.4 Objective 4: To evaluate the current level of implementation of green procurement practices 76

4.3.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement 77

4.3.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions 80

4.4 Analysis of green procurement practices in facilities management in higher education institutions: Observation data 86

4.4.1 Energy efficiency 86

4.4.2 Water conservation 87

4.4.3 Innovative designs 88

4.4.4 Innovative heating, ventilation and air conditioning systems 88

4.4.5 Sustainable landscaping 89

4.4.6 Building management system 89

4.4.7 Recycling 89

4.5 Discussion of the findings 89

4.5.1 Objective 1: To identify green procurement practices in facilities management in higher education institutions 90

4.5.2 Objective 2: To learn how the effectiveness of green procurement practices are monitored and measured 102

4.5.3 Objective 3: To determine if the current green procurement practices are effective 103

4.5.4 Objective 4: To evaluate the current level of implementation of green procurement practices. . 104

4.5.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement 105

4.5.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions 106

4.6 Summary of the findings 108

CHAPTER 5: CONCLUSION 109

5.1 Introduction 109

5.2 Addressing the research objectives 109

5.2.1 Objective 1: To identify green procurement practices in facilities management in higher education institutions 109

5.2.2 Objective 2: To learn how the effectiveness of green procurement practices is monitored and measured 110

5.2.3 Objective 3: To determine if the current green procurement practices are effective 110

5.2.4 Objective 4: To evaluate the current level of implementation of green procurement practices 110

5.2.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement 111

5.2.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions 111

5.3 Addressing the research question 112

5.4 Addressing the research problem 113

5.5 Review of research methodology and limitations of the study 114

5.5.1 Review of research methodology 114

5.5.2 Limitations of the study 114

5.6 Overview of the findings and implication of the findings 115

5.6.1 Summary of the main findings 115

5.6.2 Implication of the findings 116

5.7 Recommendations 118

5.8 Areas for future research 118

5.9 Conclusion 119

REFERENCES 120

ANNEXURE A 135

ANNEXURE B 139

ANNEXURE C 142

List of Figures

FIGURE 2.1: THREE SPHERES OF SUSTAINABILITY 10

List of Tables

TABLE 2.1: GREEN PROCUREMENT PRACTICES IN HIGHER EDUCATION INSTITUTIONS 25

TABLE 3.1: STUDENT POPULATION IN SA PUBLIC UNIVERSITIES 48

TABLE 4.1: DEMOGRAPHIC INFORMATION OF THE RESPONDENTS 59

TABLE 4.2: RESPONSIBILITIES OF RESPONDENTS WITH REGARDS TO GREEN PROCUREMENT PRACTICES 60

TABLE 4.3: RESEARCH OBJECTIVES AND RELATED INTERVIEW QUESTIONS 61

TABLE 4.4: INSTALLATION OF ENERGY SAVING LED LIGHTING 63

TABLE 4.5: INSTALLATION OF SOLAR POWER SYSTEMS 64

TABLE 4.6: GREEN PROCUREMENT PRACTICES INVOLVING WATER CONSERVATION 67

TABLE 4.7: INNOVATIVE BUILDING DESIGNS 68

TABLE 4.8: INNOVATIVE HVAC SYSTEMS 70

TABLE 4.9: SUSTAINABLE LANDSCAPING 71

TABLE 4.10: FREQUENCY OF GREEN PROCUREMENT PRACTICES 72

TABLE 4.11: MONITORING AND MEASURING METHODS 74

TABLE 4.12: THE EFFECTIVENESS OF THE CURRENT GREEN PROCUREMENT PRACTICES 75

TABLE 4.13: THE LEVEL OF IMPLEMENTATION OF GREEN PROCUREMENT PRACTICES 76

TABLE 4.14: FACTORS THAT INFLUENCE GREEN PROCUREMENT PRACTICES 78

TABLE 4.15: FUTURE-PLANS TO IMPROVE AND INCREASE GREEN PROCUREMENT PRACTICES 82

TABLE 4.16: TIMEFRAMES FOR PLANNED FUTURE GREEN PROCUREMENT PRACTICES 84

TABLE 4.17: STRATEGIES FOR ACHIEVING FUTURE GREEN PROCUREMENT PRACTICES 85

Abbreviations and Acronyms

BMS	Building Management System
FM	Facilities Management
GHG	Greenhouse Gas
GP	Green Procurement
HEI	Higher Education Institution
HVAC	Heating, Ventilation and Air Conditioning
KPA	Key Performance Area
KPI	Key Performance Indicator
LED	Light Emitting Diode
MS	Microsoft
PV	Photovoltaic
SA	South Africa
UK	United Kingdom

Chapter 1: Introduction

1.1 Research background

Carbon emission is one of the human activities that have a major adverse impact on the environment. The rapid growth in human population and the constant consumption of limited resources or raw materials is causing significant damage to the global ecosystem (Stewart, 2010). Therefore, drastic changes and actions are required to address the situation.

Scientists are unsure if the planet's ecosystems can support and sustain the needs of current and future generations due to human activities having a huge adverse impact on the environment (Vaughter, Wright and Herbert, 2015). There is significant scientific evidence that show that human activities are destroying the life support of the world and as a result some species of plants and animals are becoming extinct, water and air are being polluted (van Weenen, 2000). This compromises and place at risk the current and future generations as their wellbeing rely on natural resources such as clean air and water.

Economic advancement has been prioritised over the years and as a result the environment has been negatively affected due to subsequent carbon emissions. Weng, Chen and Chen (2015), indicate that the extensive use of natural resource materials, due to speedy economic growth, has adversely impacted the environment and raised environmental concerns. If the rate at which the economy is consuming nature is not measured and priced, the markets will behave in ways that only caters for their economic interests (Shriberg, 2002). The level of the adverse impact on the environment should be explicitly demonstrated so that people can understand and subsequently change their behaviour. Human beings have a duty to look after the environment and the scarce natural resources as the economy and society depend on them (Diab, Al-Bourini and Abu-Rumman, 2015).

Various sources have requested urgent corrective actions be taken to conserve and minimise adverse impacts on the environment, as the demands for buildings and infrastructure in developing countries have yielded substantial developments that have contributed to environmental problems, such as carbon dioxide emissions (Bohari et al. 2017). The built environment should therefore respond to this request as it is a large industry and a significant carbon emitter.

The built environment activities also utilise the natural environment as a dumping site for solid waste, carbon dioxide and effluents, but the same built environment protects humans from the forces of the natural environment (Telesford, 2010). Aigbavboa, Oke and Edward (2018), expand on this concept by reporting that as much as the construction industry consumes large amounts of energy and natural resources, it is also a major contributor towards socio-economic developments. This implies that an equilibrium is required between social, economic and environmental requirements. This creates a need for sustainable developments and green buildings. Peprah, Brako, Akosah (2018), mention that the motivation for sustainable development is also due to the adverse impact on the planet, which emanates from several environmental challenges such as the depletion of natural resources, global warming and biodiversity loss caused by urbanisation, population growth, increased energy use and transportation, among other things.

Tramontin et al. (2014), assert that taking the environmental aspect into consideration is vital because the built environment across the globe is responsible for producing about 40% of waste and accounts for freshwater consumption of approximately 12%. Visagie and Cloete (2013), also state that in Australia, United States and United Kingdom (UK), buildings account for 23%, 38% and 42% of greenhouse gas (GHG) emissions respectively and 40% of energy consumption in Australia. It is evident therefore that the construction industry has the capacity to adversely impact the environment and that drastic action is required to mitigate the situation.

Energy usage and heating are essential components of the construction industry that adds to the built environment's contribution to climate change. According to Ivascu et al. (2015), GHGs are formed in the environment, subsequent to natural processes and human activity such as burning fossil fuels to produce energy. Sapri and Muhammad (2010), also state that carbon dioxide is a major contributor to global warming and its emission has a direct association with energy consumption. This demonstrates the extent to which the construction industry is associated with the negative impact on the environment. Bohari et al. (2017), report that the negative impact caused by the built environment on the natural environment has been condemned for a long time and it is important that this be significantly reduced.

Since 1980, facilities management (FM) has progressively gained a footing within the built environment (Awang et al. 2014). FM involves the entire lifecycle of a building from planning through to construction, including the operations and maintenance phase and also renovations

and demolition (Manjula, Dissanayake and Rajini, 2015). Most higher education institutions (HEIs) have FM department that is responsible for the buildings on campus and this place facilities managers in key positions to reduce built environments' adverse impact on the environment. This can be achieved by adopting sustainable development principles and green procurement (GP) in order to procure services and products that support sustainable developments.

HEIs are the best places to gather and share new knowledge regarding sustainability and its associated challenges. However, according to Young, Nagpal and Adams (2015), the issue of sustainability is not perceived to add value to HEIs stakeholders or regarded as something HEIs should be accountable for. Even though HEIs may not be obliged to adopt sustainability principles, some studies found that sustainability principles, like GP, are being practiced in HEIs in some developed and developing countries. Awang et al. (2014), report that the concept of sustainable HEIs is not new in developed countries and has a long history of implementation but is, however, a huge transformation for HEIs in less developed countries. This is confirmed by Awuzie and Emuze (2016b), who state that even though GP is not widely practiced in HEIs in Sub-Saharan Africa, areas such as South America, Europe, United States and parts of Asia are reported to be practicing GP in their HEIs.

GP is entrenched in pollution prevention principles which seeks to minimise the risk to the environment and human health (Muraguri, Waweru and Musyimi, 2015). According to Kahanaali, Khaksar and Abbaslu (2015), the growth of industries and increasing government regulations to preserve the environment in some countries has made institutions embrace the concept of GP. This could be the reason behind the changes in some organisations' current procurement practices, as compared with their previous practices. Initially, institutions procurement processes were mainly focused on attaining goods and services effectively and efficiently, but institutions have recently moved their focus to utilising GP to achieve their sustainability goals (Awuzie and Emuze, 2016b). The construction industry as a whole has an opportunity to reduce GHG emissions through its procurement processes which include the adoption of GP (Yu et al., 2017).

1.2 Development of the problem

The core functions of HEIs are education and research. HEIs are responsible for educating most future leaders in society. Therefore, they have an imperative role in developing a sustainable future, promoting sustainability practices and assisting society to evolve to sustainable lifestyles (Awang et al. 2014).

In South Africa (SA), HEIs provide innovative and experimental environments and therefore it can reasonably be anticipated that GP will be practiced even though it is not enforced by the government. HEIs are also able to secure funding to experiment with green initiatives in their facilities.

FM in HEIs have an important role to play in reducing built environments' adverse impact on the environment, as they are responsible for all facilities on their campuses (Awang et al., 2014). The implementation of GP can therefore be used as a tool to transform FM from using conventional construction and maintenance methods, to implementing sustainable developments. In the case of HEIs, there is a need to practice sustainability principles such as GP in the management of their facilities. However, Young, Nagpal and Adams (2015), indicate that there is minimal research on GP practices in HEIs. Fuentes-Bargues, Ferrer-Gisbert and Gonzalez-Cruz (2018), concur, stating that a limited amount of research has been carried out on GP in the context of universities. This makes HEIs a relevant area to conduct this study.

Lo (2015), reports that HEIs across the world are involved in sustainability practices. Struwig, Smit and Van Wyk (2014), conducted a study on SA universities green practices focusing mostly on green buildings. The study revealed that in 2014, only few universities were implementing green initiatives on their campuses. However, even though literature exists regarding GP in FM in HEIs, little is known about their actual GP practices, the knowledge of GP, the capacity and readiness to implement GP and the influencing or challenging factors they may face in their quest to implement GP. In the absence of the above-mentioned critical information, the practice of GP continues at a sub-optimal level, as FM departments continue to contend with unresolved challenges, low levels of knowledge, readiness and capacity.

1.3 Main research problem

From the foregoing discussion, the research problem can be precisely stated as follows:

There is poor practice of green procurement in the facilities management of higher education institutions, due in part to lack of knowledge, inadequate capacity, low readiness levels, and other related challenges.

1.4 Main research question

The research question is raised so that the aim of the study can be achieved. This study will concentrate on the following main research question:

What are the actual GP practices that are being implemented in FM in HEIs in SA?

1.5 Research aim and objectives

The aim of the study is to identify the actual GP practices that are being implemented in FM in HEIs in SA.

The objectives of this study are:

- To identify GP practices in FM in HEIs;
- To learn how the effectiveness of GP practices is monitored and measured;
- To determine if the current GP practices are effective;
- To evaluate the current level of implementation of GP practices;
- To identify the motivations of institutions or personnel, to practice GP; and
- To determine future-plans to improve or increase current GP practices in FM in HEIs.

1.6 Significance of the research

FM departments in HEIs have a huge role to play in reducing built environments' adverse impact to the environment, as they are responsible for managing and delivering all facilities on their campuses. This can be achieved through adopting sustainable development principles

such as GP which can be utilised to procure services and products that support sustainable developments and retrofitting of existing buildings.

Gonzalez-Galvez et al. (2018), assert that the construction industry consumes 33% of energy in the world, resulting in it being the highest energy consumer, and subsequently a source of carbon dioxide emission. Khan et al. (2018), state that studies conducted in developed countries show that the construction industry consumes 30-44% of natural resources, 40% of the materials consumed globally and heating, ventilation and air conditioning (HVAC) use 50% of energy. These reports show that the built environment is a great contributor to the consumption of non-renewable resources, excessive energy and water consumption and is a significant polluter of the environment. These activities contribute substantially to climate change.

Due to climate change, natural resources such as freshwater have become contaminated and scarce. The United Nations reported that by the year 2050 approximately 5 billion people will encounter scarcity of clean freshwater; hence there is a desperate need to conserve water and prevent its pollution (Das, Bera and Moulick, 2015). Moglia, Cook and Tapsuwan (2018), also state that California in the United States, experienced a severe draught that limited the availability of water to support its large population, and an extended draught in Cape Town SA posed the possibility of day zero where potable water supply was going to run-out. It is evident that climate change poses potential dire consequences and the situation is worsening rapidly. Therefore, urgent action needs to be taken to address this situation going forward.

The built environment has the potential to reduce the pollution of the environment significantly and this has a potential of being achieved through the implementation of sustainability principles such as GP, as this could reduce its adverse impact. Badin et al. (2018), advise that GP practices should be implemented in all stages of a construction project so that minimal environmental impact can be achieved.

This study seeks to identify GP practices in FM in HEIs. This will assist in identifying how much the built environment in HEIs has pivoted towards embracing sustainability principles. Subsequent to the findings of the study, solutions can be sought to improve and increase the current level of implementation of GP practices.

This research is important as the findings may provide an indication of what is required from FM in HEIs to reduce carbon emissions in their building and renovations projects, including identifying the factors required to improve the implementation of GP practices.

1.7 Overview of the research design and methodology

The study is exploratory in nature and was conducted in two phases. The first phase is the study of literature which focus on collecting secondary data. This involved extended literature review in order to gain knowledge and identify similarities and gaps regarding GP practices. Secondary literature offers an impression of various aspects of the study in totality in order to reveal links and gaps (Hofstee, 2006). The second phase is the empirical study which focus on collecting primary data through semi-structured interviews and direct observations. Primary data was required to gain more knowledge and establish the links and gaps between secondary data and what is actually happening in FM in HEI in SA in relation to GP practices.

This study was carried out in the interpretivist philosophical manner because a historical background is required for understanding and interpreting the phenomenon being studied. An inductive reasoning approach was utilised through the multi-method of semi-structured interviews and observations that was used in a survey strategy. A detailed research methodology is presented in chapter three of this report.

1.8 Scope of the research

The study only focused on GP practices related to FM functions in three universities in SA. However, the universities are located in various parts of the country.

1.9 Structure of the report

This study comprises of five chapters. The next four chapters will present the following:

Chapter 2: Literature review

This chapter will discuss the relationship between sustainability and GP in the context of FM in HEIs, including several GP practices that are being implemented. The barriers and enablers

of the implementation of GP will also be discussed and the summary of findings from literature review will be presented at the end of the chapter.

Chapter 3: Research methodology

This chapter will present the selected research methods that were employed in this study, including their justification, as well the data analysis method that was applied. The limitations of the study and ethical considerations will also be elucidated.

Chapter 4: Data presentation and analysis

The analysis of the collected data will be displayed in this chapter and then the outcome of the data analysis will be discussed. The results will also be compared with that found in related literature.

Chapter 5: Conclusion

The intentions of the study will be reflected upon in this chapter, including the main findings, limitations and the methodology that was applied. Then conclusions will be drawn, and recommendations will be made. Suggestions for future studies will also be given.

1.10 Summary

The background of the study, the research problem and main question were presented in the beginning of this chapter. The aim and objectives of the study were also stated. The scope and significance of the study were also discussed and then the structure of the report was presented at the end of the chapter.

Chapter 2: Literature review

2.0 Introduction: Sustainability, procurement and facilities management in higher education institutions

Literature regarding green procurement (GP) practices in facilities management (FM) in higher education institutions (HEIs) will be reviewed in this chapter. The relationship between sustainability, GP, FM and HEIs will be discussed. This chapter will also discuss the barriers and enablers of the implementation of GP practices. The chapter will conclude with the summary of findings from literature review.

2.1 Sustainability

According to Bantanur (2012), sustainability means behaving in a manner that sustains the integrity of the universal ecosystem that life depends on. Aila and Ototo (2018), also mention that sustainability is a balancing exercise that involves using methods that do not completely debilitate or destroy natural resources. Life relies on the resources supplied by nature hence the need to maintain the balance between the environmental, economic and social aspects. Sustainability has become a means to address the imbalance in the interaction between humans and the environment (Elliot and Wright, 2013). This is the reason why sustainability is utilised to ensure that there is a balance between social requirements, economic development and preserving the natural environment. Figure 2.1 illustrates the three spheres of sustainability.

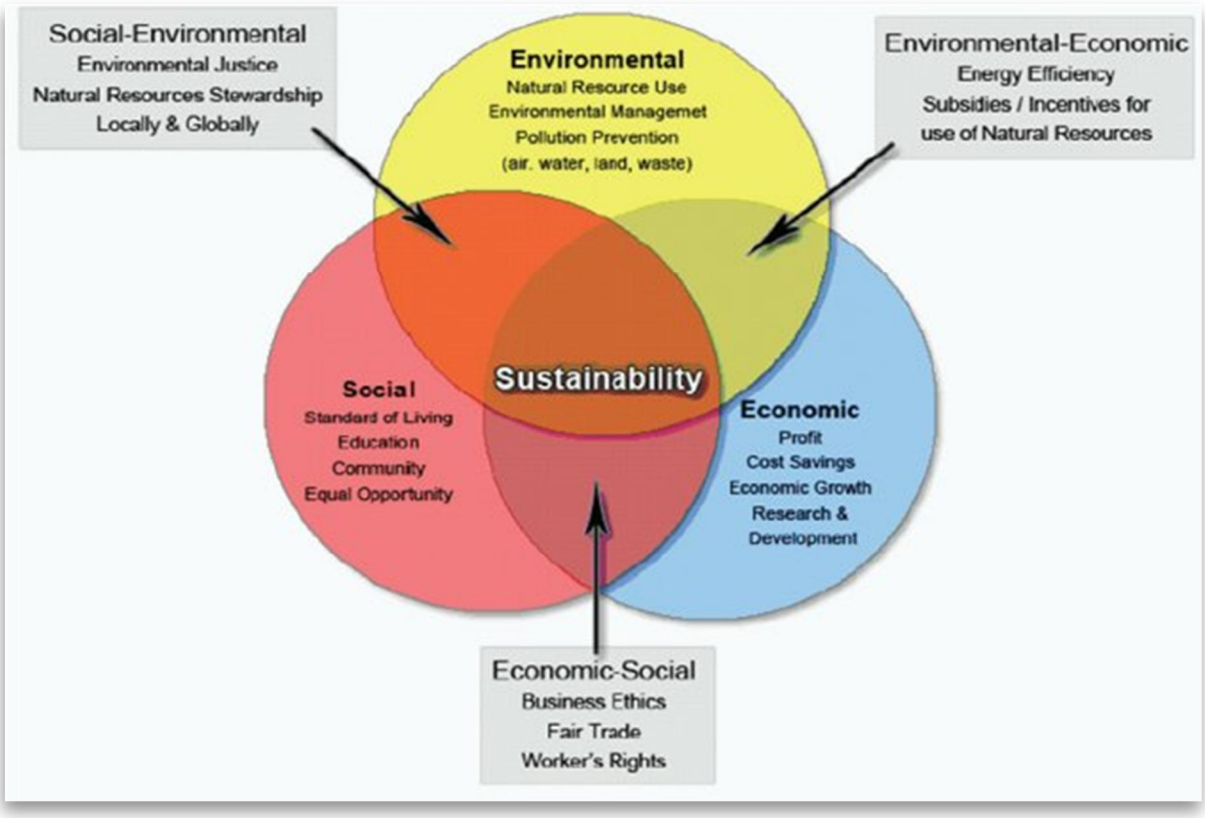

Figure 2.1: Three spheres of sustainability

Source: Aminuddin and Nawawi, 2015

It is evident on Figure 2.1 that the three spheres are interlinked with each other, which means sustainability can be applied throughout the entire supply chain in different industries, through several methods. For example, in the construction industry, sustainability principles can be applied through sustainable developments.

2.2 Sustainable developments

Ezani et al. (2018), describe sustainable developments as a process of growing developments while taking environmental requirements into consideration and seeking more methods to produce clean and renewable energy sources. Tramontin, Loggia and Trois (2012), expand on this by stating that sustainable developments should not just be viewed as a method to save energy, but also in terms of economic effectiveness and social integration.

The construction industry's impact on the environment has created pressure to embrace sustainability principles in the built environment. The built environment has the potential to improve through applying sustainability principles in new building projects and in the retrofitting of existing buildings. Sustainability was introduced to the built environment to improve the construction industry practices to be more environmentally friendly, safe and cost effective (Badin et al. 2018).

Bohari et al. (2017), assert that procurement is a key influential change agent as it enables the incorporation of green practices throughout the development phases of a building. Awuzie and Emuze (2016b), state that the need to incorporate sustainability into the procurement process for building projects is vital due to the influence it has on achieving sustainable buildings on campus. Unfortunately, sustainable procurement is not widely practiced in the built environment. However, the support for sustainable procurement practices increased after the global summit for sustainable developments in 2002, as governments were requested to endorse sustainable procurement policies to promote sustainable developments and distribution of green products and services (Ochieng, Oginda and Oteki, 2016).

2.3 Sustainable procurement

Sustainable procurement is an extension to conventional procurement practices and forms part of the broader sustainable development concept (Aila and Ototo, 2018). Nderitu and Ngugi (2014), describe sustainable procurement as a process that balances environmental protection, economic and social developments over business needs. According to Wallace and Omachar (2016), sustainable procurement is about considering the environmental, social and economic impact when making purchases which include enhanced price, quality and availability of the products as well as their lifecycle impact.

Procurement is a vital aspect of sustainability practices because it stretches beyond the institution boundaries as it involves dealing with external suppliers that provide products and services to the institutions (Meehan and Bryde, 2010). It is evident that sustainable procurement is a mechanism that can encourage the application of sustainability principles across the entire supply chain.

Sustainable procurement is a broad concept that can be applied across several sectors including the built environment, through sustainable developments. FM is one of the critical areas in the built environment that can enable the implementation of sustainability principles in the construction and renovations of buildings.

2.4 Sustainability and facilities management

2.4.1 Facilities management

According to Asbollah, Isa and Kamaruzzaman (2016), FM is a method of incorporating operations, maintenance, improvements and adjustments of buildings in order to support the organisation's core business.

For HEIs to deliver their core business, which is teaching, learning and research, they have to provide, maintain and operate a large number of infrastructure that include lecture theatres, laboratories, offices, catering facilities, residence accommodation, sports facilities and recreation centres (Sapri and Muhammad, 2010). These functions are the responsibility of FM division and can be challenging to manage, owing to the large and increasing number of infrastructures required in HEIs. McLeod et al. (2015), highlighted that the servicing and upkeeping of HEIs' large number of facilities result in challenging procurement and supply chain processes. This can be resolved through transforming to sustainable FM as it involves the implementation of sustainability principles throughout the lifecycle of a building which result in reduced maintenance and operational costs.

2.4.2 Sustainable facilities management

FM involves the entire lifecycle of buildings, from planning phase through to construction phase, including maintenance, renovations, operations and demolition of such buildings (Manjula, Dissanayake and Rajini, 2015). While sustainable FM is the process of considering sustainability of infrastructure from planning phase through to implementation, maintenance and operations (Asbollah, Isa and Kamaruzzaman, 2016).

It is important to take into consideration future maintenance and operational challenges from the planning stage of a building project, as this will influence the environmental performance of the building. Khodei (2015), mention that the selection of materials and finishes for a

building at design stage is seen as an initial step towards optimising maintenance processes in the future. Baaki, Baharum and Ali (2016), suggest that sustainability practices be integrated into the implementation and operation of facilities so that sustainable FM can be achieved.

The primary objective, with regards to sustainable FM, is to minimise energy consumption and reduce dependence on fossil fuels to produce energy (Aigbavboa, Oke and Edward, 2018). GP is one of the methods that will enable FM to reduce energy consumption and to also transition into sustainable FM. Zakaria, Hashim and Ahzahar (2018), identify GP as one of the critical success factor for sustainable FM because it involves reducing energy consumption, utilising renewable energy sources and utilising recyclable building materials.

Incorporating GP in the management of facilities will not only assist institutions in achieving their sustainability goals but will also provide their students with first-hand experience in GP through their facilities that have sustainable features. Telesford (2010), states that HEIs that embrace sustainable FM position themselves as change agents.

Sustainability is about making continuous improvements. Therefore, there is no final stage of sustainability in FM in HEIs, as it is an ongoing process of finding more ways to improve and increase sustainability (Rammel, Velazquez and Mader, 2015). This implies that ensuring continuity in the implementation of sustainability principles forms part of facilities managers' roles and responsibilities.

2.4.3 Facilities managers responsibility towards sustainability

A facility manager is someone whose role is to ensure that buildings and their related services function to meet the occupants' requirements and support the institutions core business. Noor and Pitt (2008), describe a facility manager as someone who is responsible for providing and managing facilities that are conducive and support the organisation's operations and core business.

Facility managers are well positioned to be the drivers of the implementation of sustainability principles. Therefore, it only makes sense to involve them throughout the lifecycle of buildings to ensure that buildings perform in a sustainable manner. Aigbavboa, Oke and Edward (2018), mention that facilities managers responsibilities have developed to incorporate GP and energy management. Calder and Dautremont-Smith (2009), concur, stating that facilities managers

responsibilities include water and energy saving, recycling and reducing of waste, sustainable purchasing, and sustainable developments and landscaping.

Baaki, Baharum and Ali (2016), indicate that facilities managers should advance their knowledge and competencies to enable them to mitigate challenges, take advantage of opportunities and handle the demands that come with sustainable developments. Acquiring more knowledge and skills enhancement on sustainability will assist facilities managers to transform facilities on their campuses into sustainable facilities.

Facilities managers should be good role models through managing facilities in a sustainable manner. It is vital that facilities managers are in full support of their institution's sustainability goals and principles because without their support, FM may not practice sustainability principles such as GP (Awang et al. 2014). Saferi et al. (2018), emphasise that facilities managers can be instrumental in determining the critical enabling factors of implementing GP. Facilities managers are also imperative in expediting the practice of GP in the built environment through transforming into sustainable FM (Elmualim, Valle and Kwawu, 2012). This shows that GP has a direct relationship with sustainability.

It is evident that FM is a crucial component and forms part of several organisations including HEIs as they have large numbers of buildings on their campuses. Therefore, applying sustainability principles within FM can contribute positively toward reducing the adverse environmental impact, especially in large organisations such as HEIs.

2.5 Sustainability and higher education institutions

A sustainable HEI is one that addresses and promotes the reduction of the environmental, economic and social adverse impacts in the manner it utilises resources in order to fulfil its core functions (Zainordin and Ismail, 2017). Pouya and Pouya (2018), describe a sustainable university as one that supports minimizing adverse environmental impacts that are generated during its activities and operations, while fulfilling their core business of teaching and learning and subsequently stewarding society to transition into sustainable lifestyles. It is important that HEIs transform into sustainable institutions so that they can be transformative to society as well. Societies across the globe look to HEIs to produce sustainable solutions and resolve environmental challenges (Stewart, 2010).

There is a need for HEIs to lead sustainability through demonstrating practices that protect the environment. Aleixo, Azeiteiro and Leal (2018), mention that HEIs around the world are responding to the call for leadership by also incorporating sustainability into their operations. However, Zainordin and Ismail (2017), indicate that even though the number of HEIs that have embraced sustainability is increasing, most HEIs remains conservative and slow in incorporating sustainability principles. For sustainability to be normalised, HEIs should integrate sustainability principles into their daily operations (Rammel, Velazquez and Mader, 2015). This suggests that HEIs should assume the role of ensuring that sustainability principles are incorporated into daily campus activities.

2.6 The role of higher education institutions regarding sustainability

HEIs have a responsibility to protect the ecosystem and transform society by utilising the knowledge produced in their institutions and educating future generations (Zainordin and Ismail, 2017). People need to be educated about sustainability to enable them to implement sustainability principles. Vaughter, Wright and Herbert (2015), state that the most effective means of achieving sustainable developments is through educating the society. Sustainability education should enable humanity to obtain the understanding and ability to implement and promote sustainable developments.

Both staff and students in HEIs have the potential to learn about the effects and processes of GP through sustainable developments as they spend most of their time in campus buildings such as lecture theatres, libraries, offices, living and dining spaces (Struwig, Smit and Van Wyk, 2014). Fuentes-Bargues, Ferrer-Gisbert and Gonzalez-Cruz (2018), state that universities play an informative role because they carryout massive purchasing and contracting activities that can contribute towards sustainable developments. Therefore, transformation towards sustainable developments can be achieved through incorporating green practices into campus physical operations.

Campus greening is a vital part of sustainable developments in HEIs. According to Calder and Dautremont-Smith (2009), the practice of campus sustainability in campus operations is increasing in HEIs in the United States and they recommend that HEIs across the world should follow this example. Rammel, Velazquez and Mader (2015), advise that HEIs should overcome their inertia and start the transformation process to sustainable institutions.

The potential to educate and influence change extends to institutions' suppliers and service providers. Saferi et al. (2018), mention that the procurer is the one who normally triggers the need to transition towards the green approach by demonstrating an insistence on green products and/or services. Therefore, if HEIs incorporate sustainability practices such as GP in their procurement processes, they will subsequently spread the same practices to their suppliers and service providers. Clarke (2006), observe that through Dalhousie University's encouragement, the joint buyer group (Inter University Services) adopted a GP policy. Wallace and Omachar (2016), advise that organisations such as HEIs should harmonise their sustainable procurement policies with those of their suppliers and service providers.

HEIs are in the privileged position of being able to impart knowledge about sustainable developments because of the inherent academic ability to teach and conduct research on the requirements for sustainable change (Salvioni, Franzoni and Cassano, 2017). This means HEIs have a leading role to play in transforming society into adopting sustainability principles and should therefore act promptly in this regard. Calder and Dautremont-Smith (2009), assert that HEIs are reaching the point where it will be unacceptable for them to ignore the need to implement sustainability principles.

Alshuwaikhat, Adenle and Saghir (2016), observe that in the past few decades, HEIs have been increasing their efforts and commitment to resolve challenges related to sustainability in their institutions. However, Calder and Dautremont-Smith (2009), find that even though efforts to integrate sustainability into campus operations are increasing, most campuses are still far from achieving operational sustainability. This is concerning considering the urgency required to address environmental challenges. FM as the responsible party for campus operations, should embrace sustainability principles in order to transform to operational sustainability and ultimately transform to sustainable HEIs.

2.7 Sustainability in facilities management in higher education institutions

The built environment can greatly contribute towards green practices through FM as facilities managers are at the forefront of implementing sustainability goals for their organisations because their department decide how buildings and facilities are to be built and maintained (Elmualim, Valle and Kwawu, 2012). The same applies to HEIs as they also have FM division on their campuses.

The implementation of GP practices when procuring built assets will add to knowledge development and knowledge transfer in HEIs. Gonzalez-Galvez et al. (2018), assert that university buildings should be able to display best practice in energy efficiency design as they also serve as community centres. Awuzie and Emuze (2016b), support this, stating that HEIs are expected to take the lead in implementing GP because of their role in imparting and developing knowledge. According to Zainordin and Ismail (2017), HEIs nurture and prepare future leaders and therefore play a vital role towards transforming societies to adopt sustainability principles. It is evident that GP plays a vital role in achieving sustainability goals.

2.8 Sustainability and green procurement

Previously, procurement only focused on price, quality and time but sustainability was recently added as a fourth dimension to procurement processes (Aila and Ototo, 2018). Adding the sustainability component into the procurement processes has transformed conventional procurement into sustainable procurement. Sustainable procurement focuses on the whole lifecycle of the product, not just the initial cost and it also enables organisations to attain value for money when acquiring goods and services, whilst minimising the adverse impact on the environment (Khan et al., 2018).

Subsequent to sustainable procurement, GP also emerged. GP is considered an extension of sustainable procurement activities as it focuses on decreasing the adverse impact that products have on the environment throughout their lifecycle (Mafini and Loury-Okoumba, 2018). Badin et al. (2018), mention that the purpose of GP is to reduce or prevent pollution and mitigate the risk of adverse impacts on the planet. Therefore, GP is an efficient way to address environmental issues.

Lundberg and Marklund (2018), report that GP is an important factor in creating a sustainable future as it mitigates challenges related to climate change and consumption of natural resources. Diab, Al-Bourini and Abu-Rumman (2015), concur, stating that GP is frequently used to minimise adverse impact on the natural environment and maintain environmental sustainability. Saferi et al. (2018), support this, stating that GP is regarded as a mechanism to promote sustainability for construction projects. This affirms that implementing GP practices will secure a sustainable environment for future generations.

2.9 Green procurement

Meehan and Bryde (2010), describe GP as a process used to procure goods and services in a manner which ensures minimal adverse impact on the environment throughout their entire lifecycle. While sustainable procurement focuses on all three sustainability aspects, namely, environmental, social and economic, GP focuses more on the environmental aspect of sustainability.

The environmental requirements are incorporated into the tendering process through GP in order to assist in minimizing global warming and climate change (Sanchez, Hampson and Kenley, 2014; Muraguri, Waweru and Musyimi, 2015). GP therefore is a method used to purchase green products and services that have no or minimal environmental impact. Diab, Al-Bourini and Abu-Rumman (2015), highlighted that GP practices are frequently used to minimize the adverse impact on the natural environment to maintain environmental sustainability. Therefore, it can be concluded that GP practices are implemented in order to mitigate several environmental challenges. Such practices will be discussed in the next section.

2.10 Green procurement practices

Young, Nagpal, and Adams (2015), describe GP as a method of achieving value for money when procuring products and services, while reducing the adverse impact to the environment. Mafini and Loury-Okoumba (2018), describe GP as a form of procurement that focuses on purchasing products that meet the environmental concerns in terms of reducing and recycling of waste, including preserving natural resources. GP is widely described as the kind of purchasing that is environmentally responsible and includes the purchasing of services and products that have recyclable materials, reduce greenhouse gas (GHG) emissions and are energy efficient. Aila and Ototo (2018), mention that GP practices include purchasing goods that have high recyclable contents, consumes less energy, make use of bio-degradable materials and do not contain substances that deplete the ozone layer.

One of the main purposes for GP is to improve environmental sustainability. Nderitu and Ngugi (2014), indicate that GP is an effective method which is gradually being used to decrease the adverse environmental impact and inspire clean production technology. Agyepong and Nhamo

(2017), also state that GP is a vital mechanism for addressing climate change as it has been recognised as one of the intervention measures.

Developed countries use GP as a means to protect the environment, natural resources and the residents of the earth (Felix, Zivanai and Friend, 2016). Rais et al. (2018), also mention that GP is an effective tool for decreasing the adverse environmental impact and is being practiced in many countries across the world. Humanity as a whole should be encouraged to practice GP regardless of the country they reside in because it is everyone's responsibility to protect the environment. Agyepong and Nhamo (2017), assert that the current generation in all industries, including the built environment, should view practicing GP as an ethical conduct.

Bohari et al. (2017), described GP in the built environment context by stating that, GP for building projects is the act of acquiring infrastructure and building works in a manner that takes the environment into consideration from the design stage until the completion of the construction phase. This can also be achieved through implementing GP practices in FM.

2.10.1 Green procurement practices in facilities management

Incorporating GP in the management of facilities can assist in achieving sustainability goals. Ezani et al. (2018), assert that GP is vital in managing the environmental impact of existing buildings and construction process of new buildings. Saferi et al. (2018), support this, stating that GP was initiated to improve the effectiveness of green construction and developments.

GP activities in facilities management include utilising recyclable building materials, reducing energy consumption and utilising renewable energy sources (Zakaria, Hashim and Ahzahar, 2018). Alshuwaikhat, Adenle and Saghir (2016), concur stating that the most common GP practices in FM are procuring and installing of energy efficient bulbs, reducing GHG emissions, reducing waste and improving operation efficiency. Filho, Shiel and Paco (2015), also mention that environmental initiatives such as recycling, energy efficiency, water conservation and green buildings can be observed within FM. It is evident that there are several GP practices in FM, however energy efficiency appears to be the most common practice.

It is commendable to note that FM is implementing several GP practices, however GP has also been reported to being practiced in other industries. Such industries will be discussed in the following section.

2.10.2 Green procurement practices in other industries

GP practice is a method of procuring products and services that consider the impact that the environment will have on communities, including taking into account material used to make the products, the area where materials come from, the organisation that made the products, how the products are transported and how the products are disposed of after use (Wallace and Omachar, 2016). It is clear therefore that GP can be practiced throughout the supply chain irrespective of whether it is in the private or public sector. Rais et al. (2018), state that both public and private sectors should practice GP to reduce the adverse impact on the environment. Therefore, it is important that GP is implemented at all supply chain levels and across all industries, to reduce carbon emissions worldwide.

2.10.2.1 Green procurement practices in the public sector

The support for sustainable procurement practices increased after the global summit for sustainable developments in 2002, as governments were requested to endorse sustainable procurement policies to promote sustainable developments and distribution of green products and services (Ochieng, Oginda and Oteki, 2016). However, Adamu and Shakantu (2016), observe that developing countries tend not to have adequate sustainable procurement policies for their built environment. Tramontin, Loggia and Trois (2012), expand on this stating that developing countries have limited experience in sustainable developments and as a result, sustainability principles are applied voluntarily rather than mandated by legislation.

In Malaysia GP was introduced as one of the strategies to preserve the environment and also forms part of their National Green Technology Policy (Bohari and Xia, 2015). Buniamin et al. (2016), also note that the Malaysian Government capitalises on utilising local materials and resources to promote local industries while reducing adverse impacts to the environment. This shows that practicing GP does not only address environmental issues, but also indirectly addresses economic and social issues.

Bohari et al. (2017), report that the Malaysian government is in the process of developing GP framework that will provide clear guidelines for purchasing green products and services while creating awareness in all industries, and this will influence their country to practice GP. This

brings awareness to society and will also make it easier for them to know which products are categorised as green and encourage the purchase of such products.

Ochieng, Oginda and Oteki, (2016), carried out a study on sustainable procurement practices in the context of water services board, in Kenya. The study reveals that Lake Victoria South Water Services Board takes the environmental aspect into consideration when specifying products in their tender documents. They also have effective policies for recycling and disposal methods, such as fire destruction, burying and selling products for recycling.

Aila and Ototo (2018), conducted a study on sustainable procurement concepts and find that the Kenyan government has put institutional and legislative policies in place to ensure that all business procurement activities evolve into sustainable procurement processes.

Felix, Zivanai and Friend (2016), carried out a study which reveals that the Chinese government established its GP system in 2004 and uses it to encourage sustainable developments and protect the environment.

The efforts that the public sector is demonstrating in order to increase and improve GP practices in their countries are commendable. However, the public sector cannot successfully practice GP without the involvement of the private sector as it often represents the suppliers of products and services.

2.10.2.2 Green procurement practices in the private sector

The private sector also plays a vital role with regards to practicing GP. In the supply chain process, the private sector usually represents the suppliers and service providers. Therefore, it is important that they adopt green principles as they are the ones who produces green goods and services for procurement.

Some studies show instances of the private industry embracing their sustainability responsibility by adopting some GP principles and include:

- Nderitu and Ngugi (2014), conducted a case study on East African Breweries. The study reveals that in 2010 East African Breweries limited launched their green goals which

resulted in them changing their procurement of raw materials from barley to sorghum as it is more eco-friendly.

- Sanchez, Hampson and Kenley (2014), carried out a study on an evaluation framework for GP in road construction. The study finds that the Australia Road Construction Agencies frequently carryout environmental impact assessments during the procurement phase of a proposed major transport infrastructure project. Environmental impact assessment is important because it outlines the steps to be taken to prevent or reduce environmental impact during construction. The study reveals that earthworks are one of the construction phases that generate large amounts of GHG emissions from fuel consumption. As a result, the road construction agencies encourage the purchase of biofuel for road construction because it reduces GHG emissions.

- A study conducted by Wallace and Omachar (2016), on Kenya Airways reveals that the airline purchase recyclable goods, low energy consuming goods and environmentally preferred goods as part of their GP practices.

The abovementioned practices confirm that even though GP is considered a new phenomenon, various industries have successfully adopted several GP practices, such as the inclusion of green criteria into their procurement methods and policies in order to minimise the adverse environmental impact. Asbollah, Isa and Kamaruzzaman (2016), mention that the reasons for adopting sustainability are similar irrespective of the context. Therefore, all organisations and institutions should embrace GP as it is an important concept that enables environmental sustainability (Peprah, Brako, Akosah, 2018). This include major institutions such as HEIs, as most of them have huge campuses and therefore can contribute significantly towards reducing the environmental impact through applying sustainability principles such as GP.

2.10.3 Green procurement practices in higher education institutions

Sapri and Muhammad (2010), state that most HEIs have large numbers of buildings, hence their substantial overall energy consumption which translates into high emissions of carbon dioxide that adversely impacts the environment. HEIs should therefore implement sustainable developments in order to address the adverse environmental impact caused by their building operations. Awuzie and Emuze (2016b), mention that GP is one of the key aspects that will

enable HEIs achieve sustainable development goals. It is important for HEIs across the globe to adopt GP practices as this will not only assist them achieve sustainability goals but will also grow the interest for purchasing green goods and services and subsequently boost their market.

Alshuwaikhat, Adenle and Saghir (2016), observe that many HEIs across the world are currently formulating and implementing numerous sustainability initiatives such as procuring and installing energy efficient bulbs, reducing GHG emissions, reducing waste and improving operation efficiency. However, Filho, Shiel and do Paço (2015), report that environmental initiatives such as recycling of waste, green buildings, saving on water and energy can be observed in a small number of universities across the globe. It is encouraging to observe that some HEIs are implementing GP on their campuses but there are still many more HEIs that have not started implementing GP practices and this contributes to hindrances towards reducing GHG emissions and addressing global warming.

Awuzie and Emuze (2016b), state that areas such as South America, Europe, United States and parts of Asia are reported to have been practicing GP in their HEIs. Calder and Dautremont-Smith (2009), concur, stating that green purchasing has become increasingly popular when purchasing items such as building materials in HEIs in the United States. This shows that FM in HEIs in the United States is implementing GP as they utilise green purchasing to acquire building materials.

2.10.4 Green procurement practices in facilities management in higher education institutions

Previous studies have reported on several GP practices in FM that are being implemented in a number of HEIs across the world. Lo (2015), finds that the most popular GP practices in Chinese HEIs are the procurement of light emitting diode (LED) light fittings and bulbs, photovoltaic (PV) streetlights, solar powered water heating systems, installing infra-red urinals and sink sensors to save water. While Aleixo, Azeiteiro and Leal (2018), report that GP practices in most Portuguese HEIs include waste management and recycling, installation of energy efficient equipment (solar panels, energy saving light bulbs and energy efficient heaters) and water conservation (installation of taps with timers and toilets that flushes with less water and making use of rainwater). Alshuwaikhat, Adenle and Saghir (2016), report that public universities in Saudi Arabia have adopted sustainability practices such as installation of energy

efficient lighting, efficient cooling (air conditioning), day-light techniques to save energy, adhering to energy efficiency standards when constructing new buildings, solar power and heating, water saving toilets and irrigation systems, waste recycling programs and purchasing from environmentally and socially responsible companies. The amount of effort that these HEIs are putting towards implementing GP is substantial and act as examples that HEIs across the world can follow to improve the current status of the environment.

Even though GP is not yet widely practiced across the world, literature reported GP practices in some specific HEIs in different parts of the world. Those HEIs GP practices are illustrated in Table 2.1

Table 2.1: Green procurement practices in higher education institutions

Table 2.1: Green Procurement Practices in Higher Education Institutions

	HEIs	Location of HEI	GP Practices					References
			Sustainable developments	Waste management	Energy efficiency	Water conservation	Promotion of GP practices	
1	Imperial College	United Kingdom	A sustainable design kit which includes green practises and enables performance monitoring and tracking of targets is utilised for construction projects with the value of £300,000 to £5 million (R5,565,000.00 to R92,741,000.00).	To minimise waste production, contractors are required to incorporate a site waste management plan for all construction contracts valued above £250,000.00 (R4,640,000.00).	Smart metering and voltage optimisation are installed on campus to reduce energy consumption and for monitoring purposes. There is also an energy task force in place to continuously seek more opportunities to save energy. Energy performance targets associated with energy consumption and carbon dioxide emissions for all buildings on campus have been established.		All key suppliers are required to complete a questionnaire about sustainability and corporate social responsibility. Imperial college and other higher education institutions in London have established a centre of excellence to enable knowledge sharing and to promote GP practises.	Imperial College London Sustainable Procurement Initiatives 2009/10. Sapri and Muhammad (2010)
2	University of Hertfordshire	United Kingdom	A sustainable development policy has been developed and it takes into consideration achieving of best value for money on products and services through GP.					Van Weenen (2000)
3	Bournemouth University	United Kingdom	Was a finalist in the Green Gown Awards for sustainable procurement in 2011 and Time Higher Education Awards for sustainable development in 2007 & 2011 for the sustainable developments on campus.	There is a recycling program on campus.	Energy efficiency form part of GP practices.	GP practices also include water management.		Filho, Shiel and Paco (2015)
4	The University of Westminster	United Kingdom					New and existing suppliers are required to acknowledge a charter outlining sustainability commitments.	University of Westminster sustainable procurement policy
5	Brown University	United States	Sustainable developments form part of the university's environmental principles.				Careful consideration is taken towards the institutions decisions environmental impact.	Van Weenen (2000)

Table 2.1: Green Procurement Practices in Higher Education Institutions

	HEIs	Location of HEI	GP Practices					References
			Sustainable developments	Waste management	Energy efficiency	Water conservation	Promotion of GP practices	
6	University of Michigan	United States					In the quest to become an environmental friendly institution, the university was advised by several speakers to develop a task force which include amongst others a representative from procurement and FM in order to improve the practice of GP in different departments including FM.	Van Weenen (2000)
7	Clarkson university	United States			The lighting systems has been upgraded, including installation of 60,000 new energy efficient T8 fluorescent lights and LED bulbs for outdoor lights in the whole campus.			Alshuwaikhat, Adenle and Saghir (2016)
8	University of Oregon	United States	The Lillis Business Complex building (Business School) achieved a certification from Leadership in Energy and Environmental Design	There is a recycling program which recovers 47% of all university waste.				Alshuwaikhat, Adenle and Saghir (2016)
9	Maryland University	United States			Students are encouraged to switch off lights and electronic devices when they leave their rooms and. Light fittings and bulbs, heating and cooling equipment have been replace with those that are energy efficient.			Stewart (2010)
10	Arizona State University	United States			In 2017 the development of 24.1MW on-site and 28.8MW off-site PV solar system were completed.			Van Geet, Polly, Pless and Heeter (2018)
11	University of Colorado-Boulder	United States			850KW rooftop PV solar system was installed in 2016.			Van Geet, Polly, Pless and Heeter (2018)
12	Ball State University	United States			Coal fired boilers were replaced with heat pump which resulted in significant savings on energy consumption and cost.			Van Geet, Polly, Pless and Heeter (2018)

Table 2.1: Green Procurement Practices in Higher Education Institutions

	HEIs	Location of HEI	GP Practices					References
			Sustainable developments	Waste management	Energy efficiency	Water conservation	Promotion of GP practices	
13	Butler University	United States				A combination of sprinkler shutoff valve and programmed timers is utilised to enable close control of the usage of water when watering the gardens.		Pouya and Pouya (2018)
14	University of Waterloo	Canada			Energy consumption reduction and the use of alternative energy systems is promoted.		GP system which promotes purchasing of environmental friendly products have been developed and business is conducted with service providers who are environmentally responsible	Van Weenen (2000)
15	Dalhousie University	Canada			FM practise GP in building projects through procuring environmental friendly goods and services which include replacing light fittings/bulbs, heat recovery, monitoring GHG emissions, developing a software that picks up excessive energy usage, automated energy management to enhance control of ventilation system and temperature. Energy efficient fittings are installed in new buildings. Electricity is purchased through a service provider who is gradually expanding his amount of renewable energy.		The department of FM publishes newsletters outlining the sustainability practises including GP and tips on energy conservation. Through Dalhousie University's encouragement the joint buyer group (Inter University Services) adopted green procurement policy.	Clarke (2006)
16	Fachhochschule Aalen (University of applied science)	Germany			Devices are installed to measure and monitor the usage of heating and lighting.	Water usage is measured and monitored.	Environmental friendly operations include green procurement.	Van Weenen (2000)
17	IIT Bombay, IIT Madras and Manipal Universities	India		Waste management forms part of GP practices.		Rainwater harvesting and waste water management is implemented.		Bantanur (2012)
18	University of Tampere	Finland			The importance of energy efficiency and GP practices is emphasised in the procurement guidelines. Electricity is purchased through a framework agreement and all power that is consumed in large university buildings is hydroelectric.		There is a central depository of a selection of environmentally friendly products and aims to expand the selection where possible	The University of Tampere sustainable development action plan (SDAP) 2012-2015

Based on Table 2.1, the most common GP practices in HEIs relate to energy efficiency as it is practiced in 11 out of 18 HEIs. This is followed by initiatives that promotes GP practices which appears in 8 out of 18 institutions and sustainable developments which are implemented in 5 out of 18 institutions. Waste management and water conservation are the least practiced as they appear in 4 out of 18 institutions. Sapri and Muhammad (2010), assert that rising costs of energy have contributed to institutions realising that FM affects the bottom line. Besides the reduction of GHG emissions, energy costs are also the reason behind energy efficiency being the most common GP practice amongst HEIs. This may also be the reason why water conservation is the least common GP practice in HEIs because the costs of water are much less than the costs of electricity.

It is commendable that some HEIs such as those illustrated in Table 2.1 have embraced GP within their FM, as this will reduce the adverse environmental impact and will also impart useful knowledge to present and future leaders, as well as society as a whole. One of the societies that are utilising their knowledge on GP, is the society of South Africa (SA) as they are also practicing GP in their country in order to contribute in curbing climate change. Such practices will be discussed in the following section.

2.10.5 Green procurement practices in South Africa

It is anticipated that SA should do something to mitigate GHG emissions through initiatives such as GP as it is ranked among the top 15 GHG emitters in the world (Agyepong and Nhamo, 2017). Sustainable developments can assist SA to reduce the negative impact it has on the environment because buildings are one of the biggest GHG emitters, especially during their operational phase. This means existing buildings that do not comply with sustainability principles should also be retrofitted to become compliant. According to Tramontin et al. (2014), studies conducted in SA indicate that retrofitting existing buildings can reduce energy consumption.

GP is one of the methods that can assist SA to successfully implement sustainable developments. Badin et al. (2018), mention that GP was introduced to the built environment to improve the construction industry practices to being more sustainable, safe and cost effective. Tramontin, Loggia and Trois (2012), also highlighted that a thorough design processes and comprehensive material selection methods should be applied to achieve sustainable

developments. This will involve GP as environmentally friendly materials will have to be selected and then procured.

Agyepong and Nhamo (2017), state that SA is committed to responding to challenges posed by climate change through formulation of green policies as it recognises the risks associated with the deterioration of the environment and global warming. Tramontin and Moodley (2016), support this, stating that the challenge of sustainability in the built environment was recently addressed in SA by implementing energy efficient principles for buildings as there were no regulations governing energy usage in buildings in SA before 2011.

Even though SA is a developing country, reasonable efforts to implement sustainability principles can be observed judging from the number of green buildings in the country. SA is an established member of the World Green Building Council and is implementing more green building practices, as compared with other African countries; between 2007 and 2015, 211 green buildings were developed in SA (Olanipekun, 2015). Many members of the World Green Building Council have advanced and introduced green building rating tools, and this applies to SA as well. In 2007 the Green Building Council of South Africa was established, and in 2008, the South African Green Star rating system was launched (Tramontin et al. 2014).

SA has also embarked on installation of solar power projects as part of energy conservation initiatives. Ekurhuleni municipality commissioned the first solar PV plant in SA in 2012 which generate energy that is fed directly into the municipal grid from which electricity is supplied to 133 low-cost housing, however the Public Finance Management Act and Preferential Procurement Policy Framework Act , which are the main framework for procurement in the SA government, make no provision to include environmental considerations in procurement even though some government organs are already implementing sustainability projects (Agyepong and Nhamo, 2017). The SA government should consider revising the two procurement framework documents to incorporate environmental consideration aspects so that South Africans can be encouraged to practice GP. Even though there is no formal sustainable procurement legislation yet in SA, there are organisations such as HEIs that are voluntarily doing their part to reduce the adverse impact on the environment through practicing GP.

2.10.6 Green procurement practices in higher education institutions in South Africa

HEIs across the world are involved in sustainable practices and a small but growing body of studies report this trend (Lo K, 2015). According to Fuentes-Bargues, Ferrer-Gisbert and Gonzalez-Cruz (2018), only a limited number of studies have been conducted on GP in the context of universities.

HEIs are experimental environments and are expected to practice GP even in developing countries such as SA. The Central University of Technology in the Free State Province has taken some steps to achieve sustainable developments on their campuses that include GP practices (Awuzie and Emuze, 2016b). Struwig, Smit and Van Wyk (2014), state that the University of Cape Town and the University of Pretoria are the only two universities in SA that have green buildings on their campuses. However, Nelson Mandela Metropolitan University publish on their website that they also have a green business school building that has a 4-star Green SA design rating (Nelson Mandela University, 2014).

A few universities in SA have also been reported to have sustainability related policies. The University of Cape Town has a Green Campus Plan, which presents the university's current status and future plans, including a policy statement that shows the institution's main objectives and aims (Struwig, Smit and Van Wyk, 2014). The University of Pretoria has a Facilities Management Environmental Policy which states that the university is committed to incorporating GP principles into the procurement policy, implementing practices to reduce energy consumption and conserve energy, adopting environmental management practices in order to operate existing facilities in a sustainable manner and applying green principles in the design of new infrastructure projects (University of Pretoria, 2014).

These HEIs in SA are among organisations that are already implementing GP practices in the country. The fact that these institutions have built green buildings on their campuses including having sustainability policies in place, shows that some HEIs in SA are committed to the implementation of GP practices.

SA universities are gradually embracing sustainability principles, and these will improve the knowledge transfer of these principles as universities impart knowledge and skills to communities at large. Maistry and McKay (2016), report that HEIs are under pressure to be

good examples of energy efficiency as SA society looks to them for leadership. Gonzalez-Galvez et al. (2018), concur, stating that university buildings should be able to display best practice in energy efficiency design as they also serve as community centers. Mafini and Loury-Okoumba (2018), also mention that institutions are expected to be cognisant of their environmental responsibility towards the reduction of activities that pollute the earth as this can compel other organisations into implementing sustainability principles. These reports indicate that society relies on universities to provide leadership and solutions to assist in the transformation of sustainable societies.

Environmental and social responsibilities have forced institutions to integrate non-economic criteria into their procurement practices; however, social requirements tend to be incorporated more than environmental requirements (Felix, Zivanai and Friend, 2016). HEIs should also prioritise incorporating environmental requirement into their procurement processes as this will assist in the transformation to sustainable campuses. Aila and Ototo (2018), assert that an institution can only be declared sustainable if all three aspects of sustainability (environmental, economic and social) are correctly balanced and incorporated into the institution's processes, which should include GP practices. Pouya and Pouya (2018), state that a sustainable university is one that reduces its negative effects on the environment (generated through actives and operations), fulfils its core business of teaching and learning and steward society towards sustainable lifestyles. It is evident that without the incorporation of environmental requirements into procurement processes, universities will not be able to evolve into sustainable campuses and will be unable to transform society.

The amount of GP practice that are being implemented across the world in different sectors are commendable and serve as confirmation that GP can be practiced throughout the entire supply chain. However, there are factors that prevent and/or hamper the successful implementation of GP practices. Such factors will be discussed in the following section.

2.11 Challenges to green procurement practices

Previous experiences in HEIs have presented many opportunities but several barriers have also been experienced in the implementation of sustainability programs (Velazquez, Munguia and Sanchez, 2005). Lo (2015), concurs, stating that implementing the concept of sustainability within the context of HEIs is challenging. This has resulted in the slow pace of the

implementation of sustainability principles in HEIs. Puukka (2008), indicates that HEIs ability to practice sustainability initiatives such as GP, is reduced by internal and external barriers.

GP is still generally considered a new phenomenon; hence, conventional procurement methods are still prevalent. According to Awuzie and Emuze (2016a), conventional procurement methods are still prevalent in the delivery and maintenance of infrastructure in HEIs. However, as the procuring party, HEIs should strive to overcome barriers and practice GP when procuring built assets and undertaking maintenance projects for their facilities. This is supported by Elliot and Wright (2013), who state that change comes through overcoming various challenges. As GP is still a relatively new phenomenon, the process of overcoming existing challenges will reduce the number of barriers that HEIs may encounter in the future. Overcoming barriers will not only encourage the implementation of green practices within FM but may also encourage suppliers and service providers to do the same.

According to literature consulted, the following barriers are identified as preventing or hindering the implementation of GP practices in FM in HEIs:

2.11.1 Financial constrains

The ability to implement GP is often limited due to the lack of availability of funds. Khan et al. (2018), state that one of the main barriers to GP implementation is funding constraints as sustainability is perceived to be costly. Ezani et al. (2018), mention that relatively high costs of green products and services are amongst the challenges faced when implementing GP. There is sometimes resistance in investing in green products and services especially where there are higher capital costs as the benefits of green products are often realised in the long term (Sourani and Sohail, 2011). HEIs should shift their focus from initial costs of green initiatives to the whole lifecycle costs of products and services in order to realise long term benefits. GP is a vital mechanism to achieve this as it redefines value for money, because it focuses on the whole lifecycle cost of a product and not just the capital cost which is often high (Meehan and Bryde, 2010).

Some HEIs are committed to implementing sustainability initiatives such as GP; however, a lack of funds to finance such initiatives create a hindrance (Elliot and Wright ,2013). Maistry and McKay (2016), highlight that financial constraints also emanate from the fact that HEIs

are greatly underfunded. Olanrewaju (2010), concurs, stating that in reality some governments are unable to provide adequate funding to cater for sustainable FM in HEIs. Sapri and Rahman (2014), find that facility managers claim a lack of financial resources as the main barrier to practicing GP. However, Olanrewaju, Khamidi and Idrus (2010), indicate that in Malaysia, there has been an increase of more than 420% in development funds allocation for HEIs. HEIs should strive to find other means to raise funds as governments alone are unable to adequately fund them. Fund raising events and engagements with potential sponsors could also assist in spreading GP awareness and significance in other sectors.

Sponsorships from the private sector may assist to alleviate the financial pressures that most HEIs are experiencing. Young, Nagpal and Adams (2015), report that the lack of private sector investors in HEIs add to financial pressures that institutions experience, as the private sector plays the service provider role in HEIs. Calder and Dautremont-Smith (2009), suggest that HEIs should also find ways to reinvest savings from sustainability projects into funding more sustainability initiatives.

2.11.2 Lack of expertise required to practice green procurement

GP is still in its infancy stage; therefore, stakeholders encounter challenges such as lack of knowledge and awareness of GP concepts (Rais et al. 2018). The lack of expertise required to effectively implement GP in FM in HEIs is a hindrance to practicing GP. Buniamin et al. (2016), mention that due to the lack of knowledge and understanding of GP principles, most officials and management do not prioritise the implementation of GP. Knowledge and understanding of GP principles among facilities managers and procurement personnel is vital to enable effective implementation of GP. Saferi et al. (2018), also state that personnel competencies have a direct effect on GP implementation.

Awuzie and Emuze (2016a), find that the level of understanding among FM staff in Sub-Saharan Africa HEIs is low with regards to GP; hence, they suggest that HEIs should hire sustainability advisors to form part of FM teams for infrastructure projects and their role would be to provide expertise and create interest, awareness, knowledge and understanding of GP among other things. This suggestion is supported by Awang et al. (2014), who state that sustainability officers could provide solutions to barriers that are common among FM in HEIs, such as lack of expertise and technical knowledge. Therefore, HEIs could invest in employees

with these competencies to aid in the implementation of sustainability initiatives on campuses. Aila and Ototo (2018), advise that stakeholders who are uninformed may delay the implementation of new or innovative initiatives.

2.11.3 Lack of support from the institution's management

Leadership plays an important role as drivers of transformation in an institution. Aleixo, Azeiteiro and Leal (2018), report that the difficulty of implementing sustainability principles on campus is frequently due to a lack of management support. For a successful implementation of GP to occur there should be support from the institution's top management. Peprah, Brako and Akosah (2018), indicate that the failure or success of an organisation's sustainable procurement strategy is dependent on management support, and personnel will struggle to implement GP without this support. Rais et al. (2018), concur, stating that the implementation of GP can be hindered by a lack of commitment from top management as it contributes to the lack of financial support towards green initiatives.

Sometimes management require to see good results from new innovative project before they fully commit to such innovations. Baaki, Baharum and Ali (2016), find that the benefits of energy conservation, waste reduction and increased productivity, have convinced management in some sectors to commit to adopting sustainability principles.

2.11.4 Exclusion of facility managers from decision making teams

HEIs frequently forego sustainable development opportunities as facilities managers do not form part of institutions decision-making teams and that can leave top management unaware of issues on the ground (Maistry and McKay, 2016). This is disappointing as the procurement of building projects, implementation of building projects, and management of existing buildings predominately form part of FMs' responsibilities.

One of the facilities managers' core functions is the delivery and management of facilities on their campuses, which place them in key positions to implement GP. Saferi et al. (2018), mention that facilities managers play a vital role in determining the critical success factors of implementing GP. Awang et al. (2014), also indicate that facilities managers and their teams have the privilege of viewing the whole process of built assets from planning to managing the building when completed and have great influence over the whole lifecycle of a facility.

Therefore, they are in a position to lead the transformation process from conventional procurement to GP in the delivery, management and maintenance of facilities on their campuses.

One of facilities managers' primary objectives is strategic planning which means they have influence over incorporating sustainability principles in the procurement process of facilities that they build and manage. Hence it is important that they form part of the decision-making teams in their institutions.

2.11.5 Lack of incentive for implementation of sustainability practices

Buniamin et al. (2016), mention that a lack of incentive to promote the implementation of GP contributes to the limited interest in supplying and purchasing of green products and services. Rais et al. (2018), concur, stating that inadequate incentives contribute to the lack of GP practices. However, there are some external incentive programs as mentioned by Sapri and Muhammad (2010), who indicate that the ENERGY STAR Building programme in the United States recognises buildings that performs in the top 25% energy efficiency by placing ENERGY STAR labels on such buildings and the Association of South East Asian Nations promote best practice competitions for energy efficient buildings by giving awards for buildings that show exemplary energy performance. The United States Green Building Council in Energy and Environmental Design has an initiative where organisations receive certification for addressing their facilities environmental impact and within the United Kingdom (UK) construction industry, financial incentives are offered such as higher rental rates or tax rebates for innovations directed at sustainable construction practices (Aigbavboa et al., 2018). According to Lo (2015), the Jilin Province People's Government in China rewards HEIs that have completed the highest percentage of sustainability tasks with a certificate and 10,000 RMB (R20,800). Developing countries could therefore also offer incentives for the implementation of sustainability principles so that GP practices can increase.

2.11.6 Lack of organisational sustainability policies

HEIs face numerous sustainable procurement related challenges that are gradually increasing in complexity and this requires unique and strategic solutions (Masete and Mafini, 2018). Sustainability policies are vital in fulfilling the requirements for protecting the environment

and can promote the implementation of sustainable procurement (Saferi et al., 2018). This implies that sustainability policies can assist in addressing challenges HEIs face with regards to implementing sustainable procurement.

Most institutions in developing countries only practice sustainability principles on a voluntarily basis and this has not worked well because there are no specific policies to guide and mandate the implementation of such practices (Velazquez, Munguia and Sanchez, 2005). Peprah, Brako and Akosah (2018), identify a lack of understanding on how to incorporate environmental issues into procurement as one of the barriers, and advise that organisational policies be formulated to guide personnel on how to incorporate green principles into their procurement processes. Institutions should have policies that promote knowledge, skills and capacity to develop effective GP as many officials and managers are not sure of GP procedures (Young, Nagpal and Adams, 2015). HEIs should strive to overcome these challenges through the compilation of effective GP policies as this will encourage and ease the practice of GP in their institutions.

Awuzie and Emuze (2016a), indicate that the ability to use GP for infrastructure and maintenance projects, is dependent on the contracting strategies and procurement policies of the HEIs. Though some HEIs may have GP policies in place, they are not always adhered to. Therefore, until the lack of sustainability policies or policies without implantation in HEIs stops, sustainability initiatives will not improve (Velazquez, Munguia and Sanchez, 2005). This interconnects with the importance of management support and commitments mentioned under point 2.6.3. Without management support and commitment, it may be difficult to develop sustainability policies or adhere to such policies.

2.11.7 Scarcity of green products

Green products are produced through methods that consumes minimal natural resources or uses them sustainably and this leads to savings on energy, fuel, water and other natural resources (Felix, Zivanai and Friend, 2016). There is a limited number of green products suppliers as green products cost more than conventional products, however more established green suppliers have managed to reduce the cost of green products (Young, Nagpal and Adams, 2015). The limited supply of green products hinders the implementation of GP as they may be hard to find. Peprah, Brako and Akosah (2018), mention that the lack of readily available

environmentally friendly products and the high capital cost of green products, as compared with their conventional equivalent, is a barrier to procuring environmentally friendly products.

Through GP practices, HEIs can influence the behaviour of their suppliers and service providers and subsequently create a strong market demand for green products (Agyepong and Nhamo, 2017). If environmentally friendly purchasing increases in popularity, the quantity of green products produced is bound to increase. The government could also assist in increasing the demand for green products by subsidising the capital cost of green products or by subsidising the production costs of green products.

2.11.8 Human behaviour

It is sometimes assumed that receiving new information will lead to a change in human behaviour. However, while awareness-raising may successfully disseminate information, it frequently fails to change people's behaviour (Djordjevic and Cotton, 2011). Most people are aware of global warming and the deteriorating state of the environment, but still fail to practice sustainability principles.

Unsustainable behaviours are often observed in university communities such as; leaving lights on when leaving classrooms, not switching off computers after use and throwing wrong materials in recycling bins (Velazquez, Munguia and Sanchez, 2005). This shows that there is an element of resistance or carelessness regarding the adoption of sustainability principles in HEIs communities. When new practices have to be implemented, resistance to change might be experienced among personnel and stakeholders, hence motivation and support from management is vital (Muraguri, Waweru and Musyimi, 2015). Influencing human behaviour is a continuous challenge, therefore messages about sustainability should be clear, precise and tailored to different contexts and recipients (Djordjevic and Cotton, 2011). Moglia, Cook and Tapsuwan (2018), support this, stating that awareness campaigns should be conducted on a continuous basis and should focus on behaviours that have major impacts on the environment. However, Peprah, Brako and Akosah (2018), assert that creating GP awareness is a challenge for nations and organisations in general, even in developed countries. Regardless of the current situation, persisting with awareness programs is considered vital as it may eventually lead to changes in peoples' behaviour.

People have a tendency to indifference when something does not affect them personally but according van Weenen (2000), it is time for people to become cognizant that humanity is not separate from nature and that nature reacts to human activity. This realisation will serve as a reminder that each individual has the responsibility to help preserve the environment.

The barriers listed above have contributed to the slow progress in implementing sustainability initiatives. It is important that people who are leading sustainability initiatives turn barriers into challenges that can be overcome (Velazquez, Munguia and Sanchez, 2005). Awuzie and Emuze (2016a), conclude that overcoming barriers to GP in HEIs will encourage the practice of GP in the construction and maintenance of facilities. If the abovementioned challenges are sufficiently studied, there is a high possibility that solutions can be found. Alshuwaikhat, Adenle and Saghir (2016), state that in the past few decades some HEIs have increased their commitment to address sustainability challenges in their institutions, which enables barriers to be overcome and can lead to GP being practiced more widely amongst HEIs. There are several factors that assist in overcoming the barriers and subsequently enable the implementation of GP. Such factors are discussed in the following section.

2.12 Enablers of green procurement practices

Some HEIs are practicing GP but encounter challenges that come with innovative initiatives such as GP. To overcome such challenges, there should be enablers to implement GP. Some researchers have identified factors that enable the implementation of GP practices and these factors are presented below.

2.12.1 Government Legislation

Regulatory obligations are one of the main enablers for practicing GP. Khan et al. (2018), mention that laws and regulations enable the smooth implementation of sustainability principles. Aila and Ototo (2018), support this and state that the increase in regulatory pressure has resulted in more organisations practicing GP. However, Meehan and Bryde (2010), highlighted that even though government legislation can be the main driver for institutions adopting sustainability principles, HEIs nevertheless lack information on how sustainability should be incorporated into procurement policies.

A study conducted by Ochieng, Oginda and Oteki (2016), reveals that in 2005 a task force was formed in the UK regions of Wales, Northern Ireland and Scotland, to encourage the development of sustainable procurement. Since then several public sectors such as Education and Health have provided policies and procurement frameworks that reflect their interpretation of how sustainability principles should be practiced in their different industries.

According to Sourani and Sohail (2011), the UK government published a sustainable procurement plan in 2007. One of the objectives of the plan was for the UK to be leading in sustainable procurement by 2009 in order to achieve low carbon emissions and use resources efficiently. Further, the UK Office of Government Commerce stipulates that as part of the procurement process, project briefs should highlight the significance of sustainability and that specifications include sustainability performance objectives to enable service providers/suppliers to respond to such objectives.

Buniamin et al. (2016), identify that the governments in Denmark and Sweden have incorporated GP in their environmental protection policies.

According to Young, Nagpal and Adams (2015), New Zealand and Australian governments have developed a framework for sustainable procurement that provides guidance on how to incorporate the principles of sustainability into the procurement of products, services and construction. The study however reveals that sustainable procurement policies are not clear on how to create trade-offs between green products, services and prices.

Muraguri, Waweru and Musyimi (2015), carried out a study which discovered that the Kenyan government put a variety of legislation and policies in place to manage organisations' activities with regards to their transition towards GP and protection of the environment, but found the adoption of GP to be slow, regardless of the legislation and policies. This could be due to the lack of information on how sustainability is incorporated into procurement policies as mentioned by Meehan and Bryde (2010).

Tramontin, Loggia and Trois (2012), carried out a study in the SA context and state that in 2011 the regulation for new energy efficient buildings came into effect in SA. This regulation is envisioned to achieve the goals set out by the National Energy Efficiency Strategy, issued by the Department of Mineral and Energy in 2008. The regulation stipulates the design

requirements for new energy efficient buildings; however, the regulation does not stipulate the requirements for sustainable retrofitting of existing buildings.

Environmental issues have become part of legislation in several aspects including FM and the built environment as a whole. The above-mentioned countries are good examples of their governments' effort and commitment towards addressing climate change and ultimately preserving the environment. However, having government policies in place alone, is not sufficient. Clarity should be provided in government policies on how to practice GP and how to incorporate it into existing conventional procurement processes. As much as the presence of legislation enforces organisations to adopt sustainability principles, it also serves no purpose if organisations do not know how to implement such principles.

2.12.2 Organisational policies

The main purpose of a sustainable procurement policy document is to reduce the direct and indirect adverse impact of supply chain management decisions on the environment (Agyepong and Nhamo, 2017). Zainordin and Ismail (2017), mention that sustainability principles cannot be easily implemented without proper guidelines, therefore there should be sustainability policies in place to ensure proper implementation. A policy leads to the aim, goals, objectives and procedures to be achieved (Velazquez, Munguia and Sanchez, 2005). Elmualim, Valle and Kwawu (2012), assert that amongst other things, sustainability policies should define the institutions vision, goals, areas where intervention is required, energy consumption requirements and green purchasing principles. This implies that a policy provides guidance on how to practice GP efficiently and therefore without an effective policy, GP is challenging to implement.

Like any other organisation, HEIs also need sustainability policies to assist them in meeting their sustainability goals. It is comforting to learn that Vaughter, Wright and Herbert (2015), find that 50% of HEIs in Canada have environmental or sustainability policies in place. This is commendable as it encourages the implementation of sustainability principles in such institutions. Badin et al. (2018), mention that having sustainable procurement policies in place will intensify the implementation of GP.

Young, Nagpal and Adams (2015), state that practicing GP should be a formalised process in the form of policies and that senior managers should support the process to ensure that a culture of green practice is created in their institutions. However, it should not be assumed that having policies in place automatically means efficient implementation of such policies; hence the importance of setting up policies that have clear procedures, methods of implementation and instruments for monitoring and measuring performance (Elmualim, Valle and Kwawu, 2012). This is supported by Bohari et al. (2017), who state that policies should be developed, communicated and enforced efficiently at management level as a top-down approach has been found to be effective. Therefore, management has a vital role in driving policy creation, implementation and ensuring that it is done successfully.

The Intergovernmental Panel for Climate Change has estimated that GHG emissions will increase to 100% between years 2000 and 2030, if there are no policies and solutions in place to reduce emissions (Ivascu et al. 2015). Sectors such as the built environment and FM in particular, should participate in reducing GHG emissions through developing sustainability policies and embracing sustainability principles such as GP.

2.12.3 Reporting, measuring and benchmarking

For the effective implementation of GP to occur, reporting, measuring and benchmarking has to be done. The reason behind reporting and benchmarking performance is to reduce costs, mitigate risks, encourage continuous performance, ensure targets are met and to evaluate and control processes (Hassan et al. 2015; Baaki, Baharum and Ali, 2016). Van Geet et al. (2018), emphasise that support from university management and stakeholders is required for the successful implementation of sustainability principles; including the measuring, monitoring and reporting of such practices. Institutions that implement performance measures and benchmarking are anticipated to perform better than institutions that do not. If GP practices are not measured, it will be difficult to manage, assess and improve on them (Zainordin and Ismail, 2017).

Institutions should have instruments and strategies in place to continuously evaluate the effectiveness of their green practices and identify opportunities to improve green performance (Bohari et al. 2017). Tertiary Education Facilities Management Association established a model which serves as a guide to higher education institution on how to integrate sustainability

into FM which includes measuring and evaluating performance (Telesford, 2010). Facilities managers could embrace such measuring tools as they will improve their GP practices and assist in identifying areas needing interventions so that solutions can be sought timeously.

Vaughter, Wright and Herbert (2015), assert that the level of commitment and implementation of sustainability in HEIs can be benchmarked through organisations such as Campus Sustainability Assessment Framework, Association of the Advancement of Sustainability in Higher Education's, Sustainability Tracking Assessment and Rating System and Assessment Instrument for Sustainability in Higher Education.

The main aim of sustainability is to reduce pollution levels and GHG emissions. Therefore, reporting, measuring, evaluating and benchmarking sustainability practices will assist in measuring progress towards minimizing adverse environmental impacts.

2.12.4 Support from management

As already stated in section 2.6.3, strong support and involvement of management, which includes training officials, results in better implementation of GP. Mafini and Loury-Okoumba (2018), mention that top management commitment has been identified as one of the drivers for implementing GP practices. Management are leaders and key decision makers, and this enables them to influence their teams to implement sustainability and GP principles. Khan et al. (2018), advise top management to commit to GP implementation in their institutions as this will encourage their personnel to do the same.

Maistry and McKay (2016), acknowledge that top management at most HEIs do not consider sustainability to be their core business. This attitude will need to change if sustainability principles such as GP are to be adopted and efficiently implemented as this requires people at senior levels of authority to drive the process. According to Clarke (2006), in 1990 the president of Dalhousie University became the institutions sustainability champion and by 1991 there were noticeable improvements in energy efficiency, water conservation and other areas. This demonstrates how managements' efforts in leading sustainability agendas can yield good results.

HEIs could embrace the abovementioned enablers to encourage, improve and increase GP practices in their institutions. This will also assist in overcoming some of the barriers that prevent or hinder the implementation of GP practices.

2.13 Summary of findings from literature review

Literature reviewed in this chapter is from numerous studies that were conducted through several research methods. The most common methodological approach was qualitative research, and was used in strategies such as case study, survey and grounded theory. Data was collected through different methods, including structured questionnaires, interviews, observations and reviewing of extant literature. The type of literature review applied by the researcher in this chapter was meta-synthesis method. The purpose of meta-synthesis method is to delve below the surface of what is currently understood about a phenomenon, in order to emerge with a kernel of new truth or a better understanding of something (Darvishpour, Joolaee and Cheraghi, 2014). Meta-synthesis method seeks to generate new interpretations for which there is a consensus within a particular field of study (Snyder, 2019). The findings from the literature review are discussed below.

Previous studies have indicated that there are HEIs, mostly in developed countries, that are implementing GP in their FM. Calder and Dautremont-Smith (2009), report that the practice of campus sustainability in campus operations is increasing in HEIs in the United States. Alshuwaikhat, Adenle and Saghir (2016), observe that many HEIs across the world are currently formulating and implementing numerous sustainability initiatives such as, reducing GHG emissions and improving campus operation efficiency. Aleixo, Azeiteiro and Leal (2018), mention that HEIs around the world are responding to the call for leadership by incorporating sustainability into their campus operations. However only a small body of literature has studied this trend and according to Fuentes-Bargues et al. (2018), a limited number of studies have been conducted on GP in the context of universities.

In developing countries, where GP practices are not enforced by policy or legislation, it is nevertheless anticipated that FM departments in HEIs are practicing GP voluntarily because they are innovative and experimental environments. This makes FM in HEIs a relevant area to conduct this study.

Studies conducted by Awuzie and Emuze (2016b), and Struwig, Smit and Van Wyk (2014), indicate that GP is being practiced in FM in SA institutions such as Central University of Technology, University of Cape Town and University of Pretoria. These studies reveal that there are green buildings in some institutions and some institutions have sustainability related policies. However, even though literature exists regarding GP in FM in HEIs, very little is known about their actual GP practices, the effectiveness of their GP practices, the capacity to implement GP practices, knowledge of GP, readiness to implement GP, influencing factors and plans to improve and increase GP practices. These gaps in the literature led to the following research sub-questions being raised:

- What are the actual GP practices in FM in HEIs in SA?
- How is the effectiveness of GP practices monitored and measured?
- Are the current GP practices effective?
- What is the current level of implementation of GP practices?
- What motivates institutions or personnel to practice GP?
- What are the future-plans to improve and/or increase the current GP practices in FM in HEIs in SA?

Chapter 3: Research methodology

3.1 Introduction

Research is a systematic process, which means it is planned, organised and has a particular aim (Melville and Goddard, 1996). The aim of the study is to identify the actual green procurement (GP) practices that are being implemented in facilities management (FM) in higher education institutions (HEIs) in South Africa (SA). The six objectives of the study will be investigated through applying several research methods and approaches so that the aim can be accomplished. Such methods and approaches will be discussed in detail in this chapter.

3.1.1 Research philosophy

There are several philosophies that can be adopted for research studies. Those philosophies are positivism, post-positivism, interpretivism, realism and the critical realism approach. Sahay (2017), describe these philosophies as follows; Positivism is an approach to social research where researchers observe a phenomenon at a distance and they are completely separated from the subject they are studying, whilst Post-positivism recognises that the way ordinary people think in their daily lives is not particularly different from the way scientists think or work. Interpretivism is an approach where researchers look at the social world through the eyes of people they are studying, whilst Realism is an approach that believes science is able to study social phenomenon. Then Critical Realism approach considers that reality does not depend on people's thoughts.

In order to achieve the aim of the study, the interpretivism philosophy will be adopted for this research. This philosophy requires the researcher to understand the subjective and socially constructed meanings expressed regarding the phenomenon being studied (Saunders, Lewis and Thornhill, 2016). Interpretivism involves understanding the subjective world of human experiences. According to kivunja and Kuyini (2017), interpretivism approach makes an effort to understand the subjects being studied and their interpretation of the world around them. The interpretivism philosophy is suitable for this study as a holistic picture is required in order to interpret and understand several GP practices being implemented in FM in HEIs.

3.1.2 Approach to theory development

Approaches that can be utilised for theory development are deduction, abduction and induction. In deductive approach, the researcher intends to test the existing theory by collecting fresh data from respondents, whilst abductive approach explore a phenomenon to generate new or revised theory and the inductive approach elaborates a process where theory is developed based on the researcher's observations (Rahi, 2017). For this study, the approach to theory development will be inductive. Which means a realistic and developing research design will be used to create theory or to develop a better theoretical perspective than the already existing literature (Saunders, Lewis and Thornhill, 2016). Induction approach is necessary in order to develop valid theories and advancing knowledge. Woiceshyn and Daellenbach (2018), mention that inductive research begins with unanswered questions about a particular phenomenon of interest, and the researcher focuses on how their research questions and research go beyond what is already known. Therefore, this approach is suitable for this study as literature cites that a limited number of studies have been conducted on GP in the context of universities, which means there is a need to develop more data, knowledge and better theoretical perspective in this regard.

3.1.3 Methodological choice

The three common methodological approaches to conducting research are qualitative, quantitative and mixed methods. Qualitative approach deals with research questions that require textual data, quantitative approaches deals with research questions requiring numerical data and mixed method addresses questions requiring both numerical and textual data (Williams, 2007). The methodology adopted for this study will be a qualitative research because non-numerical data will be gathered as the study will be focusing on human activities. Qualitative research also enables obtaining detailed information to answer the research question and to achieve the research objectives. Kabir (2018), assert that a lot of knowledge is uncovered through qualitative means and this method can be more practicable in addressing urgent issues or where large samples are difficult to access. The qualitative approach is deemed suitable, as this study focuses on GP practices in HEI in SA and it is an area where limited studies have been conducted, which means more knowledge is required to address urgent issues of climate change.

3.2 Research strategy

There are several methods of conducting qualitative research, however the most common methods are case studies, grounded theory, ethnography, phenomenology and survey. According to Williams (2007), case studies and grounded theory research analyse activities, processes and events whilst ethnography explores cultural-sharing behaviours of groups or individuals and phenomenology as well as case studies can be utilised to study individuals. Ghazi et al. (2018), describe survey research as a collection of information from a sample of individuals through their responses to questions. Survey research is most commonly used to answer 'what', 'who', 'where', 'how much' and 'how many' type of questions and it tends to be used for exploratory and descriptive research (Saunders, Lewis and Thornhill, 2016).

The selection of a research strategy depends on factors such as the purpose of the research, the type of research questions to be answered and the availability of resources (Ponto, 2015). The strategy selected for this study is the survey strategy. This strategy is deemed suitable for this study as it will enable the researcher to answer the main research question, which is "What are the actual GP practices that are being implemented in FM in HEIs in SA?" as stated in section 1.4 of this report.

3.3 Population selection

According to Elikplim (2019), the total number of students in the 26 public universities in SA exceeds one million and an additional ninety thousand students can be found in various private universities. The breakdown for the population in each SA public university is provided in Table 3.1

Table 3.1: Student population in SA public universities

No.	University	Location	Number of students
1	University of South Africa (UNISA)	Pretoria	400,000
2	North-West University	Potchefstroom	74,355
3	University of Pretoria	Pretoria	50,000
4	Tshwane University of Technology	Pretoria	50,000
5	University of Johannesburg	Johannesburg	48,500
6	University of KwaZulu-Natal	Durban and Pietermaritzburg	40,000
7	University of the Free State	Bloemfontein	33,000
8	Cape Peninsula University of Technology	Cape Town and Bellville	33,000
9	University of the Witwatersrand	Johannesburg	32,703
10	University of Stellenbosch	Stellenbosch	30,150
11	University of Cape Town	Cape Town	26,322
12	Nelson Mandela Metropolitan University	Port Elizabeth and George	26,000
13	Walter Sisulu University	East London and Mthatha	25,000
14	Durban University of Technology	Durban and Pietermaritzburg	25,000
15	University of Limpopo	Turfloop and Pretoria	20,000
16	Vaal University of Technology	Johannesburg	17,000
17	University of Zululand	Empangeni	16,100
18	University of the Western Cape	Tygerberg, Cape Town	15,200
19	Central University of Technology	Bloemfontein	13,534
20	University of Fort Hare	Alice and East London	12,000
21	University of Venda	Thohoyandou	12,000
22	Mangosuthu University of Technology	Umlazi, Durban	10,000
23	Rhodes University	Grahamstown	7,000
24	Sefako Makgatho Health Sciences University	Pretoria	6,558
25	University of Mpumalanga	Mbombela	1,400
26	Sol Plaatje University	Kimberly	1,350

Source: Elikplim, 2019

For this study, the population selection was guided by the scope of the research. As previously stated in section 1.8, the scope of the research was limited to GP practices related to FM functions in SA universities. As a result, the population for this research was drawn from three

HEIs, specifically public universities. All three universities are located in SA. However, they are located in various parts of the country to achieve a better spread. Respondents were drawn from the universities senior staff members from FM departments.

3.3.1 Justification of choice of sources

The three universities were selected because one of them has a vision to become one of the top universities in the world. Therefore, as part of achieving this goal, it is anticipated that this university is also implementing sustainable developments and sustainable retrofitting of the existing buildings to elevate their facilities to meet world standards. The second university has installed renewable energy sources on their campuses and this forms part of GP. The third university is expected to be practicing GP as it has a sustainability related policy in place.

3.4 Research sample

Research samples should be representative of the population being studied so that general observations regarding the population can be made (Melville and Goddard, 1996). There are two main types of research sampling methods and they are probability sampling and non-probability sampling. Probability sampling is an approach in which each unit has an equal chance of probability to be selected and non-probability sampling is an approach where the chance or probability of each unit to be selected is unknown or not yet confirmed (Rahi, 2017). Masete and Mafini (2018), mention that non-probability sampling involves selecting of sample elements based on the researcher's judgment. The sampling plan selected for this study is the non-probability sampling. This type of sampling plan involves conducting in-depth survey with a small number of people in order to answer the research question and to meet the research objectives (Saunders, Lewis and Thornhill, 2016).

According to Quinlan (2011), the following are the non-probability sampling techniques: judgemental or purposive sampling, quota sampling, snowball sampling and convenience sampling. For this study, the purposive sampling techniques was used to select the sample of respondents from each university. The purposive sampling technique is defined by the decision of the researcher regarding the distinctive criteria required of the participants to make them eligible for inclusion in the study, or exclusion (Nieuwenhuis, 2013). Taherdoost (2016), concur as he mentions that in judgemental or purposive sampling, the researcher includes

participants in the sample because they believe that they warrant inclusion. This sampling technique was adopted as the study aimed to give preference to middle and senior management personnel in FM as they possess expert knowledge and skills regarding GP practices.

For this study, the sample was taken from FM departments in different campuses within each university and included facilities managers, managers of capital projects, project managers and other staff members who are key role players with regards to GP practices in FM in their institutions. Four respondents were selected from each of the three universities, which means the study has a total number of twelve respondents. Saunders, Lewis and Thornhill (2016), indicate that twelve in-depth interviews should be sufficient in cases where the researcher aims to gain understanding of cohesion amongst a fairly homogenous group. However, a sample should comprise of participants who are knowledgeable of the research topic. The reason for limiting the sample size to key personnel from FM department was to utilise respondents with expert knowledge and experience in the field relevant to the research question in order to provide answers and suggestions. Yin (2014), states that respondents who are well informed can provide essential insights into the subject being studied.

3.5 Data collection method

There are various commonly used data collection methods for research studies. The methods are monomethod, multimethod and mixed methods. Azorin and Cameron (2010), describe these methods as follows; monomethod research involves utilising one quantitative method or one qualitative method while multi-method utilise more than one qualitative or quantitative methods and then mixed methods study involves combining both qualitative and quantitative data collection and analysis techniques in the same study. The methodological choice for this study is multi-method qualitative study using semi-structured interviews and direct observations. Kabir (2018), state that survey research may use a variety of data collection methods, with the most common being questionnaires and interviews. Saunders, Lewis and Thornhill (2016), expanded on this by mentioning that structured observations and structured interviews where all interviewees are asked standardised questions often fall under the survey strategy. Therefore, the selected data collection methods are suitable for this study as they align with the research strategy.

3.6 Structure of data collection instrument

The most commonly used instruments to gather information are; observations, interviews and questionnaires (Melville and Goddard, 1996). Observation is a purposeful, systematic and selective method of watching and listening to an interaction as it occurs, whilst interviews involve face-to-face or telephonic interaction where the researcher reads the questions to the respondents and record the respondents' answers and questionnaires consist of lists of questions with a choice of responses (Kumar, 2011). For this study, data was collected through semi-structured interviews as the main method, supported by direct observations.

According to Yin (2014), a semi-structured interview is similar to a guided conversation that follows a consistent line of enquiry so that the stream of questions can flow. The advantage of semi-structured interviews is that they allow respondents the freedom to express their views in their own terms (Kabir, 2018). Semi-structured interviews also enable the researcher to understand the meanings that daily activities hold for people (Marshall and Rossman, 2011). Another advantage of semi-structured interviews is that answers can be clarified, and interesting answers can be followed up. This enables the researcher to have a good understanding of what the respondents are trying to convey. Saunders, Lewis and Thornhill (2016), mention that interviews are essential in gaining relevant and reliable data. Therefore, semi-structured interviews are a suitable data collection instrument for this study as they will enable the researcher to collect relevant and reliable data, and to understand what the respondents are conveying.

The interview questions were open ended to allow the respondents to express their experiences in their own terms. The interviews lasted for approximately an hour and they were scheduled at the time that was convenient for the respondents. They were audio recorded and transcribed with the permission of the respondents. The interviews were conducted in the boardrooms or offices of the respondents. Due to the sensitivity of the information pertaining to the study, it was necessary to maintain a sense of sensitivity to respondents' discomfort relating to answering sensitive questions. For this reason, a debriefing was offered to respondents if needed, immediately after the interviews.

The interviews were support by direct observations that were conducted on site after the interviews. Observations can either be the main method in a study or one of several

complementary qualitative methods (Ciesielska, Boström and Ohlander, 2018). In this study observations were a complementary qualitative method. The advantage of observations is that they give the researcher an opportunity to provide rich detailed description of the subject being studied and improve interpretation (Kawulichi, 2012).

According to Smit and Onwuegbuzie (2018), observation is one of the oldest and most fundamental research methods that involves collecting data using one's senses, especially looking and listening in a systematic and meaningful way. The observations carried out on this study involved looking at the GP installations that have been or were being implemented on campuses in the participating universities. This is classified as direct observation. Ciesielska, Boström and Ohlander (2018), assert that direct observation is when the observer is looking at the events happening before his/her eyes in the moment of them occurring. Writing field notes is one primary method which is often used to gather data from observations (Kabir, 2018). In this study, field notes were taken during the observation process so that the data can be summarized and analysed.

3.7 Reliability and validity

3.7.1 Reliability

Reliability of research refers to replication and consistency (Saunders, Lewis and Thornhill, 2016). Masete and Mafini (2018), mention that data triangulation approach can be utilised to ensure that the findings of the study are reliable. The reliability of data collected in this study will be subjected to a triangulation method. A researcher triangulates by collecting and comparing information from several sources or through several methods as this assist in confirming that the data interpretations are reliable, and the views of the participants were authentic (Marshall and Rossman, 2011). Nobel and Smith (2015) also mention that data triangulation is a strategy that can be adopted to ensure credibility of the findings in qualitative research, as it involves using different methods and perspectives to assist in producing a more comprehensive set of findings. Ashour (2018), concur as he states that the combination of findings from two or more rigorous approaches provide a more comprehensive picture of the results than either approach could do alone.

Yin (2014), mentions that interviews should be considered to be solely verbal reports at all times because respondents' responses are subject to common issues such as bias, poor recollection and poor narration. To address these issues, the respondents were provided with relevant information before the interviews were conducted, and this included the nature of the study, the purpose of the study and interview questions. Therefore, the respondents were prepared enough for the interviews to also refer the researcher to conduct observations in some of the buildings and/or areas in their campuses where GP related installations where being carried out or already completed or being prepared for upcoming installations. The observations where used for triangulation.

3.7.2 Validity

Validity refers to appropriateness of the measure utilised and accuracy of the analysis of the results (Saunders, Lewis and Thornhill, 2016). Leedy and Ormrod (2016), mention that validity of the research is the extent to which the data collection instrument used measures what it is supposed to. Nobel and Smith (2015), also indicate that validity is the precision in which the findings accurately reflect the data. According to Denscombe (2010), validity of a research can be addressed by the use of respondent validation, grounded data and triangulation. This was supported by Lemon and Hayes (2020), as they mention that triangulation is a qualitative research strategy used to test validity through the convergence of information from different sources. For this study, the triangulation method was applied. The data obtained from semi-structured interviews was validated through direct observations.

3.8 Data analysis

According to Quinlan (2011), data analysis is a process that involve interacting with collected data by grouping concepts, in order to identify key themes in the data and subsequently come to a conclusion guided by the interpretation of the data.

For this study, Micro Soft (MS) excel was used in the coding process of data and MS word was used to organise coded data. The process contained the following nine steps as describe by Ose (2016).

1. Transcribing of collected data from interviews and observations: Data was collected through semi-structured interviews and direct observations. The collected data was in the form of digital audio files and handwritten field notes. Raw data was later simplified and transcribed into textual data on MS word. Each interview was transcribed individually on separate MS word documents and allocated a number. Field notes from each university were also transcribed individually.

2. Transferring the text from MS word to MS excel: All the text from interview numbers one to twelve were copied from MS word documents and pasted onto MS excel workbooks.

3. Preparing the MS excel document for coding: For better visual overview of the text, the questions and answers had different formats. The questions were in bold and the answers were not.

4. Coding in MS excel: The question and its answer were given the same code. Codes were inserted on a separate column for each interview sheet.

5. Preparing the coded interview for sorting: In order to keep track on who said what, including the sequence of the interview, respondents were allocated a university number, respondent number and line item number, for each question and answer.

6. Sorting the data: Data was then sorted according to information provided in step 5, in order to create quotes that have references.

7. Transferring quotes and references from MS excel to MS word: A new MS word document was created and the quotes containing parentheses with interview information were copied onto the MS word document.

8. Organising the text into a logical structure based on the coding: The objectives of the study were typed at the beginning of the MS word document and then key themes were developed based on the contents in the quotes. Key themes were then typed below the relevant objectives. Quotes were then grouped into categories according to the related objectives and themes in their contents. For example, quotes regarding the actual GP practices were grouped under the relevant key themes under objective 1. The key themes for objective 1 were energy efficiency, water conservation, innovative designs, innovative Heating Ventilation and Air

Conditioning, sustainable landscaping and recycling. This process was also applied on data from observations. Once the researcher was satisfied with the structure of the data, it was analysed.

9. Analysing the data: The method of analysis was content analysis. Content analysis involved codifying qualitative data into pre-defined categories in order to derive patterns in the reporting of information (Guthrie, 2006). Elo and Kyngäs (2008), describe content analysis as a process of making replicable and valid inferences from data to their context, with the aim of providing knowledge, new insight, representation of facts and a practical guide to action. The objective of content analysis is to systematically transform a large amount of text into a highly organised and concise summery of key results (Erlingsson and Brysiewicz, 2017).

According to Hussey and Hussey (1997), content analysis technique provides clear procedures and is highly accepted with regards to reliability and validity issues. Bengtsson (2016), concur as she states that content analysis method can improve validity and reliability. Therefore, this technique is suitable for this study.

During the analysis process, quotes under each key theme were examined in order to identify similarities, guided by the codes on each quote. According to Wiersma and Jurs (2009), a coding process involving organisation of data is an essential step in content analysis as it enables the researcher to be more familiar with the data. The findings under each objective and key theme were drawn after the analysis process and they are presented in detail in Chapter 4.

3.9 Ethical considerations

The researcher should be concern about ethical issues in general. Ethical research practices include respecting people who participate in the study including, protecting their identity, respecting their privacy and their rights to participate or not to participate in the study (Marshall and Rossman, 2011). This was echoed by Melville and Goddard (1996), who state that collecting data from people gives rise to ethical concerns, therefore one should avoid harm to respondents, have respect for their privacy and have respect for people in general.

The aim of the study is to identify GP practices in FM in HEIs. The data was collected through interviewing facilities managers, capital project managers and other FM personnel who play

key roles with regards to GP practices in their institutions. The respondents were selected from three different universities in various provinces in SA.

The information obtained from respondents could unintentionally cause institutional or respondents' reputational damage and that is not the intention of the study. In order to fulfil ethical considerations and protect the identity of the respondents and universities, the following guidelines were followed:

- None of the information was given to anybody or organisation;
- The information was kept confidential and in a safe manner;
- The information was only used for the purpose of this research study;
- The information will be kept safe even after the study is completed;
- The identity of the respondents and universities were protected;
- All respondents were informed about the purpose of the study and that interviews would be transcribed;
- Respondents were requested to review the transcripts of the interviews they participated in, to ensure that the researcher captured their information correctly. Sending the interview transcripts to the research respondents for evaluation reduces the bias of the researcher when analysing the data (Masete and Mafini, 2018). Marshall and Rossman (2011), highlighted that the respondents' views on the phenomenon being studied should be reported as the respondents view it and not as the researcher views it; and
- The researcher abided by the school's ethics committee rules at all times.

The researcher was granted ethics clearance by the school's ethics committee before conducting any interviews. All interviews were conducted within the ethics clearance certificate validity period. All ethical protocol and considerations were followed throughout the process of compiling this report and during the data collection process.

3.10 Research limitations

Limitations are common in research studies. The limitations encountered in this study were:

- The approach of this study is qualitative in nature. Therefore, the findings of the study cannot necessarily be generalised to all universities in SA. Leung (2015), mention that

qualitative research studies are mostly intended to study a particular phenomenon in a specific context, therefore generalizability is not often expected in qualitative research findings;

- Two out of three facilities managers from university 2 could not be interviewed as they had busy schedules and could not avail themselves for the interviews. As a result, their lack of input is unknown; and
- The data collection period was limited to a period of twelve months, starting from December 2017 to December 2018 as per the Ethics Clarence Certificate (Annexure C). Therefore, the findings may differ in future studies.

3.11 Summary

This chapter presented the rationale behind the selected research methodology and design for this study. The chapter also provided clarity on how validity and reliability of the findings were tested. The data analysis process was also discussed including the ethical considerations that were applied during the study and the limitations that were encountered.

Chapter 4: Data presentation and analysis

4.1 Introduction

Chapter 3 detailed the research methodology that was applied in this study so that the research question can be answered. This chapter presents the analysis and description of the research findings from the empirical study on green procurement (GP) practices in facilities management (FM) in higher education institutions (HEIs).

The empirical study included the collection of primary data through semi-structured interviews and direct observations. The interviews were conducted during the period of March 2018 to September 2018 and each interview was approximately an hour long. All respondents were informed about their rights and role in the interview through the interview protocol form (Annexure B) before the interviews were conducted. The ethics clearance certificate (Annexure C) was presented to the respondents so that they can be assured that the study is in line with the university's ethical conduct. Respondents were also requested to sign consent forms (Annexure A) to confirm that they participated in the study voluntarily.

Four interviews were conducted face-to-face and eight interviews were conducted telephonically. Four respondents were interviewed from each of the three selected universities, totalling 12 respondents. Observations were conducted in all three universities.

The collected data from both interviews and direct observations was later analysed so that conclusions or findings can be achieved. The purpose of data analysis is to narrow the unorganised and large data in order to understand and interpret the collected data. The data analysis process involves reflecting and engaging with the collected raw data through grouping of concepts and themes to identify key themes in the data and eventually to draw a conclusion based on the interpretation of the data (Quinlan, 2011).

4.2 Demographic information of the respondents

The demographic information of the respondents was extracted from the introductory part of the interview protocol form and interview questions 1 and 2. Demographical information was collected in order to assess how it influences GP practices in FM in HEIs. To ensure adherence

to ethical considerations of the study and to maintain anonymity, each university and each respondent were given a number instead of using their names.

Table 4.1 provides the demographic information of the respondents. The table includes the university number, respondent number, the position of the respondent and the number of years of experience in their positions.

Table 4.1: Demographic information of the respondents

University no:	Respondent no:	Position	Number of years of experience
1	1	Facility Manager	-
1	2	Facility Manager	5
1	3	Facility Manager	8
2	4	Facility Manager	2
3	5	Facility Manager	15
3	6	Facility Manager	14
3	7	Facility Manager	3
1	8	Head of Campus Planning and Development	9
2	9	Assistant Director - Project Management: Facilities Planning and Management	5
2	10	Project Manager: Small Projects	3
3	11	Project Manager	2
2	12	Electrical Engineer: University Estates - Facilities Planning and management	10

As presented in Table 4.1, respondents occupied middle and senior management positions such as facilities manager, project manager, head of campus planning and development, assistant director: project management and electrical engineer, with facilities managers being the majority, covering 58% (7 out of 12) of the total number of respondents. The focus of the study was to engage respondents who are key role players and/or decision markers with regards to GP practices in FM in their institutions hence only respondents in senior positions were interviewed.

Table 4.1 also shows the number of years of experience of the respondents. This refers to the number of years they have been working in their current positions. This will assist in gauging their level of GP exposure in their institutions. One respondent did not disclose the number of years of experience, but generally, the respondents have sufficient experience to enable them to contribute to the study as most of them hold experience of 5 years and above.

4.2.1 The roles of respondents with regards to green procurement practices

The roles of respondents refer to their work responsibility in relation to GP practices in their institutions. This question was asked in order to establish if the respondents play vital roles with regards to implementing GP practices because the focus of the study was to engage key role players. Table 4.2 outlines several responsibilities of the respondents in relation to GP practices.

Table 4.2: Responsibilities of respondents with regards to green procurement practices

	Responsibilities	No. of participants	%
1	Compiling scope of works and specifications	9 out of 12	75%
2	Maintaining green features on existing buildings	5 out of 12	42%
3	Managing procurement processes	2 out of 12	17%
4	Energy management	2 out of 12	17%
5	Implementing green initiatives projects	3 out of 12	25%
6	Conducting research	2 out of 12	17%
7	Assisting in planning for future green buildings	1 out of 12	8%
8	Providing advice	2 out of 12	17%
9	Compiling reports on energy savings	1 out of 12	8%

The most common responsibility amongst the respondents is compiling scope of works and specification as 9 out of 12 (75%) of the respondents indicated that this forms part of their responsibilities. Followed by maintaining green features on existing buildings at 45%, then implementing green initiatives projects at 25%. Managing procurement processes, energy management, conducting research and providing advice are at 17% each. Lastly at 8% is

assisting in planning for future green buildings and compiling reports. All nine responsibilities listed in Table 4.2 are relevant to the study and this means the respondents can provide relevant information to assist in meeting the objectives of the study.

4.3 Analysis of green procurement practices in facilities management in higher education institutions: Interview data

This section presents the findings of the interview questions 3 to 7 that the respondents were requested to answer. The interview questions were derived from literature that was studied and are representative of the research objectives. Table 4.3 shows the research objectives and the related interview questions.

Table 4.3: Research objectives and related interview questions

Research objectives	Interview questions
1. To identify GP practices in FM in HEIs.	3. What are the actual green procurement practices in facilities management at your institution?
	Probe: how often are these practices implemented?
2. To learn how the effectiveness of GP practices is monitored and measured.	4. How do you monitor and measure the effectiveness and the level of implementation of green procurement practices in facilities management at your institution?
3. To determine if the current GP practices are effective.	Probe: how effective is green procurement so far in your institution?
4. To evaluate the current level of implementation of GP practices.	Probe: What is the current level of implementation?
5. To identify the motivations of institutions or personnel to practice GP.	5. What motivates you/your institution to use innovative methods such as green procurement?

Research objectives	Interview questions
6. To determine future-plans to improve or increase GP practices in FM in HEIs.	6. What are your institution's future-plans on improving and increasing the practice of green procurement in facilities management?
	Probe: what are the timeframes for such plans?
	7. What is this institution's strategy to materialise the future-plans mentioned in question 6 above?

The interview data was transcribed into text format. Then Micro Soft (MS) Excel was used in the coding process of data and MS Word was used to organise coded data. In order to keep track of who said what, the respondents were defined by their institution's number and their respondent's number. To retain the sequence of the interview, a sequence of numbers was allocated to each line item of the interview questions and answers. For example, *"**It is effective. (University 1_Respondent 1_30)**"*. This means that this quote is from respondent number 1, who is from university 1 and this quote was line item number 30 in the interview transcript.

The method of analysis was content analysis. Content analysis involves codifying qualitative data into pre-defined categories in order to derive patterns in the reporting of information (Guthrie, 2006). The analysis of the study focused on identifying patterns in the responses provided by the respondents. The findings from the analysis are presented below under each objective.

4.3.1 Objective 1. To identify green procurement practices in facilities management at higher education institutions

This sub-section presents the analysis of the answers to the two questions related to GP practices in FM in HEI. The first interview question sought to identify the actual GP practices in FM, while the second question aimed to determine how often GP practices are implemented.

4.3.1.1 Green procurement practices in facilities management

In order to identify GP practices in South African HEIs, respondents were requested to list the actual GP practices that are currently being implemented in their respective institutions. From the respondents' answers, themes such as energy efficiency, water conservation, innovative building designs, energy efficiency on heating, ventilation and air conditioning (HVAC), sustainable landscaping, building management systems (BMS) and recycling emerged. The analysis under each of these themes is presented below.

4.3.1.1.1 Energy efficiency

Burning of fossil fuels to generate electricity significantly contributes to the adverse impact on the environment. Therefore, energy efficiency is vital for the protection of the environment. A number of GP practices in relation to energy efficiency were listed by the respondents. Those practices are presented below.

Energy saving light fittings and bulbs

As presented on Table 4.4, 10 out of 12 of the respondents indicated that light emitting diode (LED) energy saving light fittings and bulbs were procured and installed to replace conventional lighting or bulbs in existing buildings on their campuses. While 2 of the respondents indicated that for all new buildings on their campuses, LED light fittings and bulbs are installed during the construction phase.

Table 4.4: Installation of energy saving LED lighting

LED Lighting	No. of respondents	%
Replacing conventional light fittings with energy saving LED light fittings and bulbs	10 out of 12	83%
Installation of energy saving LED light fittings and bulbs on new buildings	2 out of 12	17%

One respondent expanded by mentioning that LED lights are fitted in several areas that are suitable for such lighting on their campuses.

…replacing conventional light fittings with energy saving LED light fittings and bulbs in areas such as offices, lecture halls, laboratories and recreation areas but a lux level test has to be carried out prior installation to ensure that the area is suitable for LED lighting. (University 1_Respondent 1_10)

Solar Power Systems

Seven of the respondents stated that roof mounted solar power systems have been procured and installed for harvesting sunlight to generate electricity and heating water. Two respondents mentioned that Solar Photovoltaic (PV) lighting system is utilised for streetlights on their campuses. Another 2, confirmed that there are solar farms being erected on their campuses. Lastly, 1 of the respondents indicated that an Olympic size swimming pool on their campus only uses solar energy and a solar tree has been installed on campus. This analysis is presented in Table 4.5

Table 4.5: Installation of solar power systems

Solar power systems	No. of respondents	%
Solar power system has been installed in some buildings for harvesting sunlight to generate electricity and heating water.	7 out of 12	58%
Solar PV lighting system is utilised for streetlights on campus.	2 out of 12	17%
Solar farms are being erected on university campuses.	2 out of 12	17%
Olympic size swimming pool on campus only uses solar energy.	1 out of 12	8%
A solar tree has been installed on one of the campuses.	1 out of 12	8%

One respondent also indicated that the solar systems in their institutions are connected to the main power grid.

The solar system relies on Eskom power to run. It does not have batteries installed yet. When there is no Eskom electricity, the solar system relies on the backup generator. Basically, the solar system relies on Eskom power or the backup generator to run or to collect solar power. For example, if the solar power collected is 15Kwatt and the Eskom power required to run a building is 10Kwatt, the invertor will block Eskom power and use solar power. The same applies when the generator is on. (University 2_Respondent 10_14)

The extent of the solar farms was also elaborated on by the respondents.

A decision was taken to not continue with roof mounted solar systems due to the risks associated with working on heights. Ground mounted solar systems (Solar Farms) will be installed going forward. The following solar farms have been planned to be completed towards the end of 2018: one 955kilowatt and two 600kilowatt solar farms in three different campuses. (University 2_Respondent 12_22)

There are three solar farms currently under construction and planned to be completed in December 2018. The biggest solar farm is 1000 Kilowatt and the other two solar farms are 500 kilowatt each. (University 2_Respondent 9_12)

It is evident that solar farms are of a large scale and will produce large amounts of renewable energy that will result in energy efficiency and subsequent costs savings.

Motion sensors for lights

4 out of 12 respondents representing 33% mentioned that motion sensors have been installed on lights in several areas on their campuses so that lights only switch on when rooms are occupied in order to save energy. According to the respondent quoted below, motion sensors also dim the lights during the day and switches them off when the rooms are unoccupied.

…motion sensors also dim the lights during the day and switches them off when no one is in the room. (University 3_Respondent 6_16)

4.3.1.1.2 Water conservation

From the answers provided by the respondents it emerged that there are several initiatives in their institutions that are aimed at conserving water. Below are some of the initiatives that were mentioned by the respondents.

Greywater system is installed in residences and is used for irrigation and flushing toilets. (University 2_Respondent 12_24)

Boreholes have been installed and the water is utilised for everything after being chlorinated. (University 2_Respondent 4_18)

Boreholes have been installed and the water is utilised for irrigation purposes to save water. (University 3_Respondent 7_12)

One of the new buildings has rainwater harvesting system. (University 3_Respondent 6_14)

Taps on some wash hand basins have been closed off and sanitizers have been installed to save water. (University 3_Respondent 7_18)

It is commendable to find that universities in SA are implementing several methods to conserve water. Due to global warming, water has become a scarce natural resource that has no substitution hence the importance of conserving it. The comprehensive list of water conservation activities that were listed by the respondents is presented in Table 4.6.

Table 4.6: Green procurement practices involving water conservation

	Water conservation methods	No. of respondents	%
1	Greywater systems are installed and used for irrigation and flushing toilets.	4 out of 12	33%
2	Metering taps/ demand taps are installed on wash hand basins.	4 out of 12	33%
3	Boreholes have been installed and the borehole water is utilised for irrigation purposes and for everything else after being chlorinated.	3 out of 12	25%
4	Harvesting rainwater to use for irrigation purposes.	2 out of 12	17%
5	Taps on some wash hand basins have been closed off and sanitizers have been installed.	1 out of 12	8%
6	Urinals have sensors in the flush mechanism that senses when to automatically flush and how much water to use for each flush.	1 out of 12	8%
7	Devices are installed on showerheads to reduce the water pressure.	1 out of 12	8%
8	Toilets flush masters were replaced with "Geberit" system which uses less water.	1 out of 12	8%
9	Water pressure for flushing toilets have been reduced.	1 out of 12	8%
10	Leak detection meters are installed on campus to detect water leaks so that water wastage can be reduced.	1 out of 12	8%

Thirty three percent of the respondents indicated that greywater systems and metering taps are installed in their institutions. Followed by 25% who mentioned that there are boreholes on their campuses. Then 17% of the respondents stated that they have rainwater harvesting systems on their campuses. Lastly 8% indicated that some wash hand basin taps have been closed off, water pressure on urinals, showers and toilets have been reduced and leak detection meters are installed.

4.3.1.1.3 Innovative designs

Some respondents indicated that when it comes to designs for new buildings, their institutions are utilising innovative designs that take advantage of the climate in order to maintain comfortable temperatures in the buildings. Below are some of the quotes from respondents.

We are incorporating passive design on new buildings. This is the kind of design that takes advantage of the climate to maintain a conducive temperature range in the building. (University 1_Respondent 8_14)

New buildings are designed in such a way that the windows maximise natural lighting in the rooms and the buildings require minimal HVAC. (University 1_Respondent 3_8)

Low-E glass is used for new glazing installations. This type if glass keeps the heat inside buildings during winter and cools the rooms in summer. (University 1_Respondent 3_20)

There is a building on campus which is rated level 6 Green Star Rating, it is a green building. (University 3_Respondent 5_20)

Table 4.7 presents a list of all innovative designs that were mentioned by the respondents.

Table 4.7: Innovative building designs

Innovative designs	No. of respondents	%
Incorporating passive design on new buildings.	4 out of 12	33%
Low-E glass is used for new glazing installations to keep the heat inside buildings during winter and to cool the rooms in summer.	1 out of 12	8%
Plascon "Green Paint System" is utilised on campus buildings.	1 out of 12	8%
There is a building on campus which is rated level 6 Green Star Rating (Green Building).	1 out of 12	8%

The table above reflects that 33% of the respondents mentioned that passive design is incorporated on new buildings in their institutions. Eight percent indicated that Low-E glass is used for new glazing installations, another 8% stated that Plascon "Green Paint System" is utilised on campus buildings and lastly another 8% mentioned that there is a green building on their campus.

4.3.1.1.4 Innovative heating, ventilation and air conditioning systems

HVAC systems are installed in buildings to provide thermal comfort. However, these systems consume a substantial amount of energy which result in high energy costs. The respondents have indicated that their institutions have undertaken to provide thermal comfort in their buildings and heating water by utilising innovative HVAC systems that are energy efficient. Below are some of the initiatives that were mentioned by the respondents.

We have replaced geysers and boilers with heat pumps for heating and supplying hot water in the residences. (University 2_Respondent 4_20)

Gas solar system is installed in some buildings. This system harvest heat from the gas generator to heat water. (University 1_Respondent 3_10)

We are installing air cool HVAC instead of water cool. The manufacturer for this system told us that the advantages of air cool systems include low installation and maintenance costs, as they do not require cooling towers, condensers, water pumps and related condenser water chemical treatments. However, the operating costs for air cool systems are higher than those of water cool systems because water cool systems can take advantage of lower condensing temperatures. (University 3_Respondent 6_12)

One of the new buildings on campus has thermally activated concrete slabs. (University 1_Respondent 8_16)

Table 4.8 presents all HVAC systems that were listed by the respondents.

Table 4.8: Innovative HVAC systems

HVAC Systems	No. of respondents	%
Geysers and boilers are replaced with heat pumps for heating and supplying hot water in the residences.	4 out of 12	33%
Gas solar system is installed in some buildings (the system harvest heat from the gas generator to heat water)	2 out of 12	17%
Air cool HVAC is installed, instead of water cool.	1 out of 12	8%
Air conditioning units that are being installed currently are energy and water efficient.	1 out of 12	8%
One of the new buildings has thermally activated concrete slabs	1 out of 12	8%

The table above indicates that 33% of the respondents stated that their institutions have replaced geysers and boilers with heat pumps and 17% mentioned that gas solar system is installed in some buildings. Then 8% stated that air cool HVAC is utilised, another 8% indicated that water and energy efficient air conditioners are installed on their campus buildings and lastly another 8% mentioned that there are thermally activated slabs in one of their campus buildings.

4.3.1.1.5 Sustainable landscaping

Landscaping boost the universities physical image as they make them look more attractive and creates a beautiful environment. However, landscaping requires irrigation, and this involves high water consumption. As per quotes below, to enable water efficiency, 8% of the respondents mentioned that their institution has resorted to planting more indigenous plants as they require less watering. Another 8% also indicated that the new landscaping designs have less lawns.

...adding more indigenous plants that requires less watering. (University 2_Respondent 9_22)

...reducing the size of lawns in our new landscape designs. (University 2_Respondent 10_20)

This is elaborated in Table 4.9

Table 4.9: Sustainable landscaping

Sustainable landscaping	No. of respondents	%
Planting more indigenous plants that requires less watering	1 out of 12	8%
Reducing lawns by adding more paving	1 out of 12	8%

4.3.1.1.6 Building management system

One of the respondents described BMS as follows:

Building Management System or "Johnson Control System" is a centralised system that monitors and controls processes in the plant room. This system has been installed in plant rooms in both new and some existing buildings to control and monitor air conditioners as they are a large consumer of electricity. (University 2_Respondent 12_16)

One of the respondents also elaborated on the use of BMS as follows:

For electricity usage, digital meters have been installed in all mini and main substations. The metres are part of the Building Management System. Digital meters send data for energy usage to a computer and/or cell phone. The meters can provide data for energy usage for different kinds of periods and for different buildings. (University 2_Respondent 4_24)

The BMS system basically manages and monitors energy consumption in buildings. Five out of 12 (42%) of the respondents mention that BMS has been installed on their campus buildings.

4.3.1.1.7 Recycling

One of the respondents representing 8%, mentioned the following regarding recycling:

The university has placed bins in various places on campus to collect recyclable items such as cans, plastic and papers. (University 2_Respondent 9_18)

Recycling is important because waste has a major adverse impact on the environment as toxic chemicals and greenhouse gasses (GHG) are released from waste. Therefore, it is commendable to find an HEI that has embraced recycling of waste.

4.3.1.2 Frequency of green procurement practices

Even though the objective is to identify GP practices in FM in HEIs, the researcher also wanted to know how often GP practices are implemented. From the answers that the respondents provided, it was discovered that 83% of the respondents stated that GP practices are implemented on a continuous basis. Followed by 17% who indicated that GP practices are implemented on all new building projects where possible and 8% mentioned that some GP practices are implemented as and when required. This is presented on Table 4.10.

Table 4.10: Frequency of green procurement practices

Frequency of GP practices	No. of respondents	%
On a continuous basis where possible.	10 out of 12	83%
On all new building projects where possible.	2 out of 12	17%
As and when required for some.	1 out of 12	8%

The respondents also highlighted that there are factors that influence the frequency of GP practices; 17% stated that their campuses have many heritage buildings, which makes it difficult to install green features into these buildings, as the heritage has to be preserved. Another 17% also mentioned that the frequency of GP practices also depends on availability of funds. Below are the quotes from the respondents in this regard.

The campus has many heritage buildings which makes it difficult to install green features into those buildings as the heritage has to be conserved. (University 1_Respondent 2_20)

Some green procurement activities depend on availability of funding. (University 1_Respondent 1_24)

The analysis of the answers to the two questions related to objective 1 revealed that the current GP practices include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling across all three universities and these GP practices are mostly implemented on a continuous basis even though there are hindrances such as preserving heritage buildings and lack of funding.

4.3.2 Objective 2: To learn how the effectiveness of green procurement practices is monitored and measured.

This sub-section presents the analysis of the answers to the question related to monitoring and measuring the effectiveness of GP practices in FM in HEIs. This interview question sought to understand how the effectiveness of the current GP practices is monitored and measured. Participants were requested to list the methods or systems that are utilised in their institutions for monitoring and measuring the effectiveness of GP practices. From the respondents' answers, it was discovered that several methods are utilised such as those quoted below:

BMS is used to measure, monitor and manage energy consumption. (University 2_Respondent 12_30)

Water and electricity bills are used to evaluate consumption. (University 1_Respondent 2_24)

There is an external company that monitors energy and water consumption and then provide reports and recommendations to reduce levels of consumption. The company also conduct research on other green products or innovations that are on the market. (University 3_Respondent 5_26)

Solar system comes with a monitoring system which measures production of solar power and the usage thereof. (University 2_Respondent 12_34)

Full building audits from roof to bottom are conducted every 3 years. (University 3_Respondent 5_28)

For LED lights, savings are calculated on 20watt LED tubes that replaced 36watt florescent tubes. Basically, the hours that the light will operate are multiplied by the electricity tariff. (University 2_Respondent 12_32)

The methods and systems are elaborated comprehensively in Table 4.11

Table 4.11: Monitoring and measuring methods

Monitoring and measuring methods	No. of respondents	%
BMS is used to measure, monitor and manage energy consumption.	8 out of 12	67%
External companies are appointed by the university to monitor energy and water consumption and then provide reports and recommendations on how to reduce levels of consumption.	6 out of 12	50%
Water and electricity bills are used to evaluate consumption.	5 out of 12	42%
The solar system comes with a monitoring system which measures production of solar power and the usage thereof. The university relies on this system for measuring and monitoring	1 out of 12	8%
Relying on research conducted prior to the implementation of projects.	1 out of 12	8%
For LED lights, savings are calculated on 20watt LED tubes that replaced 36watt florescent tubes. Basically, the hours that the light will operate are multiplied by the electricity tariff.	1 out of 12	8%
Full building audits (from roof to bottom) are conducted every 3 years.	1 out of 12	8%

As indicated on table 4.11, 67% of the respondents indicated that BMS is used to measure, monitor and manage energy consumption. Followed by 50% stating that external companies are appointed by their universities to monitor energy and water consumption. Then 42% mentioned that water and electricity bills are used to evaluate consumption. 8% listed methods such as utilising monitoring system that come with the solar system, conducting research, preforming calculations on LED lights lifespan and conducting full building audits.

The analysis above presented BMS, utilising external consultants and evaluation of water and electricity bills as the most commonly used methods to measure and monitor the effectiveness of GP practices. However, the respondents also mentioned that they utilise other methods such as conducting research, relying of the solar monitoring system, calculating saving on LED

lighting and conducting full building audits. It is evident that there is a reasonable amount of effort from the three universities to ensure that the effectiveness of their GP practices is monitored and measured.

4.3.3 Objective 3: To determine if the current green procurement practices are effective.

Measuring, monitoring and evaluating the effectiveness of GP practices is important in order to determine whether green initiatives are performing the way they should be or not. This sub-section presents the analysis of the answers to the questions on how effective the current GP practices are. The interview question sought to understand the outcomes of the monitoring, measuring and evaluation processes of the effectiveness of GP practices. In simple terms, the researcher seeks to understand if the current GP practices were found to be effective or not. The outcome from the respondents is presented on Table 4.12.

Table 4.12: The effectiveness of the current green procurement practices

Effectiveness of GP practices	No. of respondents	%
They are effective	10	84%
Not yet effective	1	8%
Not sure if they are effective	1	8%
Total	12	100%

From the respondents' answers, it emerged that the current GP practices are effective as confirmed by 10 of the respondents. 1 respondent indicated that the current GP practices are not yet effective and another 1 stated that they are not sure is the current GP practices are effective.

The analysis on responses to the question related to objective 3 show that the current GP practices are effective. However, 1 out of 12 respondents did not concur with the rest of the respondents as they indicated that the current GP practices are not yet effective and another one was not sure whether the current GP practices are effective or not.

4.3.4 Objective 4: To evaluate the current level of implementation of green procurement practices

This sub-section presents the analysis of the answers to the questions on what the level of implementation of GP practices is. This question sought to determine where universities place themselves with regards to the level of GP practices that they are currently implementing as compared with what they wish to implement. The analysis of responses in this regard is shown on Table 4.13.

Table 4.13: The level of implementation of green procurement practices

The level of implementation of GP practices	No. of respondents	%
Optimal	1	8%
Moderate to optimal	2	17%
Moderate	5	41%
Low to moderate	2	17%
Low	2	17%
Total	12	100%

As per Table 4.13, 41% of the respondents stated that the level of implementation is Moderate. While 17% mentioned that the level of implementation is moderate to optimal, another 17% indicated that the current level is low to moderate and another 17% stated that the current level is low. Lastly 8% said that the current level of implementation is optimal.

The analysis for objective 4 responses indicates that the current level of implementation is moderate as indicated by most respondents. There are three respondents who indicated that the current level of implementation is above moderate as two of them mentioned that the current level is moderate to optimal and one mentioned that it is optimal. However, four respondents mentioned that the current level of implementation is below moderate as two of them indicated that the current level is low to moderate and another two stated that the current level is low.

4.3.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement

This sub-section presents the analysis of the answers to the questions on what motivates the universities and their personnel to implement GP practices. This question sought to identify factors that influence the implementation of GP practices. Some of the responses from the respondents were as follows:

Facilities management KPIs and KPAs include saving energy and water. (University 1_Respondent 3_36)

Government Green Initiatives program also serves as a motivator. The Department of Higher Education has funded Greywater systems projects and the LED lighting retrofitting projects. (University 2_Respondent 12_44)

Savings on maintenance costs. (University 2_Respondent 4_32)

The Vice Chancellor has tasked facilities managers to reduce the utility bill by 8% by the end of February 2019. (University 1_Respondent 3_34)

The current practises emanate from the time when Eskom was initially effecting load shedding in South Africa. The University wanted to play its part in saving energy at the time, but the practises have been continuing since then. (University 1_Respondent 2_30)

The university has a Planning and Sustainability Committee that focuses on improving energy efficiency and water conservation on campus on a continuous basis. (University 3_Respondent 5_34)

The University has a Green Campus Initiative Plan which is signed by the University's top management. It is a five-year plan which is currently in its third year. The plan covers items such as how water should be utilised sparingly. (University 3_Respondent 6_32)

From the answers provided by the respondents, several themes arose as influential factors.

The themes are elaborated in Table 4.14

Table 4.14: Factors that influence green procurement practices

Theme	Factors that influence GP practices	No. of respondents	%
Achieving Key Performance Indicators (KPIs) and Key Performance Area (KPAs)	Facilities management KPIs and KPAs include saving energy and water.	2 out of 12	17%
	One of the KPA for the department in relation to promoting students' academic success is to provide conducive teaching and learning facilities.		
Meeting targets set by management	Meeting targets that the Vice Chancellor has set. The Vice Chancellor tasked facilities managers to reduce the utility bill by 8% by the end of February 2019	5 out of 12	42%
	One of FM department's high-level deliverables is to decrease the universities dependence on the Eskom power grid. This is also a motivator for renewable energy installations.		
	It is a mandate from the university's management to implement GP practices.		
	Motivation from the executive director as he leads and motivates the maintenance team on greening the campus.		
	The Capital Planning and Development division is responsible for incorporating green features when designing new buildings. FM has to maintaining such installations.		
Support from Management	The Support from the institution top management and meeting energy efficiency targets set by them	1 out of 12	8%

Theme	Factors that influence GP practices	No. of respondents	%
Support from the Government	Government Green Initiatives program also serves as a motivator. The Department of Higher Education and Training has funded greywater systems projects and the LED lighting retrofitting projects.	1 out of 12	8%
Savings on costs	Savings on maintenance costs.	3 out of 12	25%
Taking responsibility	The responsibility to take care of the environment.	5 out of 12	42%
	Maintaining a good reputation.		
	The university wants to play its part in saving energy. Load-shedding by Eskom was a motivator to start saving energy.		
University committees	The institution has an "Energy Task Team" that focuses on improving energy efficiency on campus on a continuous basis.	2 out of 12	17%
	The university has a Planning and Sustainability Committee that focuses on improving energy efficiency and water conservation on campus on a continuous basis.		
Lessons learnt	Lessons learnt from other's mistakes (e.g. water shortages in Cape Town).	1 out of 12	8%
Organisational Policies	The University has a green campus policy framework which is signed by the University's top management. It is a five years plan which is currently in its third year. The plan covers items such as how water should be utilised sparingly.	2 out of 12	17%

The analysis on Table 4.14 shows that meeting targets set by management and taking responsibility are the highest influential factors as stated by 42% of the respondents. Twenty five percent indicated that savings on cost is an influential factor. Achieving KPIs and KPAs, influence from university committees and organisational policies were the third highest influential factors as mentioned by 17% of the respondents and 8% of the respondents stated that support from management, support from the government and lessons learnt are influential factors.

The analysis for objective 5 show that the factors that motivate universities and their personnel the most, are meeting targets and taking responsibility. The respondents also mentioned other motivational factors such as cost savings, achieving KPIs and KPAs, influence from university committees and organisational policies. The least motivational factors were found to be support from management, support from the government and lesson learnt.

4.3.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions

This sub-section presents the analysis of the answers to the last three interview questions related to the future-plans that universities have, to improve and increase the current GP practices in FM. The first interview question sought to identify the actual future-plans, while the second question aimed to determine the timeframes set to materialise future-plans and the third question sought to understand the strategies put in place to achieve such plans. The analysis for each of the three questions is presented below.

4.3.6.1 Future plans that universities have in place to improve and increase green procurement practices

In order to identify future-plans to improve and increase GP practices in FM, respondents were requested to list a number of plans that their universities currently have in place to improve and increase GP practices. Some of the responses from the respondents were as follows:

Formal policies for green initiatives will be developed. (University 2_Respondent 9_40)

Harvesting rainwater and greywater to use in residences for flushing toilets and for irrigation purposes. (University 3_Respondent 5_36)

Seventeen cooling towers will be replaced with environmentally friendly ones. (University 3_Respondent 6_36)

Our university has budgeted R2 million for expanding the installation of BMS/Johnson Control System on more buildings on our campus. (University 2_Respondent 12_50)

From the respondents' answers, themes such as energy efficiency, water conservation, innovative building designs and sustainable landscaping emerged. A comprehensive list is elaborated in Table 4.15

Table 4.15: Future-plans to improve and increase green procurement practices

Theme	Future-plans to improve and increase GP practices	No. of respondents	%
Organisational policies	Develop policies for green initiatives	2 out of 12	17%
Energy efficiency	Measuring and monitoring energy consumption during construction phase of new buildings.	12 out of 12	100%
	Install day/night switches on security lights to save energy.		
	LED lights retrofitting project will continue until all existing buildings are done.		
	Installation of motion sensors for extractor fans and lights in the ablution facilities will be done.		
	Solar power system will be installed above one of the parking areas in the near future.		
	All the buildings on campus should have solar installations in the future.		
	Ground mounted solar systems (Solar Farms and trees) will be installed going forward.		
	Batteries will be procured for the solar system so that it can run independently without relying on Eskom electricity or generator.		
	Installing Solar PV lighting system for streetlights on campus.		
Proper planning for new buildings	Allow sufficient time to plan for new buildings before development occurs.	1 out of 12	8%
Creating awareness	Convincing end-users that saving energy and natural resources is the right thing to do and it is every individual's responsibility.	1 out of 12	8%

Theme	Future-plans to improve and increase GP practices	No. of respondents	%
Conducting research	The university will investigate new renewable energy sources as they become available on the market.	2 out of 12	17%
	More methods to conserve water will be investigated.		
Water conservation	Incorporate greywater system in new buildings.	8 out of 12	67%
	Greywater system installation on existing buildings is currently at planning stage.		
	Utilise borehole water for flushing toilets as well.		
	Harvest rainwater and recycling greywater to use in residences for flushing toilets and for irrigation purposes.		
	Harvesting stormwater from the mountains close to the university.		
	Install timed irrigation system that waters the lawns at times when the water will not evaporate quickly.		
Innovative building designs	Maximise passive designs on new buildings.	3 out of 12	25%
	New buildings will be designed and built to be green compliant.		
	Building green star rated buildings on campus		
Energy Efficient HVAC	Install timers for heaters and air conditioners.	2 out of 12	17%
	17 cooling towers will be replaced with green compliant ones.		
Sustainable landscaping	Plant more indigenous plants that require less watering and reduce lawns.	1 out of 12	8%
Expanding BMS	The university has budgeted R2 million for expanding the installation of BMS/Johnson Control System on more buildings on campus.	1 out of 12	8%

Theme	Future-plans to improve and increase GP practices	No. of respondents	%
Revised KPIs and KPAs	Revised and new targets, KPIs and KPA will be set so that more goals can be achieved.	1 out of 12	8%

The analysis on Table 4.15 shows that most future-plans are related to energy efficiency as indicated by 100% of the respondents. Followed by water conservation as stated by 67% of the respondents; 25% mentioned that innovative building designs are part of their institution's future-plans. Then 17% indicated that organisational policies, conducting research and energy efficient HVAC are part of their future-plans. Plans such as proper planning for new buildings, creating awareness, sustainable landscaping, increasing BMS and revised KPIs and KPAs were listed by 8% of the respondents.

4.3.6.2 Timeframes for achieving planned future green procurement practices

Though the objective is to identify future-plans for improving and increasing GP practices in FM in HEIs, the researcher also wanted to know the timeframes set to materialise such plans. From the answers that the respondents provided, it was discovered that most future-plans are set to be achieved by the end of the financial year ending at the end of February 2019 as stated by 50% of the respondents. Followed by 33% who indicated that some future-plans are set to be achieved within the next five years. Then 17% mentioned that some future-plans are set to be achieved within the next ten years and beyond. This is presented in Table 4.16.

Table 4.16: Timeframes for planned future green procurement practices

Timeframes for future GP practices	No. of respondents	%
Current financial year	6 out of 12	50%
Within the next 5 years	4 out of 12	33%
Within the next 10 years and beyond	2 out of 12	17%

Five respondents, representing 42% highlighted that unavailability of funds also influences timeframes for achieving planned GP practices as they cannot be implemented without funding.

...others will depend on opportunities that arises and availability of funds. (University 3_Respondent 6_42)

...but some will be done when funds are available. (University 2_Respondent 9_50)

...some will depend on the availability of funding. (University 1_Respondent 1_56)

4.3.6.3 Strategies for achieving planned green procurement practices in future

The researcher was also interested to know the strategies that universities have in place to enable them to achieve future GP goals within the set timeframes. All the respondent's answers refer to strategies related to acquiring funding for future projects. This shows that availability of funds is a major enabler for implementing GP practices.

According to 42% of the respondents, some projects will be funded from the university funds. While 33% mentioned that funding will also be requested from the Department of Higher Education and Training; 17% stated that they will achieve targets set by management and meet the KPIs and KPAs so that the university can release more funding. Then 8% indicated that the university plans to attract more sponsors to donate funding for green initiatives projects. This information is presented on Table 4.17

Table 4.17: Strategies for achieving future green procurement practices

Strategies	No. of respondents	%
Some projects will be funded from the university funds	5 out of 12	42%
Funding will be requested from the Department of Higher Education and Training.	4 out of 12	33%
Targets will be met, KPIs and KPAs will be achieved so that the university can provide more funding for green initiatives projects	2 out of 12	17%
There is a plan to attract more sponsors to donate funds for green initiatives projects.	1 out of 12	8%

The analysis for responses to the three questions related to objective 6 revealed that most future-plans on increasing and improving current GP practices are related to energy efficiency and water conservation. Other future-plans are related to innovative building design, developing organisational policies, conducting research, installing energy efficient HVAC, proper planning for new buildings, creating awareness, sustainable landscaping, expanding BMS and revising KPIs and KPAs. Most of these future-plans are anticipated to be achieved in the financial year ending in February 2019 and within the next five years, however there are some that will take 10 or more years to achieve. Financial constraints were again highlighted, this time as a factor that influence the timeframes. This was also confirmed by the strategies that universities have in place for achieving future-plans as all their plans have to do with making funding available.

The data analysis and findings that were presented under each objective and key theme in this section will be discussed in more detail in Section 4.5.

4.4 Analysis of green procurement practices in facilities management in higher education institutions: Observation data

This section presents the findings from the site observations that were conducted to support the interview data. After the interviews, the respondents were requested to refer the researcher to conduct observations in some of the buildings and/or areas in their campuses where GP related installations where being carried out or already completed or being prepared for upcoming installations.

Field notes were taken during the observation process so that data can be summarized and analysed. To establish themes, content analysis was used to analyse observation data. The analysis focused on identifying patterns in the field notes. The findings from the analysis are presented below.

4.4.1 Energy efficiency

Several GP practices in relation to energy efficiency were listed by the respondents. The researcher identified some of them during site observations and those practices are presented below.

4.4.1.1 Energy saving light fittings and bulbs

All 12 respondents referred the researcher to buildings on their campuses where LED energy saving light fittings and bulbs were installed. Some buildings were new, and some were old. On new buildings, there were mostly LED lights throughout the buildings in all three universities. Some old buildings were retrofitted with LED lights in some areas in all three universities. However, there were two campuses, one in university 1 and one in university 3 where there were few areas in some existing buildings that has LED lights. Both these two campuses have some very old buildings. Nonetheless, all participating universities were found to have LED lights even though some areas, especially in old buildings did not have them.

4.4.1.2 Solar Power Systems

Respondents from university 1 and 2 referred the researcher to some of their student residents' buildings for observations of solar systems as most solar power systems are installed there than on their campuses. The observed residences in both universities had roof mounted solar system for heating water. University 2 also had solar powered streetlights. University 3 has a green building on campus, and it has solar power.

4.4.1.3 Motion sensors for lights

Office buildings in university 1 and 3 were observed for motion sensors for lights. It was observed that, indeed the lights switch off completely when there is no one in the room/area. In some areas the lights are dim when they are on to save energy; however, the lighting may not be sufficient for some people, especially on cloudy days.

4.4.2 Water conservation

The respondents indicated that there is a number of initiatives in their institutions that are aimed at conserving water. Reported below are the initiatives that were identified when site observations were conducted.

4.4.2.1 Boreholes University 2 and 3 were found to have boreholes on their campuses during the site observations. The borehole at University 3 was at the sports filed area and it was mainly

used for irrigating sports fields. University 2 borehole was located near a garden area and is also utilised for irrigation amongst other things.

4.4.2.2 Water efficient bathroom fittings

All three universities have metering taps/demand taps on the wash hand basins in the toilets in the buildings that were observed. However, one tap was not working at all and another one had water dripping constantly. At university 3, the researcher observed that the water pressure for flushing toilets was reduced to save water. However, due to the low pressure there may be a need to flush twice in some instances. There is a bathroom in one of the lecture halls at university 3 where bathroom taps have been closed off and sanitizers have been provided instead. However, some sanitizer dispensers were empty.

4.4.3 Innovative designs

Respondents from university 1 and 3 indicated that new buildings in their institutions are utilising innovative designs that take advantage of the climate. Observations were conducted in some new buildings at university 1 and there was natural lighting in most areas, especially boardrooms, kitchenette, foyers and some offices. The green building at university 3 was also observed and found to have a lot of glass panels on the façade and in various areas inside to allow for natural lighting. The signage on the building states that it was awarded a four-star green rating by the Green Building Council of South Africa. This is different from what respondent 5 stated as he indicated that the building has a level 6 green star rating.

4.4.4 Innovative heating, ventilation and air conditioning systems

According to the respondents from all three participating universities, installation of innovative HVAC systems is one of their GP practices. The gas solar system and energy efficient air conditioning systems were identified during the observation process. The researcher was referred to conduct observation for gas solar system at one of the campuses at university 1. The system was also used for heating water for the Olympic size swimming pool. At university 3, invertor air conditioners were identified in some offices.

4.4.5 Sustainable landscaping

Respondents from university 2 indicated that sustainable landscaping is being implemented at their university. The researcher was referred to do observations on the landscaping near the new buildings on campus. The lawns were found to be smaller compared to the paved areas and there was a combination of indigenous plants and conventional flowers.

4.4.6 Building management system

Five respondents from all three participating universities indicated that BMS is used in their universities. The system is installed in the substations' and provide information through a computer or cell phone. In this case, observations were done on a computer screen of one of the respondents from university 2. The researcher was shown how to get a report for power usage from the system. The system seemed to be informative.

4.4.7 Recycling

At university 2, observations were conducted to identify recycling bins. Most of them were found in the dinning/cafeteria and communal areas. Some recycling bins were also identified in both universities 1 and 3 even though none of their respondents indicated that they have recycling bins.

The observations results were used as a data source for the triangulation technique in this study. Therefore, they might or might not be consistent with the interview results. However, these results provide some explanation and understanding of GP practices that are currently being implemented in the participating universities. The data analysis and findings that were presented under each GP practice and key themes in this section will be discussed in more detail in Section 4.5.

4.5 Discussion of the findings

This section discusses the findings that were presented in section 4.3 and 4.4. The discussion is based on the objectives of the study in order to answer the main research question.

4.5.1 Objective 1: To identify green procurement practices in facilities management in higher education institutions

The aim for the research objective was to identify GP practices in FM in HEIs. Part of this research objective was addressed in section 2.10. The research objective was achieved through asking respondents about the actual GP practices in FM in their institutions and how often GP is practiced in their institutions. Site observations were also conducted on some GP practices that were mentioned by the respondents. The findings on both questions will be discussed below.

4.5.1.1 Green procurement practices

The response to the first question revealed that the current GP practices include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste. The next section will discuss these GP practices individually.

4.5.1.1.1 Energy efficiency

Energy efficient installations can significantly improve the environmental performance of a building because every kilowatt hour of energy brought to a building causes atmospheric emission of carbon dioxide (Manjula, Dissanayake and Rajini, 2015). Therefore, buildings that are energy efficient promote environmental sustainability (Sapri and Muhammad, 2010).

It is commendable that some universities in SA are taking energy efficiency seriously. The findings from both interviews and site observations indicate that current GP practices include purchasing and installation of energy efficient LED lighting, solar power systems and motion sensors for lights. These practices are discussed below.

LED Lighting

The findings from both instruments show that SA universities are replacing conventional light fittings with energy saving LED light fittings and bulbs in existing buildings and LED light fittings and bulbs are also installed during the construction phase in new buildings. However, the results from observations indicate that old buildings still have some areas that have not yet

been retrofitted with LED lights. These findings are similar to those in the studies conducted by Pouya and Pouya (2018), and Alshuwaikhat, Adenle and Saghir (2016), who state that in Istanbul Technical University, LED lighting and LED bulbs are used instead of incandescent and fluorescent lighting and Clarkson university has placed its focus on upgrading the lighting systems including installation of 60,000 new energy efficient T8 fluorescent lights and LED bulbs for outdoor lights in the whole campus.

Even though the findings are similar compared to literature, the participating universities in SA appears to be prioritising the installation of LED lights in newer buildings. Older buildings should also be prioritised as there are more older buildings in some universities than new buildings. Which means a lot more energy can be saved if more LED lights are installed in older buildings as well.

It is however, reassuring to find that SA universities have embraced energy efficiency with regards to procuring and installing of energy saving LED lights. LED lights use less energy, and this translates to reduced carbon emissions and cost savings on energy consumption. Therefore, this practice supports environmental-economic sustainability.

Solar Power System

Solar power generation is the most accepted renewable energy source as it is low on costs, generates electricity directly from the sun, has environmental benefits and is high in efficiency (Palanichamy, 2016). Another advantage is that solar systems can be connected on or off the power grid.

The interviews and site observations data revealed that solar power systems have been installed in the participating universities and they are used for harvesting sunlight to generate electricity. The most common solar systems found in the universities were roof mounted systems and it is mostly used for heating water in the residences. However, respondents from one of the universities indicated that they have discontinued the installation of roof mounted solar systems and have evolved to rather erecting solar farms. These findings are echoed by Van Geet et al. (2018), who report that in 2017 the Arizona State University completed the development of 24.1 megawatt on-site and 28.8 megawatt off-site PV solar systems and the University of Colorado-Boulder installed an 850 kilowatt rooftop PV solar system in 2016.

Judging from the findings from both instruments, solar power systems are prioritised in the residences and they are mostly used to generate power for heating water. It makes sense to prioritise residences as that is where hot water is utilised the most. However, universities should also give more attention to solar power installations on campus buildings, especially laboratories as they utilise a lot of energy on a continuous basis.

The solar power installations in these universities are substantial and one can safely conclude that energy consumption costs have reduced considerably as compared to before the solar systems were installed. This practice supports environmental-economic sustainability as it reduces energy consumption, and this translate to savings on costs.

Motion Sensors for Lights

The respondents mentioned that motion sensors have been installed on lights in several areas on campus. This was further confirmed when observations were conducted. These sensors assist in saving energy as they automate the lights to switch on only when the rooms are occupied, and they also dim the lights during the day. Gonzalez-Galvez et al. (2018), state that automated use of lighting prevents the lights from being on when the rooms are not occupied. This helps to save energy; however, observations results revealed that the lighting could be insufficient when the lights are dim during the day on cloudy days.

Ensuring that lights are switched off when rooms are not occupied is one of the many efforts that participating universities are practicing in order to reduce energy consumption. This practice is similar to that of Maryland University as Stewart (2010), report that Students in this university are encouraged to switch off the lights and electronic devices when they leave their rooms. Switching off lights that are not in use saves energy and the associated costs. Therefore, this practice form part of environmental-economic sustainability.

Based on the findings above on energy efficiency, it is evident that the three universities are committed to reducing energy consumption as they are procuring and installing large numbers of energy efficient products. The types of energy efficient installations that are installed are at a large scale which translates into high capital costs; however, these universities are investing in these installations. This reflects their level of commitment and understanding of the importance of protecting the environment through energy efficiency. This also show that top

management and management within FM in the three universities are looking into energy efficient installations with the whole lifecycle cost in mind and not just focusing on the initial cost. This finding concurs with what has been reported in the research conducted by Maistry and McKay (2016), and van Weenen (2000), as they mention that in the quest to be energy efficient, some HEIs have resorted to using GP to purchase and install energy efficient lights and solar products.

4.4.1.1.2 Water conservation

Water conservation involves reducing the usage and wastage of water as the wastage of water and extra use of water result in the drowning of freshwater resources (Das, Bera and Moulick, 2015). Moglia, Cook, and Tapsuwan, (2018), concur, stating that water conservation has the ability to protect the environmental water flows, especially in times of draught.

It is remarkable to discover that the three participating universities are also doing their part to conserve water as it is a natural resource that has no substitution. The findings from both instruments presented several methods that are utilised in these universities to save water and those methods are discussed below.

Greywater system

Greywater refers to wastewater from bathtubs, showers and wash hand basins. Greywater system refers to the system that recycles greywater so that it can be re-used. The respondents indicated that greywater systems are installed on their campuses and the water is used for irrigation and flushing toilets. Taemthong and Phenphon (2017), support this practice as they mention that flushing toilets consumes high amounts of potable water hence it is important to use recycled greywater in flushing systems so that fresh water can be conserved. Universities that are using this system should be saving a lot of freshwater as they have big lawns that require irrigation and a large number of students and staff utilising the toilets on campus and in the residences. Reducing freshwater consumption also reduces the cost associated with it, which mean the use of greywater system can be associated with environmental-economic sustainability.

Metering taps/ demand taps

The findings from interviews show that metering taps/ demand taps are installed on wash hand basins in the universities. Observation results also confirmed that demand taps are installed; however, there was a tap that was not working at all and another one had water dripping when it is supposed to be totally closed. These taps are set to release water for a certain period of time once they are pushed or pressed. This system also assists to avoid flooding because people tend to leave taps open when there is no water. Even though this system assists in saving water, it is not certain from the results if it is working efficiently because a dripping tap wastes water and a tap that does not work cannot provide the much-needed water.

A respondent from one of the universities also mentioned that their university has gone as far as closing-off taps on some wash hand basins and installed sanitizers instead. However, observations results revealed that some sanitizer dispensers were empty. Closing of taps in this regard assist in saving water but it could create other problems if the alternative, which is sanitizers runs out. Universities should ensure that they maintain a balance so that people's needs are still met whilst practicing GP.

Universities have a large number of bathrooms and toilet facilities. This translates into high water consumption on wash hand basins through washing of hands and brushing of teeth. It is remarkable to observe that universities have measures in place to save water in these areas. It is clear that these practices support environmental-economic sustainability as they save water and the associated costs.

Boreholes

The results from both instruments confirmed that the borehole system is installed and used in the participating universities. A borehole water supply is a method of abstracting groundwater through a borehole which is drilled into the aquifer (Das, Bera and Moulick, 2015). The respondents indicated that this system is utilised in their universities and borehole water is used for irrigation purposes and domestic use after being chlorinated. Observations results revealed that this system is mostly used for irrigation purposes in the sports fields and lawns. This is commendable as university have huge sporting fields and gardens that can consume large

amount of water. The system assists in saving freshwater and the related costs thereof. Therefore, it can be associated with environmental-economic sustainability

Harvesting rainwater

Rainwater harvesting involves collection of rainwater from the roof top; the water is then deposited into a reservoir with filtration and later distributed for irrigation, domestic use or groundwater recharge (Das, Bera and Moulick, 2015).

The respondents indicated that they have rainwater harvesting systems on their campuses and the harvested rainwater is used for irrigation purposes. This system is not unique to SA universities as there are reports of it being utilised in HEIs in other countries. Pouya and Pouya (2018), report that a rainwater harvesting system has been installed at Yale University's Kroon Hall and is anticipated to save 500,000 gallons (1,892,706 litres) of water per year, as the water is used for irrigation and flushing toilets. Bantanur (2012), reports that at Indian Institute of Technology Bombay, Indian Institute of Technology Madras and Manipal Universities, GP practices include initiatives such as rainwater harvesting and wastewater management.

In this case, universities are basically taking advantage of nature to protect the environment and subsequently save costs related to water consumption. This practice form part of environmental-economic sustainability as it saves water and costs.

Bathroom fittings

Choosing to install water efficient fittings assist in reducing water consumption (Khan et al. 2018). The respondents indicated that their universities use water efficient bathroom fittings such as low flushing toilets and urinals, and reduced water pressure showerheads as these assists in saving water. Observation results also confirmed that water pressure for flushing toilets was reduced to save water. However, due to the low pressure there may be a need to flush twice in some instances. Universities have a large number of bathroom fittings as they accommodate a larger number of students during the day and some of these students stay at campus accommodation. Therefore, universities save large amounts of water through water efficient bathroom fittings. It is outstanding to find that universities are addressing water consumption in bathroom areas as these are the areas where high water consumption activities

occur on campus and in the residences. This practice also promotes environmental-economic sustainability as it saves water and costs.

Leak detection meters

The findings also show that leak detection meters are installed on campuses to detect water leaks so that water wastage can be reduced. Moglia, Cook and Tapsuwan (2018), elaborate on this system by stating that smart meter data provides information on water consumption, water use patterns and leakage management. Universities are huge establishments with high water consumption for several purposes and this makes it difficult to detect leaks without some form of assistance. It is commendable that universities have leak detection devices that assist them to detect water leaks timeously as this result in prevention of water wastage and the associated costs. Therefore, this practice form part of environmental-economic sustainability.

Out of all water efficiency practices discussed above, the ones that are more popular among the three universities are greywater systems, boreholes and demand taps as they were mentioned by most respondents. Water is one of the most important resource on earth and it has no substitution hence it is encouraging to find that universities are doing their part to preserve this resource. It is also commendable to find that all water conservation practices discussed above support environmental-economic sustainability.

4.5.1.1.3 Innovative building designs

The findings from both instruments presented that for new buildings, universities are utilising environmentally friendly innovative designs. The innovative designs that were revealed by the findings are discussed below.

Incorporating passive design on new buildings.

Passive design is described as the design that take advantage of the climate to maintain conducive temperature range in a building (Khan et al. 2018). Under the theme innovative designs, most respondents indicated that passive design is incorporated in new campus building designs. They also elaborated by stating that new buildings are designed in such a way that windows maximise natural lighting and the buildings requires less HVAC. The observations

result also confirmed that there was natural lighting in most areas in new buildings, especially boardrooms, kitchenette, foyers and offices.

Most HEIs buildings were designed and built in an era where climate change was not a major issue (Maistry and McKay, 2016). As a result, those buildings have to be retrofitted to become green compliant. From this finding it is evident that universities are evolving with times as they have improved their new building designs to be innovative enough to take advantage of the climate and subsequently improve the environmental performance of the buildings. This type of design also assists to reduce energy consumption and costs on HVAC systems. Khan et al. (2018), mention that one of the methods to save energy is to install doors and windows that maximise natural ventilation and lighting in buildings. This practice can be included under environmental-economic sustainability as it reduces the need for lighting and mechanical HVAC and subsequently reducing the costs on energy consumption.

Low-E glass

The findings show that Low-E glass is used for new glazing installations on campus as it keeps the heat inside buildings during winter and cools the rooms in summer. Buildings gain heat through glass windowpanes and if glass windowpane temperature is reduced, the room temperature will also decrease, and this subsequently reduces air-conditioning energy consumption (Hamdan, Shaalan and Al-Asfar, 2018) and therefore energy costs are also reduced.

HVAC is one of the high energy consumers in buildings. It is commendable that universities are utilising innovative methods such as Low-E glass on windows to reduce the need and usage of mechanical HVAC as this result in reduced energy consumption and costs. Therefore, the installation of Low-E glass supports environmental-economic sustainability.

Plascon "Green Paint System"

According to the findings, green paint system is utilised in campus buildings. This type of paint is environmentally friendly as it releases fewer toxins into the air. By utilising this type of paint, universities are contributing significantly into reducing air pollution as they have multiple buildings on their campuses. Air pollution is one of the great contributors to global warming.

Therefore, it is commendable to see universities doing their part to reduce emissions through this kind of GP practices that support environmental sustainability.

Green star rated buildings (Green Buildings)

A green building is an environmentally friendly designed building which makes use of minimal natural resources such as water and energy whilst reducing several adverse effects to the environment (Das, Bera and Moulick, 2015). Green buildings are designed thoroughly to ensure that every aspect of the building meets green standards. The findings from interviews show that one of the universities has a building on campus which is rated level 6 Green Star Rating (green building). The results from the observation revealed that indeed there is a green building and it has a lot of glass panels on the façade and in various areas inside to allow for natural lighting and ventilation; however, it was awarded a 4 star green rating by the Green Building Council of South Africa. It is commendable that a university in a developing country such as SA has gone to great lengths such as building a green star rated building, even if it is rated 4 star as this significantly contributes towards protecting the environment. This kind of buildings contribute greatly towards environmental-economic sustainability as they have a reduced lifecycle cost and they are built out of environmentally friendly materials.

4.5.1.1.4 Energy efficiency on HVAC

The costs associated with running an HVAC system are substantial in most buildings and are estimated to be approximately 50% of the total energy consumption of buildings (Krarti, 2008). It is impressive to find that universities are doing something to address the issue of high energy consumption on HVAC. The energy efficient HVAC systems that are presented in the findings are discussed below.

Heat pumps

The respondents mentioned that geysers and boilers are replaced with heat pumps for heating and supplying hot water on campus. These findings are congruent with a study conducted by Van Geet et al. (2018), who report that Ball State University replaced coal fired boilers with heat pumps, which resulted in significant savings on energy consumption and costs. Another respondent indicated that gas solar systems, which harvest heat from the gas generator to heat water, are installed in some buildings on campus. The observation results revealed that the gas

solar system is also used for heating water for the Olympic size swimming pool. These systems can be classified under environmental-economic sustainability as they reduce energy consumption and the cost for operating the HVAC systems.

Air cool HVAC

The findings indicate that air cool HVAC systems are installed in one of the universities, instead of water cool HVAC systems. The respondent indicated that the manufacturer of this system mentioned that the advantages of air cool systems include low installation and maintenance costs, as they do not require cooling towers, condensers, water pumps and related condenser water chemical treatments. However, the operating costs for air cool systems are higher than those of water cool systems because water cool systems can take advantage of lower condensing temperatures. This implies that the air cool system reduces water consumption but increases operating costs, which means the air cool system may address environmental issues but do not address the economic aspect of sustainability. It will be worthwhile for universities to investigate other forms of HVAC systems that can address all three aspects of sustainability.

Energy efficient Air Conditioners

Air conditioning systems are usually the highest consumer of energy in buildings (Gonzalez-Galvez et al., 2018). The respondent mentioned that air conditioning units that are being installed currently are energy and water efficient. The observations results confirmed this as they revealed that invertor air conditioners are installed. It is remarkable to note that SA universities are aware of the high energy consumption related to air conditioning and are doing something to address and to reduce the high consumption in this regard. This type of air conditioners supports environmental-economic sustainability as they reduce energy consumption and the cost for operating air conditioners.

Thermally activated building system

The findings reflected that one of the universities has a new building that has thermally activated concrete slabs. The thermally activated building system is generally described as a combination of a heating and cooling system that has pipes embedded in the structural concrete slabs or walls of multi storey buildings. Babiak and Vagiannis (2015), elaborate on this by

stating that thermally activated building system provides optimised thermal indoor environment as it is a water-based cooling and heating system with thermal mass activation that provides benefits such as significant savings on energy, low operating costs, thermal comfort and a lifespan of 50 years. It is outstanding to find that one of the universities has already implemented an advance innovative design, such as thermally activated building system, to reduce the impact on the environment, energy consumption and cost. Therefore, this design promotes environmental-economic sustainability.

Under the theme Energy Efficiency on HVAC, replacing of boilers and geysers with heat pumps was mentioned by the most respondents as a GP activity on their campuses. Most of the GP practices under this theme were also found to support environmental-economic sustainability.

4.5.1.1.5 Sustainable landscaping

Landscaping involves making gardens more attractive by planting trees, shrubs, lawns and flowers. It also improves the image and the atmosphere of the universities; however, it can come with high water consumption through irrigation of the plants, hence the need for sustainable landscaping.

The findings from both instruments show that one of the universities has embraced sustainable landscaping by planting more indigenous plants that requires less watering and reducing lawns in their new landscape designs. This echoes the findings of a study conducted by Pouya and Pouya (2018), who report that Arizona State University has a policy that enforces the use of indigenous plants. They also found that some HEIs utilise permeable and porous paving to reduce lawns as this allows for storm water to penetrate into under laying soil, thus preventing flooding. It is commendable to find that FM is not only focusing on buildings when it comes to water conservation, but also conserving water in landscaping as well. This supports environmental-economic sustainability as conserving water also result in saving costs.

4.5.1.1.6 Building management system

Cao et al. (2018), describe BMS as a system that supports energy management processes that involves monitoring, consolidating energy related data from different sources, utilising data access tools to analyse buildings performance, generating reports from energy related data, and

controlling and optimising energy usage. The findings from both instruments show that all three universities are utilising this system to control and monitor energy consumption amongst other things. The findings resonate with Clarke (2006), who reports that FM in Dalhousie University is developing a software that picks up excessive energy usage. The findings have demonstrated that universities are not just reducing energy consumption, but they also monitor and control the process of energy efficiency. This system supports environmental-economic sustainability as reducing energy consumption also result in saving costs.

4.5.1.1.7 Recycling

The findings from interviews showed that only one university out of the three has recycling bins on campus; however, findings from observation data reflect that recycling bins have been placed on campus in all three universities to collect recyclable items such as cans, plastics and papers. This finding concurs with what other researchers have found in other universities. Alshuwaikhat, Adenle and Saghir (2016), report that the University of Oregon has a recycling program which recovers 47% of all university waste. Pouya and Pouya (2018), also report that recycling bins for daily waste such as plastic, tins, paper and glass have been placed at the Ayazaga Campus of Istanbul Technical University. Recycling waste is important as toxic chemicals and GHGs are released from waste and it is commendable to find that universities have embraced recycling of waste as it promotes environmental sustainability.

The practices discussed in this section provide details on the findings from both instruments regarding actual GP practices that are being implemented in the participating SA universities. It is encouraging to find that most of these GP practices are associated with environmental-economic sustainability. However, the findings would have been much better if there were practices that also address social sustainability. The next section will elaborate on how often these practices are implemented.

4.5.1.2 Frequency of green procurement practices

The responses to the second question under objective 1 revealed that GP practices are implemented on a continuous basis. However, financial constraints and the presence of heritage buildings on campus makes it difficult to implement GP practices at times. Maistry and McKay (2016), state that most HEIs buildings were not designed to be energy efficient as they were

built in an era when energy efficiency was not a priority. Lundberg and Marklund (2018), mention that the ability to implement GP is often limited to the availability of funding. It is outstanding to find that universities are implementing GP practices on a regular basis even with hindrances such as lack of funding and heritage buildings. The persistence in practicing GP in these universities may also lead to practices that promote social sustainability as the current practices are mostly aimed at addressing environmental-economic sustainability.

4.5.2 Objective 2: To learn how the effectiveness of green procurement practices are monitored and measured

The aim of this objective was to learn how the effectiveness of current GP practices is monitored and measured. Part of this research objective was addressed in section 2.12.3. The responses to the question related to this research objective revealed that several methods and systems are utilised to monitor and measure effectiveness. These methods and systems are discussed below.

BMS emerged as the most utilised system to measure and monitor the effectiveness of GP practises related to energy efficiency. A participant also indicated that BMS information can be easily accessed from a computer and the system can produce information for the periods that the user requires. This finding is similar to what is stated by Tariq et al. (2012), that BMS is a computerised system that analyses certain requirements in a building by controlling the related plant in that building in order to save energy. The participants were also confident of the reliability of the BMS as it appears to produce valid results and reports. A respondent also demonstrated to the researcher how to get a report for energy usage on BMS, and the system seemed to be informative. BMS seem to be the only software of its kind being used in all three universities as no respondent mentioned any other software being used to performs the same function.

Making use of external companies to monitor energy and water consumption and then provide reports and recommendations, emerged as a common practice. One of the respondents mentioned that external companies are also requested to conduct research on other green products or innovations that are on the market. This finding concurs with that mentioned by Van Geet et al (2018), who assert that universities can make use of their engineering staff, researchers or external consultants to investigate more opportunities to save energy on existing

campus buildings. It is remarkable to find that universities are investing in ensuring that their GP practices are effective while keeping track of new and innovative products on the market.

The respondents also mentioned other monitoring methods such as using water and electricity bills to evaluate consumption, using the monitoring system that comes with the solar system to measure the production and usage of solar power, LED lights lifespan and savings calculations and conducting full building audits. These findings are commendable as they reflect that universities use several methods to measure the effectiveness of different GP practices. This finding also show that universities are implementing GP practices with the understanding that their effectiveness result in contribution toward reducing the impact on the environment. Without measuring and monitoring, it is difficult to tell if GP practices that are being implemented are efficient; it is also more difficult to determine where improvements are required. Therefore, the process of measuring and monitoring is vital. Van Geet et al. (2018), report that successful energy management plans include measuring, monitoring and reporting on such plans. The findings for objective 1 revealed that most GP practices are aimed at addressing environmental-economic sustainability. Therefore, measuring and monitoring the effectiveness of such practices also supports environmental-economic sustainability.

4.5.3 Objective 3: To determine if the current green procurement practices are effective

The aim of this objective was to determine if the current GP practices are found to be effective after the measuring and monitoring process. The responses to the question revealed that current GP practices are proving effective as stated by the majority of respondents. Effective is described as being successful in producing a desired or intended outcome (Oxford Dictionary, 2019, effective entry).

This result simply means that universities are successfully implementing the current GP practices and subsequently contributing towards reducing the adverse impact on the environment. Generally, HEIs have a large number of infrastructure, which means the impact that universities have in reducing the negative impact on the environment is significant. The findings for objective 1 revealed that most GP practices are aimed at addressing environmental-economic sustainability. Therefore, the effectiveness of such practices also supports environmental-economic sustainability.

4.5.4 Objective 4: To evaluate the current level of implementation of green procurement practices.

The aim of this objective was to determine the level of GP practices that universities are currently implementing as compared with what they wish to implement. From the responses to the question related to this research objective, it emerged that the current level of implementation is moderate as indicated by most respondents. Moderate means average in amount, intensity, quality or degree (Oxford Dictionary, 2019, moderate entry). Which implies that most of the universities would like to implement much more than they are currently able to.

Even though some respondents stated that the current level of implantation is below moderate and some mentioned that it is above moderate, it is concerning to find that most respondents mentioned that the current level of implementation is moderate considering the urgency required to address climate change. This finding resonates with the study conducted by Calder and Dautremont-Smith (2009), who find that even though efforts to integrate sustainability into campus operations are increasing, most campuses are still far from achieving operational sustainability. The finding also concurs with a study conducted by Mafini and Loury-Okoumba (2018), who indicate that in countries such as SA that are still developing, environmental mindfulness and the level of GP implementation is still low. Universities are experimental environments, and this could be the reason why their level of GP implementation is moderate, while the general level of implementation in the country as a whole, is low. Table 2.1 elaborates on GP practices in HEIs in other countries, and institutions such as Bournemouth University and Imperial College in the UK appear to be more advanced in implementing GP practices.

Implementing GP requires a mind shift and commitment as it is still considered a new phenomenon that comes with many challenges. According to Khan et al. (2018), implementing GP can be challenging due to its technicalities and different organisational cultures. Even though challenges exist in relation to implementation of GP practices, HEIs should strive to reach optimal implementation levels as this will expedite the reduction of the adverse impact on the environment and subsequently address all three spheres of sustainability.

4.5.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement

The aim of this objective was to identify factors that influence the implementation of GP practices. The responses to the question related to this research objective revealed that most influential factors are meeting targets set by management, taking responsibility and savings on costs.

It is commendable to find that management in the three universities are enforcing the implementation of GP practices by setting targets, which include timeframes that FM department should meet. The importance of management support and their involvement was elaborated in section 2.12.4.

This result implies that management is committed to the successful implementation of GP practices and transforming their campuses into sustainable campuses. Mafini and Loury-Okoumba (2018), mention that top management commitment has been identified as one of the drivers for implementing GP practices. Khan et al. (2018), also emphasise that top management should commit to GP implementation in their organisations.

Respondents also mentioned that they are motivated by the need to take responsibility towards protecting the environment. This finding is remarkable as it shows that management within FM have gained enough understanding to realise that climate change needs to be addressed and it is everyone's responsibility to do so. This finding is supported by Agyepong and Nhamo (2017), who assert that the current generation should treat GP as an ethical issue because it is the right thing to do. Even though some studies report that environmental awareness in SA is low, the finding of this study suggests that environmental awareness in FM in the participating universities is high.

Savings on costs also emerged as one of the most influential factors. Most green products or projects come with a high capital cost and the savings are usually only realised over a period of time. Muraguri, Waweru and Musyimi (2015), report that environmentally friendly products may not always be price competitive, but they outperform the conventional equivalent in efficiency and lifecycle costs. This finding implies that FM as a department in HEIs have experienced the long-term cost saving benefits of purchasing green products and implementing

sustainable developments to an extent that it motivates them to continue with these practices. Van Weenen (2000), reports that sustainable development takes into consideration achieving best value for money on products and services through GP. It is reassuring that universities are already reaping some financial benefits from their investments in green initiatives on their campuses. This may attract more funding for implementing other green initiatives from private sponsors and the Department of Higher Education and Training.

4.5.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions

The aim of this objective was to identify the actual future-plans, to determine the timeframes set to achieve future-plans and to understand the strategies put in place to achieve such plans. The results are discussed in the three sub-sections below.

4.5.6.1 Future-plans that universities have in place to improve and increase green procurement practices

The responses to the question regarding future-plans to increase and improve GP practices revealed that there are plans to improve the current GP practices and there are also plans to put measures in place that will influence, improve and increase the current GP practices.

The findings indicate that future-plans include continuing with and improving on energy efficiency, water conservation, innovative building designs, energy efficient HVAC and expanding BMS. These GP practices are discussed under 4.5.1.

It is commendable to note that continuing and improving on current GP practices form part of universities' future-plans. This result implies that participating universities are open to new and improved innovations that become available on the market and are committed to doing their part in reducing adverse impacts on the environment.

Another revelation was that future-plans include going beyond just implementing GP practices, but also to introduce other measures that will ease, increase and improve current GP practices. Such measures include; developing organisational GP policies, allowing for sufficient time to properly plan for new buildings, creating green initiative awareness within university

stakeholders, conducting research on available and/or upcoming green initiatives and revising KPIs and KPAs so that more green initiatives can be achieved.

It is remarkable that university management has realised that there are other factors that can improve and increase GP practices. Organisational policies in particular are great enablers of GP implementation as highlighted in section 2.12.2. Proper planning for new buildings, creating awareness, conducting research and revising KPIs and KPAs will also enable better implementation of GP practices. Once green initiatives are properly planned and thoroughly researched, GP implementation will improve and increase as implementers become well informed and prepared. Therefore, revised KPIs and KPAs will be achieved and subsequently greater awareness will be created as more green initiatives are implemented.

The abovementioned future-plans are commendable, even more so because universities are committed to realise them as they have also set timeframes for achieving them. Such timeframes will be discussed in the next section.

4.5.6.2 Timeframes for achieving planned future green procurement practices

The results indicate that there are different timeframes set for achieving different future-plans as some require more time, resources and funding than others. Most of the plans are set to be achieved in the financial year ending in February 2019; followed by that to be achieved within the next 5 years. There are few plans that are set to be achieved within the next 10 years or beyond. Judging by the timeframes in place, universities' management are not procrastinating with regards to meeting their future objectives. These timeframes may also assist in accelerating the current level of implementation of GP practices beyond moderate levels to more optimal levels, as discussed in section 4.5.4.

It will be challenging to meet the set timeframes without any strategies in place to ensure that objectives are achieved on time. The participating universities also have strategies in place and will be discussed in the following section.

4.5.6.3 Strategies for achieving planned green procurement practices in future

From the findings, it emerges that all the strategies that the participating universities have in place for achieving their future GP objectives relate to making funds available. Financial

constraint is a major barrier for the implementation of GP practices as stressed in section 2.11.1. The results show that most green initiatives will be funded by the universities themselves and some funds will be requested from the Department of Higher Education and Training. Some respondents also mentioned that funds will be raised through fundraising methods and through sponsors. It is reassuring that universities have strategies in place to mitigate the barrier of financial constraints in their quest to implement more and improved GP practices.

4.6 Summary of the findings

According to section 4.3, 4.4 and 4.5, the findings of the study revealed that the current GP practices in participating SA universities include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste. Most of these findings were similar to those found in other HEIs in other countries when compared with consulted literature. The findings also confirmed that these GP practices are mostly implemented on a continuous basis and were found to be effective after the measuring and monitoring processes that mostly involve utilising BMS, external consultants and evaluation of water and electricity bills. Most of these GP practices were found to be associated with environmental-economic sustainability and a few are associated with environmental sustainability. The findings would have been much better if there were practices that also address social sustainability.

The most common motivation for implementing GP practices were found to be meeting targets set by management and taking responsibility; however, the level of implementation is at moderate level. To improve the level of implementation, the findings show that most future-plans involve increasing and improving GP practices related to energy efficiency and water conservation and most of them are anticipated to be achieved within the next five years. The universities also have strategies in place to raise funds in order to materialise their future-plans as funding constraints have been found to be a hindrance to the implementation of GP.

Chapter 5: Conclusion

5.1 Introduction

This research was guided by the research aim of identifying green procurement (GP) practices in facilities management (FM) in higher education institutions (HEIs). In order to achieve the aim of the research, six objectives were established. Then relevant secondary and primary data were collected, analysed, interpreted and synthesised.

This chapter will summarise the most important findings from the research objectives, then the research question and problem will be discussed. Thereafter, a reflection of the research methodology and limitations of the study will be presented. Finally, suggestions and area for further research will be presented and relevant conclusions will be drawn.

5.2 Addressing the research objectives

For the main research question to be answered, the six research objectives were addressed. This sub-section will discuss how each objective was achieved and the findings from each objective is given.

5.2.1 Objective 1: To identify green procurement practices in facilities management in higher education institutions

The first research objective was two-folds (1) to identify GP practices and (2) to know how frequent GP practices are implemented. This objective was achieved through asking respondents to describe the current GP practices in FM in their institutions and to also state how often such practices are implemented in their institutions.

The findings obtained showed that the current GP practices included energy efficiency, water conservation, innovative building designs, energy efficiency on heating, ventilation and air conditioning (HVAC), sustainable landscaping, building management systems (BMS) and recycling of waste. The results also indicate that GP is practiced on a continuous basis. These findings imply that universities are applying GP comprehensively as they are implementing it frequently and in several areas within FM in order to address several factors that are contributing to climate change. Most of the findings with regards to specific GP practices

resonated with results from previous studies that were conducted in other universities in other countries (mainly developed countries).

5.2.2 Objective 2: To learn how the effectiveness of green procurement practices is monitored and measured

To meet this objective, participants were requested to list the methods or systems that are utilised in their institutions for monitoring and measuring the effectiveness of GP practices. The findings to this interview question revealed that several methods are used to measure and monitor effectiveness. However, BMS, utilising consultants and evaluating water and electricity bills, are the most common methods according to the respondents.

Measuring and monitoring the effectiveness is a vital exercise as it enables universities to identify where improvement and/or changes are required. This finding therefore indicates that participating universities' aim is to effectively reduce the adverse impact on the environment hence they have measures in place to ensure that their GP practices are producing the required outcomes.

5.2.3 Objective 3: To determine if the current green procurement practices are effective

This objective was addressed by asking the respondents to indicate if the current GP practices were found to be effective after the measuring and monitoring process. The results show that the current GP practices are effective, which means they are successful in producing required outcomes.

This finding confirms that universities have successfully implemented some GP practices in their institutions and find that they produce good results. Therefore, it can be concluded that the participating universities are on the right track with regards to GP practices, however there is still room for implementing more GP practices.

5.2.4 Objective 4: To evaluate the current level of implementation of green procurement practices

This objective was achieved by requesting the respondents to gauge the current level of implementation of GP practices in their universities by comparing what they are currently

implementing to what they wish to be implementing. From the results, it emerged that the current level of implementation is generally moderate.

This finding implies that universities are only implementing half of the GP practices that they wish to implement, which means there is still more GP practices that have not yet been implemented. Therefore, it can be concluded that participating universities still have a long way to go with regards to reaching optimal implementation of GP practices.

5.2.5 Objective 5: To identify the motivations of institutions or personnel to practice green procurement

In order to meet this objective, respondents were asked to discuss factors that influence the implementation of GP practices in FM in their universities. The findings revealed that most influential factors are meeting targets set by management, taking responsibility and savings on costs.

This outcome shows that both university management and facilities managers understand the significance of GP practices as they form part of their performance targets and they realise that implementing GP practices is the responsible thing to do. The outcome also confirms that universities are already experiencing some cost savings, due to green initiatives, even though savings tend to only be realised after some time. Therefore, it can be anticipated that participating universities will continue implementing GP practices on their campuses as they are motivated by the commitment from upper management and because of experienced cost savings resulting from green installations.

5.2.6 Objective 6: To determine future-plans to improve or increase green procurement practices in facilities management in higher education institutions

This research objective was three-folds (1) to identify the actual future-plans (2) to determine the timeframes set to achieve future-plans and (3) to understand the strategies put in place to achieve such plans. This objective was achieved through asking respondents to detail actual future-plans for GP practices in FM in their institutions, to indicate the timeframes set to achieve such plans and to also state how they intended to achieve the future-plans within the set timeframes.

Results suggest that future-plans involve continuing with and improving on, the current GP practices, including introducing organisational GP policies, allowing sufficient time to properly plan for new building projects, creating awareness amongst universities stakeholders about green initiatives, conducting research on available and upcoming green initiatives and revising KPIs and KPAs so that more green initiatives can be achieved.

The findings also reveal that most future-plans are set to be achieved in the financial year ending in February 2019, followed by those to be achieved within the next 5 years and some long-term plans to be achieved in the next 10 years and beyond. The strategies for achieving future GP objectives within the set timeframes were found to be related to making funds available and they are planned to be funded by the universities themselves and/or by the Department of Higher Education and Training.

The results suggest that universities are aware that they still have a long way to go with regards to reaching optimal implementation of GP practices and hence have several plans to improve and increase their current GP practices. University management realise the urgency required to address climate change as most of their plans are set to be achieved by the end of the financial year ending in February 2019 or within the next five years. The commitment to ensure that future-plans are realised can be seen by the fact that universities are planning to fund their own green initiatives projects. However, funds will also be requested form the Department of Higher Education and Training. It can be concluded therefore that participating universities are aware that they need to implement more GP practices and have actual future-plans to improve and increase their current GP practices.

5.3 Addressing the research question

The main research question for this study was stated in Section 1.4 as follows: What are the actual GP practices that are being implemented in FM in HEIs in SA? This question was raised because literature does not provide much detail regarding the actual green products and services that are being procured in FM in HEIs in SA. In order to answer the research question, six objectives were derived from the aim of the research. The six objectives were also addressed in section 5.2. After analysing, presenting and discussing the data, the following can be concluded with regards to the three participating universities in SA:

- GP practices in the participating universities include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste. These practices are implemented on a continuous basis;
- There is an aim at universities to effectively reduce the adverse impact on the environment and there are measures in place to ensure that GP practices are producing the required outcomes;
- Upper management and facilities managers actively strive to implement GP practices in their institutions and find them to be effective;
- The current level of implementation is moderate which means that universities are only implementing half of GP practices that they wish to implement; and
- There is acknowledgement that SA universities are behind with regards to what they wish to be implementing and hence strategies, such as setting timeframes and having fundraising methods, are in place to improve and increase their GP practices.

Therefore, to answer the Main Research Question: GP practices in the participating universities include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste. However, participants in the study perceive that they lag behind in the implementation of GP practices as compared with what they wish to implement. Much of this is due to financial constraints.

5.4 Addressing the research problem

In section 1.3, the research problem statement was presented as follows: There is poor practice of green procurement in the facilities management of higher education institutions, due in part to lack of knowledge, inadequate capacity, low readiness levels, and other related challenges.

The research problem emerged from existing literature which suggests that GP practices are limited in FM in HEIs as there is lack of knowledge of GP, poor capacity to implement GP, lack of readiness to implement GP and challenges to GP practices. The findings from this study presented that the level of implementation of GP practices is unsatisfactory as it is at moderate level. This is due to the amount of GP practices that FM in HEIs wish to be implementing being higher compared to what they are already implementing owing to the lack of knowledge and capacity to deliver amongst other things. These findings corroborate with previous research

that was conducted in HEIs in SA and other developing countries. This confirms that there are challenges with regards to practicing GP in FM in HEIs, especially in developing countries.

5.5 Review of research methodology and limitations of the study

This section will review the research methodology that was employed in this study and the limitations that were encountered.

5.5.1 Review of research methodology

This study was carried out in the interpretivist philosophical manner because a historical background is required for understanding and interpreting the phenomenon being studied. An inductive reasoning approach was utilised through the multi-method of semi-structured interviews and observations that was used in a survey strategy.

The survey strategy was utilised for this study and respondents were selected from three public universities in SA. Semi structured interviews were conducted with four respondents from each university, totalling to twelve respondents. On site observations were also conducted in all three universities to support the interview data. The information provided by the respondents was transcribed into text format. Field notes from the observation process were also transcribed. Microsoft (MS) Excel was utilised in the process of coding data and MS Word was utilised for organising coded data. The method of analysis was content analysis, which was used to examine patterns in the responses provided by the respondents and field notes. The findings from the interviews data were also triangulated by comparing them with data from literature and observations. A detailed research methodology was presented in Chapter 3.

Though a properly structured research methodology and design was employed for this study, there are however, some limitations that were encountered, and they are discussed in the next section.

5.5.2 Limitations of the study

The following limitations were encountered in the study and addressed as described below:

- The approach of this study is qualitative in nature. Therefore, the findings of the study cannot necessarily be generalised to all universities in SA. Leung (2015), mention that qualitative research studies are mostly intended to study a particular phenomenon in a specific context, therefore generalizability is not often expected in qualitative research findings;

  To improve the generalizability of the findings, the study was conducted in three universities in various provinces in SA as discussed in Section 3.3. The respondents also occupied various senior positions within FM and these improved generalisability as they are involved with GP in the same context but in different ways;
- Two out of three facilities managers from university 2 could not be interviewed as they had busy schedules and could not avail themselves for the interviews. As a result, their lack of input is unknown;

  In order to collect sufficient data relating to the two campuses that are managed by the two facilities managers who could not be interviewed, a project manager, an assistant director and an electrical engineer who are also involved in projects on those two campuses were interviewed;
- The data collection period was limited to a period of twelve months, starting from December 2017 to December 2018 as per the Ethics Clarence Certificate (Annexure C). Therefore, the findings may differ in future studies; and

  To anticipate what the findings could be in the future, one of the objectives of the study is to determine future plans to improve or increase GP practices in FM in HEIs. This objective also included identifying the timeframes set to achieve the future-plans including the strategies in place to materialise such plans.

5.6 Overview of the findings and implication of the findings

This section will summarise the main findings of the study and also highlight the importance of the implications of such findings.

5.6.1 Summary of the main findings

This subsection summarises the main findings of the research objectives. The research objectives were aimed at identifying GP practices in FM in HEIs.

The findings obtained show that current GP practices included energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste and they are implemented on a continuous basis. These GP practices were also found to be effective after being measured and monitored through methods such as BMS, utilising consultants and evaluating water and electricity bills. The findings also suggest that the current level of implementation is generally moderate and motivation to implement GP mostly emanate from the requirement to meet targets set by management, taking responsibility for the environment and savings on costs. Future-plans were found to include continuing with and improving on current GP practices. Planned improvements include; introducing organisational GP policies, allowing sufficient time to properly plan for new buildings, creating awareness amongst universities stakeholders about green initiative, conducting research on available and upcoming green initiatives and revising KPIs and KPAs so that more green initiatives can be achieved. Most of these plans are set to be achieved within the financial year ending in February 2019; with some initiatives taking 5 or more years. Most of them are anticipated to be funded by the universities themselves and some by the Department of Higher Education and Training. Overall, current GP practices are mostly associated with environmental-economic sustainability and a few are associated with environmental sustainability. The findings would have been much better if there were practices that also address social sustainability.

The findings discussed above have implications, especially because some of them are unsatisfactory, such as the current level of implementation of GP practices. Such implications will be discussed in detail in the following section.

5.6.2 Implication of the findings

HEIs activities and operations have a large adverse impact on the environment, as a result campus sustainability has become a concern globally (Pouya and Pouya, 2018). Most campus activities and operations involve high energy and water consumption, which result in the significant adverse impact on the environment. Zainordin and Ismail (2017), report that the two major issues regarding environmental factors in HEIs are reducing energy and water consumption.

It is reassuring to find that SA universities are practicing GP and that their practices include energy efficiency and water conservation. However, it is concerning that the level of GP implementation is still only at moderate levels and that funding constraints are still a major challenge in implementing green related projects.

Over $6 billion is spent annually on energy cost by the higher education sector and the highest energy consumers are buildings as they include laboratories and catering services (Van Geet et al. 2018). Universities have large numbers of buildings, including old buildings, and most of them were not built to be energy efficient hence, their high energy consumption. Gonzalez-Galvez et al. (2018), advise that university buildings should be able to display best practice in energy and water efficiency as they also serve as community centres.

The sources of fresh water that can be utilised by human beings have become limited due to climate change and the rapid increase in population which lead to increased demands for water (Das, Bera and Moulick, 2015). This can be addressed through water efficiency innovations as they involve reducing the usage of freshwater and its wastage.

Some parts of the world have already started experiencing water shortages. Moglia, Cook and Tapsuwan (2018), report that California in the United States experienced a severe draught that limited the availability of water to support its large population and an extended draught in Cape Town, SA posed the possibility of day zero where potable water supply will run-out. Water scarcity has dire consequences; therefore, universities should expedite the implementation of additional and improved water efficiency projects.

Climate change is worsening; therefore, universities should strive to improve their level of implementation of GP practices by improving and increasing their current GP practices. Practices that address social sustainability should also be included so that all three spheres of sustainability can be addressed. Universities should also strive to transform into sustainable campuses and implementing GP can assist them to successfully transform. Pouya and Pouya (2018), mention that a sustainable university should maintain a healthy environment including minimum adverse impact on the environment through energy efficiency, waste reduction, biodiversity protection, using environmentally friendly materials and through efficient environmental management. Therefore, if all universities across the globe become sustainable universities, the environmental impact can be reduced significantly.

5.7 Recommendations

Though the findings of the study confirm that GP is being practised in universities in SA, it is clear from the implications of the findings discussed in Section 5.6.2 that there is still a challenge with the level of implementation of GP practices as it is unsatisfactory. It is therefore recommended that universities strengthen their commitment to implementing more GP practices and materialising their future-plans for GP practices within the set timeframes. Practices that address social sustainability should also be prioritised as the current practices mainly address environmental-economic sustainability.

Financial constraints are a major challenge to the implementation of GP practices in FM in universities. As a result, universities have a higher amount of GP practices that they wish to be implementing compared to what they are actually implementing. To aid in improving the level of implementation, it is recommended that HEIs source funding sponsorship from the private sector as this may assist to alleviate the financial pressures that most universities are experiencing. Universities should also find ways to reinvest savings from green projects into funding more sustainability initiatives such as those related to energy efficiency and water conservation.

High energy and water consumptions were also posed as the major challenges that universities face. Universities have large numbers of buildings that they operate daily; therefore, high energy and water consumptions are inevitable. However, they have to mitigate the situation. It is recommended that universities continue with the implementation of current GP practices, especially those related to energy efficiency and water conservation. They should also strive to increase and improve on current GP practices, especially those related to conserving water and energy.

5.8 Areas for future research

The following suggestions for future research are based on limitations encountered during the study and observations made from the results after the analysis of data from interviews and observations:

- Future research could employ a different research strategy such as mixed methods instead of qualitative approach in order to improve generalizability of the findings;
- This study could be repeated in a broader context that include all 26 public universities in SA as findings might differ; and
- A comparative study could also be conducted in order to benchmark SA universities against African universities and universities in similar regions of the world.

5.9 Conclusion

The study focused on identifying the actual GP practices in FM in SA universities. In order to achieve the objectives of the study, exploratory questions were established as the researcher wanted to gain a deeper understanding of the research problem, emanating from the literature which suggests that GP is practiced in HEIs across the world, however the details of such practices are limited especially in the context of SA universities. The study was qualitative in nature and employed face-to-face and telephonic semi-structured interviews including direct observations that were conducted in three universities in SA.

The findings revealed that current GP practices in SA universities include energy efficiency, water conservation, innovative building designs, energy efficiency on HVAC, sustainable landscaping, BMS and recycling of waste. These practices are mostly implemented on a continuous basis and have been found to be effective after being measured and monitored. Meeting targets set by management was also found to be the biggest motivator for implementing GP. However, the level of implementation of GP practices was found to be moderate. The gradual progress in the level of implementation could be associated with the lack of funding as it was highlighted as a hindrance by respondents. However, the strategies to achieve future-plans on improving and increasing GP practices involve several methods to make funding available.

References

Adams, C.A. (2013). Sustainability reporting and performance management in universities: Challenges and benefits. *Sustainability Accounting, Management and Policy Journal,* 4(3), pp. 384-392.

Adamu, A.D., and Shakantu, W. (2016). A concept: Strategic maintenance management for built facilities of universities. *In Proceedings of the 9th cidb Postgraduate Conference: Emerging Trends in Construction Organisational Practices and Project Management Knowledge Areas*. Cape Town: pp. 135-141.

Agyepong, A.O., and Nhamo, G. (2017). Green procurement in South Africa: perspectives on legislative provisions in metropolitan municipalities. *Environ Dev Sustain*, 19(6), pp. 2457-2474.

Aigbavboa, C.O., Oke, A.E., and Edward, L.D. (2018). Improving sustainable construction practices through facilities management. In J. Calautit, F. Rodrigues, H. Chaudhry, H. Altan, eds, *Towards Sustainable Cities in Asia and the Middle East*. New York: Springer International Publishing, pp. 30-39.

Aila, F.O., and Ototo, R.N. (2018). Sustainable procurement concept: Does it all add up? *International Journal of Development and Sustainability*, 7(2), pp. 448-457.

Akshey, B., Swati, B., and Disha, B. (2018). Green buildings - A step towards environmental protection. *Journal of Waste Recycling*, 3(1:7). [online] Available at: http://www.imedpub.com/articles/green-buildings--a-step-towardsenvironmental-protection.pdf [Accessed 03 January 2019].

Aleixo, A.M., Azeiteiro, U., and Leal, S. (2018). The implementation of sustainability practices in Portuguese higher education institutions. *International Journal of Sustainability in Higher Education*, 19(1), pp. 146-178.

Alshuwaikhat, H.M., Adenle, Y.A., and Saghir, B. (2016). Sustainability assessment of higher education institutions in Saudi Arabia. *Sustainability*, 8(8), 750, https://doi.org/10.3390/su8080750.

Aminuddin, A.S.A., and Nawawi, M.K.M. (2015). Investigation of the philosophy practiced in green and lean manufacturing management. *International Journal of Customer Relationship Marketing and Management*, 4(1), DOI: 10.4018/jcrmm.2013010101.

Asbollah, A.Z., Isa, N.M., and Kamaruzzaman, S.N. (2016). Sustainability and the facilities management in Malaysia. *MATEC Web of Conferences*, 66, 00085, https://doi.org/10.1051/matecconf/20166600085.

Ashour, M. (2018). Triangulation as a powerful methodological research technique in technology-based service. *BMIJ*, 6(1), pp. 193-208.

Asmone, A. S., and Chew, M. Y. L. (2016). Sustainable facilities management and the requisite for green maintainability. *In Proceedings of the SMART Facilities Management Solutions Regional Focus Group Session*. Singapore. [online] Available at: https://www.researchgate.net/publication/308777626_Sustainable_facilities_management_and_the_requisite_for_green_maintainability [Accessed 13 March 2018].

Awang, M., Mohammad, A.H., Sapri, M., Rahman, M.S.A., and Lah, N.M.I.N. (2014b). Measurement of facility management competencies in higher education institution. *Jurnal Teknologi*, 71(4), pp. 145-157.

Awang, M., Mohammad, M., Sapri, M.B., and Rahman, M.S.A. (2014a). Requisite facilities management competencies for sustainable development at higher education institutions. *Journal of Sustainability Science and Management*, 9(2), pp. 71-89.

Awuzie, B., and Emuze, F. (2016a). Barriers to the sustainable procurement of built university assets in Sub-Saharan Africa. *In Proceedings of the International Conference on Infrastructure Development in Africa*. [online] Available at: http://ir.cut.ac.za/bitstream/handle/11462/1215/ICIDA-2016_Conference%20Proceedings1.pdf?sequence=1&isAllowed=y [Accessed 20 June 2017].

Awuzie, B., and Emuze, F. (2016b). Enabling sustainable procurement of built assets in African universities: Perspectives of facilities' directors. *Journal of Construction Project Management and Innovation*, 6(SI), pp. 1548-1562.

Azorin, J.M., and Cameron, R. (2010). The application of mixed methods in organisational research: A literature review. The *Electronic Journal of Business Research Methods,* 8(2), pp. 95-105.

Baaki, T.K., Baharum, M.R., and Ali, A.S. (2016). A review of sustainable facilities management knowledge and practice. *MATEC Web of Conferences*, 66, 00075, https://doi.org/10.1051/matecconf/20166600075.

Babiak, J., and Vagiannis, G. (2015). Thermally activated building system (TABS): Efficient cooling and heating of commercial buildings. *In Proceedings of the Climate 2015 France*. [online] Available at: https://www.researchgate.net/publication/281968993_Thermally_Activated_Building_System_TABS_Efficient_cooling_and_heating_of_commercial_buildings [Accessed 10 September 2018].

Badin, Z.A., Bohari, A.A.M., Rais, S.L.A., and Saferi, M.M. (2018). Green related practices for construction procurement. *IOP Conference Series: Earth and Environmental Science*, 140, 012099, https://doi.org/10.1088/1755-1315/140/1/012099.

Bantanur, S., Mukherjee, M., and Shankar, R. (2012). Sustainability practices and leadership in higher education institutes of India. [online] Available at: https://www.researchgate.net/publication/259569358_Sustainability_Practices_and_Leadership_in_Higher_Educational_Institutes_of_India [Accessed 10 September 2018].

Baxter, P., and Jack, S. (2008). Qualitative case study methodology: study design and implementation for novice researchers. *The qualitative report,* 13(4), pp. 544-559.

Bengtsson, M. (2016). How to plan and perform a qualitative study using content analysis. *NursingPlus open*, 2(2016), pp. 8-14.

Bohari, A.A.M., and Xia, B. (2015). Developing green procurement framework for construction projects in Malaysia. *In Proceedings* of the *6th International Conference on Engineering, Project, and Production Management*. Australia: Griffith School of Engineering, pp. 282-290.

Bohari, A.A.M., Skitmore, M., Xia, B., and Teo, M. (2017). Green oriented procurement for building projects: Preliminary findings from Malaysia. *Journal of Cleaner Production*, 148(1 April 2017), pp. 690-700.

Buniamin, S., Ahmad, N., Rauf, F.H.A., Johari, N.H., and Rashid, A.A. (2016) Green government procurement practices (GGP) in Malaysian public enterprises. *Procedia Economics and Finance*, 35(2016), pp. 27-34.

Calder, W., and Dautremont-Smith, J. (2009). Higher education: More and more laboratories for inventing a sustainable future. In: J.C. Dernbach, ed. *Agenda for a Sustainable America*. Washington: ELI Press, pp. 93-107.

Cao, Y., Wang, C., Wei, J., and Pan, X. (2018). Health building management system based on business intelligent. *In Proceedings of the 2nd International Conference on Data Mining, Communications and Information Technology (DMCIT 2018)*. Shanghai: 1060, 012011 doi :10.1088/1742-6596/1060/1/012011.

Ciesielska, M., Boström, K.W., and Ohlander, M. (2018). Observation methods. *Qualitative methodologies in organizational studies*, pp. 33-52.

Clarke, A. (2006). The campus environmental management system cycle inn practice: 15 years of environment management, education and research of Dalhousie University. *International Journal of Sustainability in Higher Education*, 7(4), pp. 374-389.

Crespo, B., Miguez-Álvarez, C., Arce, M.E., Cuevas, M., and Miguez, J.L. (2017). The sustainable development goals: An experience on higher education. *Journal of Sustainability*, 9(8), 1353, https://doi.org/10.3390/su9081353.

Darvishpour, A., Joolaee, A., and Cheraghi, M.A. (2014). A meta-synthesis study of literature review and systematic review published in nurse prescribing. *Medical journal of the Islamic republic of Iran*, 28(77), pp. 1-12.

Denscombe, N. (2010). The good research guide: For small-scale social research projects. McGraw-Hill International.

Diab, S.M., Al-Bourini, F.A., and Abu-Rumman, A. H. (2015). The impact of green supply chain management practices on organizational performance: A study of Jordanian food industries. *Journal of Management and Sustainability*, 5(1), pp. 149-157.

Djordjevic A., and Cotton, D.R.E. (2011). Communicating the sustainability message in higher education institutions. *International Journal of Sustainability in Higher Education*, 12(4), pp. 381-394.

Elikplim, E. (2019). What are the Largest Universities in South Africa? [online] Available at: https://africavarsities.com/largest-universities-in-south-africa/ [Accessed 29 June 2020].

Elliot, H., and Wright, T. (2013). Barriers to sustainable universities and ways forward: A Canadian students' perspective. *In Proceedings of the 3rd World Sustainability Forum*. [online] Available at: https://www.researchgate.net/profile/Heather_Elliott2/publication/269203082_Barriers_to_Sustainable_Universities_and_Ways_Forward_A_Canadian_students_Perspective/links/572a469f08ae2efbfdbc1d24/Barriers-to-Sustainable-Universities-and-Ways-Forward-A-Canadian-students-Perspective.pdf [Accessed 02 August 2018].

Elmualim, A., Valle, R., and Kwawu, W. (2012). Discerning policy and drivers for sustainable facilities management practice. *International Journal of Sustainable Built Environment*, 1(1), pp. 16-25.

Elo, S., and Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, 62(1), pp. 107-115.

Erlingsson, C., and Brysiewicz, P. (2017). A hands-on guide to doing content analysis. *African journal of emergency medicine*, 7(2017), pp. 93-99.

Ezani, N.S.N., Alias, A.H., Azami, I.C., Hassim, S., and Haron, N.A. (2018). Sustainability: Assessment of green procurement implementation in the construction industry of Malaysia. *AIP Conference Proceedings,* 2020(1), 020062, https://doi.org/10.1063/1.5062688.

Felix, C., Zivanai, O., and Friend, K. (2016). Factors that affect green procurement implementation in the manufacturing industry: A case of Harare firms in Zimbabwe. *The International Journal of Business and Management,* 4(3), pp. 215-220.

Filho, W.L., Shiel, C., and do Paço, A. (2015). Integrative approach to environmental sustainability at universities: An overview of challenges and priorities. *Journal of Integrative Environmental Sciences,* 12(1), pp. 1-14.

Fuentes-Bargues, J.L., Ferrer-Gisbert, P.S., and González-Cruz, M.C. (2018). Analysis of green public procurement of works by Spanish public universities. *International Journal of Environmental Research and Public Health*, 15(9), 1888, https://doi.org/10.3390/ijerph15091888.

Ghazi, A.N., Petersen, K., Reddy, S., and Nekkanti, H. (2018). Survey research in software engineering: Problems and mitigating strategies. 6(2018), pp. 1-16.

González-Galvez, O., Morales, M., Seefoó, C., Morillón, D., and Valdes, H. (2018). Energy diagnosis of university buildings: Renewal energy institute from UNAM. *Buildings*, 8(1), 136, https://doi.org/10.3390/buildings8100136.

Guthrie, J. (2006). Content analysis as a research method to enquire into social and environmental disclosure: What is new? *Journal of accounting and business law*, 1(1), pp. 3-7.

Hamdan, M., Shaalan, A., and Al-Asfar, J. (2018). Solar window for hot domestic water and passive design. *International Journal of Mechanical and Production Engineering*, 6(6), pp. 24-27.

Hassan, S., Ramli, S.H., Roslan, R., and Jaafar, J. (2015). Supplier performance management at higher education institutes. *Procedia Economics and Finance*, 31(2015), pp. 671-676.

Hofstee, E. (2006). Constructing a good dissertation. Sandton: EPE.

Hussey, J., and Hussey, R. (1997). Business research. A practical guide for undergraduate and postgraduate students. London: Macmillan.

Ibrahim, M. (2015). The art of data analysis. *Journal of Allied Health Sciences Pakistan*, 1(1), pp. 98-104.

Imperial College London. (2010). Sustainable Procurement Initiatives 2009/10. [online] Available at: https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/estates-facilities/public/sustainability/sustainable-procurement.pdf [Accessed 28 April 2017].

Ivascu, L., Mocan, M., Draghici, A., Turi, A., and Rus, S. (2015). Modelling the green supply chain in the context of sustainable development. *Procedia Economics and Finance*, 26(2015), pp. 702-708.

Kabir, S.M.S. (2018). Methods of data collection. *Basic guidelines for research,* pp. 201-276.

Kahanaali, R.A., Khaksar, E., and Abbaslu, L. (2015). The impact of green procurement on consequences of green supply chain management. *International Journal of Operations and Logistics Management*, 4(1), pp. 1-13.

Kawulichi, B. (2012). Collecting data through observations. *Research methods pedagogy*, pp. 1-20.

Khan, M.W.A.K., Ting, N.H., Kuang, L.C., Darun, M.R., Mehfooz, U., and Khamidi, M.F. (2018). Green procurement in construction industry: A theoretical perspective of enablers and barriers. *MATEC Web of Conferences*, 203(2015), 02012, doi.org/10.1051/matecconf/201820302012.

Kivunja, C., and Kuyini, A.B. (2017). Understanding and applying research paradigms in educational context. *International journal of higher education*, 6(5), pp. 26-41.

Krarti, M. (2008). Energy efficient systems and strategies for heating, ventilating, and air conditioning (HVAC) of buildings. *Journal of Green Building*, 3(1), pp. 44-55.

Kumar, R. (2011). Research methodology a step to step guide for beginners. 3rd ed. London: SAGE Publishing.

Leedy, P., and Ormrod, J. (2016). Practical Research: Planning and Design. 11th Ed. London: Pearson.

Lemon, L.L., and Hayes, J. (2020). Enhancing trustworthiness of qualitative findings: Using Leximancer for qualitative data analysis triangulation. *The qualitative report*, 25(3), pp. 604-614.

Leung, L. (2015). Validity, reliability, and generalizability in qualitative research. *Journal of Family Medicine and Primary Care*, 4(3), pp 324-327.

Lo, K. (2015). Campus sustainability in Chinese higher education institutions: Focuses, motivations and challenges. *International Journal of Sustainability in Higher Education*, 16(1), pp. 34-43.

Lundberg, S., and Marklund, P.O. (2018). Green public procurement and multiple environmental objectives. *Economia e Politica Industriale*, 45(1), pp. 37-53.

Mafini, C., and Loury-Okoumba, W.V. (2018). Extending green supply chain management activities to manufacturing small and medium enterprises in a developing economy. *South African Journal of Economic and Management Sciences*, 21(1), http://dx.doi.org/10.4102/sajems.v21i1.1996.

Maistry, N., and McKay, T.M. (2016). Promoting energy efficiency in a South African university. *Journal of Energy in South Africa*, 27(3). [online] Available at: http://www.scielo.org.za/pdf/jesa/v27n3/01.pdf [Accessed 20 January 2018].

Manjula, N.H.C., Dissanayake, D.M.P.P., and Rajini, P.A.D. (2015). ICSECM 2015 - Facilities management approaches for sustainability. *In Proceedings of the 6th International Conference on Structural Engineering and Construction Management*. Sri Lanka: pp. 187-193.

Marshall, C., and Rossman, G.B. (2011). Designing qualitative research. 5th ed. California: SAGE Publications.

Masete, M.Z., and Mafini, C. (2018). Internal barriers to supply chain management implementation in a South African traditional university. *Journal of Transport and Supply Chain Management*, 12(1), pp. 1-12.

Masoumik, S.M., Abdul-Rashid, S.H., Olugu, E.U., and Ghazilla, R.A.R. (2015). A strategic approach to develop green supply chains. *Procedia CIRP*, 26(2015), pp. 670-676.

McLeod, F., Cherrett, T., Bailey, G., Allen, J., Browne, M., Leonardi, J., Aditjandra, P., and Zunder, T. (2015). *Sustainable procurement for greener logistics in the higher education sector*. [online] Available at: https://www.researchgate.net/profile/Jacques_Leonardi/publication/282980958_Sustainable_

Procurement_for_Greener_Logistics_in_the_Higher_Education_Sector/links/5625712708aeabddac91cd6c.pdf [Accessed 05 May 2018].

Meehan, J., and Bryde, D.J. (2011). Sustainable procurement practice. *Business Strategy and the Environment*, 20(2), pp. 94-106.

Melville, S., and Goddard, W. (1996). Research methodology. Cape Town: Juta.

Memon, I.A., Qureshi, S., Soomro, M., Shah, S., and Pathan, M.A. (2018). Oreils (Jharokha) as passive design strategy for energy efficiency. *International Research Journal of Innovations in Engineering and Technology*, 2(6), pp. 15-19.

Meyer, D.Z., and Avery, L. (2008). Excel as a qualitative data analysis tool, doi:10.1177/1525822X08323985.

Moglia, M., Cook, S., and Tapsuwan, S. (2018). Promoting water conservation: Where to from here? *Water 2018*, 10(11), https://doi.org/10.3390/w10111510.

Mohajan, H. (2017). Two Criteria for good measurements in research: validity and reliability. *Annals of Spiru Haret University,* 17(3), pp. 58-82.

Muraguri, E.E., Waweru, E., and Musyimi, P.K. (2015). Application and practice of sustainable procurement in Kenya. *International Journal of Innovative Science, Engineering and Technology*, 2(12), pp. 289-299.

Myers, M. (2009). Qualitative research in business and management. London: Sage Publication.

Nderitu, M.K., and Ngugi, K. (2014). Effects of green procurement practices on an organization performance in manufacturing industry: Case study of East African breweries limited. *European Journal of Business Management*, 2(1), pp. 341-352.

Nelson Mandela University (2014). NMMU Green Business School building a first for Africa. [online] Available at: https://sustainability.mandela.ac.za/News-and-Current-Projects/Operations/NMMU-Green-Business-School-building-a-first-for-Af [Accessed 02 January 2019].

Nieuwenhuis, J. (2013). Introducing qualitative research. First steps in research. Pretoria: Van Schaik Publishers.

Nobel, H., and Smith, J. (2015). Issues of validity and reliability in qualitative research. *Evidence based nursing*, 18(12), pp. 34-35.

Noor, M.N.M., and Pitt, M. (2008). Defining facilities management (FM) in the Malaysian perspective. [online] Available at: https://eres.org/eres2010/contents/papers/id2.pdf [Accessed 05 October 2018].

Ochieng, M.M., Oginda, M., and Oteki, E.B. (2016). Analysis of sustainable procurement practices and the extent of integration in Lake Victoria South Water Services Board, Kenya. *IOSR Journal of Business and Management*, 18(3), pp. 109-115.

Olanipekun, A.O. (2015). Successful delivery of green building projects: A review and future directions. *Journal of Construction*, 8(1), pp. 31-40.

Olanrewaju, A.L. (2010). Quantitative analysis of criteria in university building maintenance in Malaysia. *Australian Journal of Construction Economics and Building*, 10(3), pp. 51-61.

Olanrewaju, AL., Khamidi, M.F., and Idrus, A. (2010). Building maintenance management in a Malaysian University campuses: A case study. *The Australian Journal of Construction Economics and Building*, 10(1/2), pp. 101-114.

Ose, S.O. (2016). Using Excel and Word to structure qualitative data. *Journal of Applied Social Science*, pp. 1-16, https://doi.org/10.1177/1936724416664948.

Palanichamy, C. (2016). A solar plant for Curtin University Malaysia. *IOP Conference Series: Material Science and Engineering*, 121(2016), 012012, doi:10.1088/1757-899X/121/1/012012.

Peprah, J.A., Brako, S., and Akosah, N.B. (2018). The awareness level of green procurement at the district assemblies in west region in Ghana. *Journal of Manufacturing and Sustainability*, 8(1), pp 46-58.

Ponto, J. (2015). Understanding and evaluating survey research. *Translating research into practice*, 6(2), pp. 168-171.

Pouya, S., and Pouya, S. (2018). Sustainable landscaping in Istanbul Technical University. *Turkish Journal of Forest Science*, 2(1), pp. 98-114.

Puukka, J. (2008). Mobilising higher education for sustainable development - lessons learnt from the OECD study. *In Proceedings of the 4th International Barcelona Conference on Higher Education*. Global University Network for Innovation. [online] Available at: https://core.ac.uk/download/pdf/41783514.pdf [Accessed 20 August 2018].

Quinlan, C. (2011). Business research methods. United Kingdom: South-Western Cengage Learning.

Rahi, S. (2017). Research design and methods: A systematic review of research paradigms, sampling issues and instruments development. *International Journal of Economic and Management Sciences*, 6(2), 1000403, DOI: 10.4172/2162-6359.1000403.

Rais, S.L.A., Badin, Z.A., Bohari, A.A.M., and Saferi, M.M. (2018). The possible challenges of green procurement implementation. *IOP International Conference Series: Materials Science and Engineering*, 429(2018), 012023, doi:10.1088/1757-899X/429/1/012023.

Rammel, C., Velazquez, L., and Mader, C. (2015) Sustainability assessment in higher education institutions - What and how? In: M. Barth, G. Michelsen, M. Rieckmann, I. Thomas, eds., *Routledge Handbook of Higher Education for Sustainable Development*. London: Routledge, pp. 331-346.

Saferi, M.M., Bohari, A.A.M., Bidin, Z.A., and Rais, S.L.A. (2018). Green procurement for construction project: The roles of stakeholder values. *IOP International Conference Series: Materials Science and Engineering*, 429(2018), 012024, doi:10.1088/1757-899X/429/1/012024.

Sahay, A. (2017). *The dilemma of doctoral students in management: Positivism or Interpretivism*. [online] Available at: https://www.researchgate.net/publication/314948747_The_Dilemma_of_Doctoral_Students_in_Management_Positivism_or_Interpretivism [Accessed 03 January 2019].

Salvioni, D.M., Franzoni, S., and Cassano, R. (2017). Sustainability in the higher education system: An opportunity to improve quality and image. *Sustainability 2017*, 9(6), 914, https://doi.org/10.3390/su9060914.

Sanchez, A.X., Lehtiranta, L., Hampson, K.D., and Kenley, R. (2014). Evaluation framework for green procurement in road construction. *Smart and Sustainable Built Environment*, 3(2), pp. 153-169.

Sapri, M., and Muhammad, S. (2010). Monitoring energy performance in higher education buildings for sustainable campus. *Malaysian Journal of Real Estate*, 5(1), pp. 18-25.

Saunders, M., Lewis, P., and Thornhill A. (2016). *Research methods for business students.* 7th ed. London: Pearson.

Shriberg, M. (2002). Institutional assessment tool for sustainability in higher education: Strengths, weaknesses, and implications for practice and theory. *Higher Education Policy*, 15(2), pp. 153-167.

Smit, B., and Onwuegbuzie, A.J. (2018). Observations in qualitative inquiry: When what you see is not what you see. *International journal of qualitative methods,* 17(1), pp. 1-3.

Snyder, H. (2019). Literature review as a research methodology: An overview and guidelines. *Journal of business research*, 104(2019), pp. 333-339.

Sourani, A., and Sohail, M. (2011). Barriers to addressing sustainable construction in public procurement strategies. *Proceedings of the Institution of Civil Engineers: Engineering Sustainability*, 164(4), pp. 229-237.

Stewart, M. (2010). Transforming higher education: A practical plan for integrating sustainability education into the student experience. *Journal of Sustainability Education*, 1(May 2010), pp. 195-205.

Struwig, M., Smit, G., and Van Wyk, J. (2014). Green building guidelines at South African universities. *Journal of Clean Energy Technologies*, 2(3), pp. 210-215.

Taemthong, W., and Phenphon, P. (2017). Greywater recycling system for a university building: A case study in Thailand. *International Journal of Environmental Science and Development*, 8(6), pp. 421-424.

Taherdoost, H. (2016). Sampling methods in research methodology; How to choose a sampling technique for research. *International journal of academic research in management,* 5(2), pp. 18-27.

Tampereen Yliopisto. (n.d.). The University of Tampere sustainable development action plan *(SDAP) 2012-2015*. [online] Available at: http://www.uta.fi/ekokampus/en/program/SDAP_University_2012.pdf [Accessed 25 September 2018].

Tariq, W., Mustafa, A., Rasool, Z., Haseeb, S.M., Ali, S.M., Mustafa, A. Khan, S., and Warsi, S.I. (2012). Building management system for IQRA University. *Asian Journal of Engineering, Sciences and Technology*, 2(2), pp. 106-109.

Telesford, J.N. (2010). Towards best practices in facilities management (FM): Incorporating sustainability into FM at the Caribbean Higher Education Institute (HEI) of the future. *Journal of Education and Development in the Caribbean*, 12(1), pp. 54-73.

Tramontin, V., and Moodley, V. (2016). Sustainability and education: Towards improving energy efficiency in building through higher education. *Journal of Construction*, 9(1), pp. 20-28.

Tramontin, V., Loggia, C., and Trois, C. (2012). Strategies for sustainable building design and retrofit in developing countries. New goals for green buildings in South Africa. *Journal of Construction*, 5(1), pp. 12-17.

Tramontin, V., Naicker, T., Loggia, C., and Trois, C. (2014). A methodological framework related to international best practices towards greening affordable housing in South Africa. *Journal of Construction*, 10(1), pp. 24-31.

University of Pretoria. (2014). *U*niversity of Pretoria Department of Facilities Management Environmental *Policy*. [online] Available at: http://www.up.ac.za/media/shared/409/Webcenter%20Content/uppr097031_environmental-policy.zp89786.pdf [Accessed 05 February 2018].

University of Westminster (2016) Sustainable procurement policy & strategy. [online] Available at: https://www.westminster.ac.uk/file/33016/download [Accessed 25 September 2018].

Van Geet, O.D., Polly, B.J., Pless, S., Heeter, J.S., and Shepherd, R. (2018). Zero energy university campuses: A 2018 progress update on reaching campus energy goals. *In Proceedings of the 2018 ACEEE Summer Study on Energy Efficiency in Buildings*. California: Omnipress, pp. 10-1 – 10-16.

Van Weenen, H. (2000). Towards a vision of a sustainable university. *International Journal of Sustainability in Higher Education*, 1(1), pp. 20-34.

Vaughter, P., Wright, T., and Herbert, Y. (2015). 50 Shades of green: An examination of sustainability policy on Canadian campuses. *Canadian Journal of Higher Education*, 45(4), pp. 81-100.

Velazquez, L., Munguia, N., and Sanchez, M. (2005). Deterring sustainability in higher education institutions: An appraisal of the factors which influence sustainability in higher education institutions. *International Journal of Sustainability in Higher Education*, 6(4), pp. 383-391.

Visagie, L.A., and Cloete, C.E. (2012). Energy-efficiency of South African retail properties. *Journal of Construction*, 5(1), pp. 18-23.

Wallace, A., and Omachar, A.E. (2016). Effects of green procurement practices on operational efficiency at Kenya Airways limited, Kenya. *Imperial Journal of Interdisciplinary Research (IJIR)*, 2(7), pp. 69-87.

Weng, H.H., Chen, J.S., and Chen, P.C. (2015). Effects of green innovation on environmental and corporate performance: A stakeholder perspective. *Sustainability 2015*, 7, pp. 4997-5026.

Wiersma, W., and Jurs, S.G. (2009). Research methods in education: An introduction. 9th ed. London: Pearson.

Williams, C. (2007). Research methods. *Journal of Business and Economic Research*, 5(3), pp. 65-72.

Woiceshyn, J., and Daellenbach, U. (2018). Evaluating inductive vs deductive research in management studies: Implications for authors, editors and reviewers. *Qualitative research in organisations and management: An international journal*, 13(2), pp. 183-195.

Yin, R. (1994). Case study research: Design and methods. 2nd ed. Los Angeles: SAGE Publishing.

Yin, R. (2014). Case study research: Design and methods. 5th ed. Los Angeles: SAGE Publishing.

Yin, RK. (2003). Case study research: Design and methods. *Volume 5 of applied social research methods series.* USA: Sage Publication.

Young, S., Nagpal, S., and Adams, C.A. (2015). Sustainable procurement in Australian and UK universities. *Public Management Review*, 18(7), pp. 993-1016.

Yu, M., Wiedmann, T., Crawford, R.H., and Tait, C. (2017). The carbon footprint of Australia's construction sector. *Procedia Engineering*, 180, pp. 211-220.

Zainordin, N., and Ismail, S. (2017). Sustainability assessment for higher education institutions: A literature review. [online] Available at: https://www.researchgate.net/profile/Sr_Nadzirah_Zainordin2/publication/320798700_Sustainability_Assessment_for_Higher_Education_Institutions_A_Literature_Review/links/5a67c9bd0f7e9b76ea8f0a56/Sustainability-Assessment-for-Higher-Education-Institutions-A-Literature-Review.pdf [Accessed 15 May 2018].

Zakaria, I.B., Hashim, S.Z., and Ahzahar, N. (2018). Critical success factor for sustainable facilities management: A review of literature. *International Journal of Academic Research in Business and Social Sciences*, 8(7), pp. 469-480.

Annexure A





Consent to Participate in a Research Study

Introduction of the researcher

Good day

My name is Ndivhuwo Nethengwe and I am a student at the University of the Witwatersrand (Wits) studying towards my Master degree in Construction Project Management and I am being supervised by Associate Professor Obinna Ozumba. I am inviting you to participate in my research on assessing the practise of green procurement in facilities management at higher education institutions. The aim of the study is to determine the level of green procurement practises in facilities management at higher education institutions. It is important to do this research because the findings may provide an indication on how much effort is still required to reduce carbon emission through infrastructure projects by practising green procurement in facilities management at higher education institutions.

You have been selected because you have experience in facilities management in a higher education institution and your professional opinion is of value to my study. The study will require you to be interviewed by myself via semi structured interview. Participation is entirely voluntary and the interview should not take more than 60 minutes. The interview will be arranged well in advance and not to interfere adversely with your schedule. With your permission the interview may be recorded in order to ensure accuracy. You may withdraw from participating at any time during the interview without any penalty. All participants will remain anonymous.

Only I and my supervisor Associate Professor Obinna Ozumba will have access to the raw data which will be stored in a locked file, and all electronic information will be coded and secured using a password protected file. You are welcome to contact me for further clarity.

Thank you for taking time to consider this invitation. Your participation will be greatly appreciated.

Researcher contact details:

Ndivhuwo Nethengwe, Cell no: 082 727 9100, Email: 1601580@students.wits.ac.za

Associate Professor Obinna Ozumba (Supervisor) Tel: 011 717 7654, Email: obinna.ozumba@wits.ac.za

Consent Form

Title of the Research

The practise of green procurement in facilities management at higher education institutions

Researcher

Ndivhuwo Nethengwe, Cell no: 082 727 9100, Email: 1601580@students.wits.ac.zaAssociate Professor Obinna Ozumba (Supervisor) Tel: 011 717 7654, Email: obinna.ozumba@wits.ac.za

Introduction of the Research

My research will be focusing on assessing the practise of green procurement in facilities management at higher education institutions. The aim of the study is to determine the level of green procurement practises in facilities management at higher education institutions. In simple terms, the purpose of the study is to determine the level of implementation of green procurement.

It is important to do this research because the findings may provide an indication on how much effort is still required to reduce carbon emission through infrastructure projects by practising green procurement in facilities management at higher education institutions.

Description of the Study Procedures

You have been selected to participate in this study because you have experience in facilities management in a higher education institution and your professional opinion is of value to my study. The study will require you to be interviewed by myself via semi structured interview. Participation is entirely voluntary and the interview should not take more than 60 minutes.

Risks/Discomforts of Being in this Study

There are no reasonable foreseeable (or expected) risks. There may be unknown risks.

Confidentiality

- This study is anonymous. I will not be reporting any information about your identity.
- The records of this study will be kept strictly confidential. Research records will be kept in a locked file and all electronic information will be coded and secured using a password protected file.
- The findings will be used for academic purposes only.
- None of your information will be given to anyone or any organization.
- Only I and my supervisor will have access to raw data (your information).
- Your information will be kept safe and confidential even after the research project is completed.

Payments

There will be no payments for participating in this study.

Right to Decline or Withdraw

Participation in this study is entirely voluntary. You may decline or withdraw from taking part in the study at any time without any penalty. You have the right not to answer any single

question, as well as to withdraw completely from the interview at any point during the process. You also have the right to request the interviewer not to use any of your interview material.

Reputation and institution damage

The researcher will ensure that there is no reputational or any institutional damage caused by this study when reporting on the findings.

Right to Ask Questions

If you have any further questions about the study please feel free to contact me (Ndivhuwo Nethengwe) at 1601580@students.wits.ac.za or by telephone on 082 727 9100. My supervisor may be contacted on Tel: 011 717 7654 or Email: obinna.ozumba@wits.ac.za

Consent

I the undersigned, ……..…… (full name) agree to participate in this research project. The research study has been explained to me and I understand what my participation will involve.

I agree that my participation will remain anonymous and I agree to participate in the interview.

Participant's signature: _____ Date:_____

Researcher's signature: _____ Date:_____

Annexure B





Semi Structured Interview Protocol Form

Institution name: _____

Interviewee Name: _____

Interviewee Position: _____

Interviewer Name: _____

Title of the Research

The practise of green procurement in facilities management at higher education institutions

Introductory Protocol

To facilitate my note-taking, I would like to audio tape our conversation today. Only I and my supervisor Associate Professor Obinna Ozumba will have access to the raw data which will be stored in a locked file, and all electronic information will be coded and secured using a password protected file. In addition, all information will be held confidential including your identity. Your participation is voluntary and you may stop at any time if you feel uncomfortable as I do not intend to inflict any harm.

May I kindly request you to grant me a formal consent in order for me to proceed with the interview. Please read through the consent letter/form, if you are comfortable with the contents kindly grant me consent by filling in and signing the consent form.

I have planned this interview to last no longer than 60 minutes. During this time, I have several questions that I would like to cover. If time begins to run short, it may be necessary to interrupt you in order to push ahead and complete this line of questioning.

Introduction

You have been selected to participate in this study because you have experience in facilities management in a higher education institution and your professional opinion is of value to my study. My research project as a whole focuses on the level of green procurement practises in facilities management at higher education institutions (level of implementation) and the institutions future plans to improve/increase the level of green procurement practices. It is important to do this research because the findings may provide an indication on how much effort is still required to reduce carbon emission through infrastructure projects by practising green procurement in facilities management at higher education institutions.

Interview questions

1. How long have you been in your current position at this institution?

2. Briefly describe your role with regards to green procurement practises in facilities management in this institution.

3. What are the actual green procurement practises in facilities management at your institution?

   Probe: how often are these practises implemented?

4. How do you monitor and measure the effectiveness and the level of implementation of green procurement practises in facilities management at your institution?

Probe: how effective is green procurement so far in your institution?

: What is the current level of implementation?

5. What motivates you/your institution to use innovative methods such as green procurement?

6. What are your institution's future plans on improving and increasing the practise of green procurement in facilities management?

   Probe: what are the time frames for such plans?

7. What is this institution's strategy to materialise the future plans mentioned in question 6 above?

Post Interview Comments and/or Observations:

Thank you for agreeing to participate in this study.

Annexure C

School of Construction Economics & Management

University of the Witwatersrand, Johannesburg -PO Box 20, Wits 2050, South Africa • Tel: +27 (0)11 717 7652/77669

· Fax: +27 (0)11 717 9729 Email:CEM@wits.ac.za

SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT RESEARCH ETHICS COMMITTEE

CLEARANCE CERTIFICATE PROTOCOL NUMBER CEM/17/12/NN1/MSC

PROJECT TITLE: The practice of green procurement in FM in HEI

INVESTIGATOR Ndivhuwo Nethengwe 1601580

SCHOOL/DEPARTMENT SCHOOL OF CONSTRUCTION ECONOMICS AND MANAGEMENT

DATE CONSIDERED 12/12/2017

DECISION OF THE COMMITTEE Approved conditionally with respect to the declaration and attached feedback

EXPIRY DATE 4th December 2018

DATE 4th December 2017

CHAIRPERSON_____

Dr. Kola Ijasan

cc: Supervisor: Associate Professor. O Ozumba

DECLARATION OF INVESTIGATOR

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

I fully understand the conditions under which I am/we are authorized to carry out the abovementioned research and I/we guarantee to ensure compliance with these conditions.

Should any departure to be contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the committee. **I agree to completion of a yearly progress report.**

_____ _____/_____/_____

Signature Date