# ACHIEVEMENT OF SUSTAINABLE AFFORDABLE HOUSING IN SOUTH AFRICA THROUGH EFFECTIVE IMPLEMENTATION OF PLANNING TECHNIQUES

**by**

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## DECLARATION

I, Adeola Olayinka Adekanbi, student number 218318235, declare that the content of this research is my unaided work, and this work has not been previously submitted towards obtaining any qualification; therefore, it represents my work and not that of the Cape Peninsula University of Technology.

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## ABSTRACT

Sustainable affordable housing is an essential housing delivery system in any nation to ensure access for all to adequate, safe and affordable housing for the achievement of Sustainable Development Goal (SDG) 11. Providing not just sustainable buildings but also affordable ones is necessary to serve the present generation and generation to come. However, constraints and challenges are impeding the success of project execution, and there is no doubt that the poor sustainability nature of the construction industry in most developing countries has been identified as contributing to these problems. This study, therefore, investigates the factors that will enhance the effective implementation of planning techniques during the delivery of sustainable affordable housing in South Africa. Drawing from a literature review and a mixed method inquiry approach these are quantitative data and qualitative data, primary data were collected using questionnaires administered to construction participants selected from construction firms. The data were captured and encoded using SPSS and subsequently analysed using descriptive (including means score, percentage and frequencies) and inferential statistics such as Kruskal-Wallis H-test.

The salient findings regarding the effect of construction constraints on the implementation of planning include fluctuation in prices of materials, late payments for completed work, and use of damaged and low-quality materials. Furthermore, the most significant planning techniques for achieving sustainable affordable housing delivery during the planning process include the following: regular monitoring of the progress of work; quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change; delegating work appropriately; and effective budget planning at tender stage. To improve sustainability and affordability in delivering housing projects, it is suggested that strict government policies and innovation of sustainable affordable-oriented methods of construction are necessary. These findings imply that the process of operations and execution of sustainable affordable housing for low-income earners can be fast-tracked through the implementation of effective planning techniques for achieving sustainable affordable housing. This could be a good driver of success.



**Keywords:** Construction industry, housing, planning techniques, South Africa, sustainable affordable housing

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## DEDICATION

I dedicate this thesis to Almighty God who made this programme a success: for his sustenance.

To my parents for their unwavering support and patience.

To Mr and Mrs Joseph Adelemi and Foluso Folake Adekanbi, in the toughest moments.

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## LIST OF ABBREVIATIONS

**SHRA:** Social Housing Regulatory Authority

**GEHS:** Government Employees Housing Scheme

**NHBRC:** National Home Builders Registration

**BNG:** Breaking New Ground

**DHS:** Department of Human Settlement

## DEFINITION OF TERMS

**Sustainable housing:** a house designed with sustainability that will meet the need of the present generation without compromising the ability of future generation to thrive (Omoregie & Adegbembo, 2018).

**Affordable housing:** Any type of housing that is rented or purchased within the financial capacity of a household (Wiesel & Davinson, 2012).

**Planning techniques:** This are type of techniques for deciding project activities, materials, duration, cost and relations between each activity to execute a project (Abdul Kareem, 2020).

# CHAPTER ONE

# INTRODUCTION

## 1.1 Preamble

The need of affordable housing is a global concern as it parallels the boom in population growth; that is, a lack of affordable housing is due to an increase in population growth that emanates from poverty. This is a widespread issue that is diminishing the quality of life of citizens. The only solution to this problem is sustainable housing. However, the affordability of these houses by an average income earner to own or rent is another concern (Goebel, 2007). Sustainable houses are expensive to construct because they enhance the lifecycle of the building. They increase property value while minimising energy consumption. But sustainable housing can be affordable depending on the type of building design approved for its execution (Genie belt, 2017).

New construction and retrofits of housing projects can reduce energy consumption and provide building comfort. In order to achieve affordable housing and avoid a larger homeless population, smaller house designs have been undertaken which require less material to build and use less energy use than normal-sized buildings (Di

kinson, 2018). However, Reddy (2016) suggests that through technological advancement techniques and innovative concepts such as solar energy and panels to reduce the cost of electricity, installation of high ceiling and big windows for lightning, housing might be both sustainable and affordable for low-income earners. Abulnour (2014) insists that the cost of construction should be controlled without compromising building designs through proper planning techniques. Affordability and sustainability are introduced through an excellent design and design team, and small government housing provisions: a home with a small floor area functions better than a home with larger floor area. Thus, sustainable design leads to affordable homes.

## 1.2 Background to the research problem

The provision of affordable housing has been an imperative task for the South African Government, primarily in urban areas, because of apartheid housing policies and rapid urbanisation (Goebel, 2007). Housing problems restrict economic growth as people struggle to have a viable place to live due to unaffordability of housing. The government has taken the vital steps to address racial housing inequalities, poor service delivery and urbanisation with the arrangement of housing policies such as the New Housing Vision and ‘Breaking New Ground’ (BNG) intended for improving housing provision. The Breaking New Ground policy supports a joint, non-racial society through the production of quality and affordable housing (Geertman, Allan, Petit & Stillwell, 2017). According to Finch (2017), the benefits of sustainable affordable housing include less waste, recycling, lower environmental impact and

cost, reliability, low maintenance and better user satisfaction. However, Hamizah, Fatimah and Hazlina (2013) contend that while the standard of sustainable housing is practicable in developed countries, it is difficult to implement in developing countries. It is claimed by some construction experts that despite an understanding and appreciation of the concept, the extent of its implementation is still slow and constraints of planning have caused difficulties in achieving sustainable affordable housing plan (Hamizah *et al.,* 2013).

Effective planning techniques are implemented with proper vision and mission statements for affordable housing achievement and accessibility for a community and through proper project management areas such as time management techniques, cost management, quality management, integration management leadership management, risk management, procurement management, human resource management However, there is a clear a need to implement effective planning towards achieving sustainable affordable housing in the South African housing sector for low-income earners dealing with housing issues – this is presently problematic for the country. There are factors to be considered regarding effective planning for achieving sustainable affordable housing in South Africa and planning tasks to be applied for a successful project. For instance, Mulliner and Maliene (2014) introduced the foundation of 'sustainable housing affordability' to establish a standard for sustainable affordable housing. The authors argue that affordable housing should not be secluded from other criteria such as location, social, environment and economic sustainability of the housing. Affordable housing, they contend, is not merely about cheap homes, but must incorporate other factors as well, like planning., it is vital to implement a platform of multiple housing development management systems, focused on construction methods, housing financing concepts and social integration, into an incorporated system of sustainability in construction works.

An affordable housing process has key factors such as accessibility measures for intending occupants, adequacy and quality, availability measures and affordability measures. appropriateness of the dwelling, housing and social mix, tenure choice, location, quality of environmental planning, and design and cost. In developing countries, such as South Africa, the low-income groups are generally unable to access the housing market. Consequently, cost effective housing is a feasible option through budgeting and reduced construction cost through better management, appropriate use of local materials, skills and technology but without sacrificing the performance and structure life (Ganiyu:2016 cited in Tam, 2011)

Sustainability of housing development provides emphasis to environmental, economic and social issue such as environmental problems, greenhouse gas emission and environmental pollution, mostly because of the materials, nature of design, construction techniques, locations and layout, physical structure and maintenace.(Ganiyu, 2016)

Observing an informal settlement in South Africa shows that the majority of rows of shacks are built of corroded metal and corrugated iron, arranged to form a housing structure. Cardboard plastics are used to support these structures. These kinds of settlements are susceptible to fire outbreak and flooding. Suffocating smoke from coal fires form a blurred cloud over these structures while the absence of basic sanitation creates a breeding ground for contagious and infectious diseases and the social difficulties that such situations produce confirm that the majority are still in need of sustainable affordable housing (Huchzermeyer, 2006).Against this background, this study will address the achievement of sustainable affordable housing in South Africa through effective implementation of planning techniques. This will be achieved by outlining the effective implementation of planning for achievement of sustainable affordable housing in terms of cost, time and quality.

### 1.3 Problem statement

Housing is an important element of human settlements, an elementary need impact significantly on quality of life, efficiency, health, security and wellbeing of an individual and families. However, a substantial population of people in developing countries are still experiencing housing problems emanating from lack of effective planning. Governments and private establishments are continuously taking steps to combat economic and social challenges originating from insufficient housing delivery, mostly in developing countries. These steps have come in the form of policies, regulations and reforms that have led to a variety of housing plans (Ibem & Amole, 2010). This racial segregation gave rise to economic and social detachment in urban places (Gardener, 2003). In this research, the housing problems faced by low-income earners in South Africa due to a lack of affordable and sustainable housing delivery will be addressed.

### 1.4 Research questions

The study's research questions are as follows:

- What are the effects of construction constraints in terms of time, cost and quality on the effective implementation of planning for sustainable affordable housing in South Africa?
- What is the influence of stakeholders during planning in providing sustainable affordable housing for low-income earners?
- What are the challenges of implementing planning for the achievement of sustainable affordable housing delivery?
- What framework describes the implementation of planning techniques for achieving sustainable, affordable housing in South Africa?
- What are the modalities of achieving sustainable affordable housing delivery during the planning process?

### 1.5 Aim and research objectives

The aim of the study is to identify the factors that will enhance the effective implementation of planning techniques during the delivery of sustainable affordable housing

The study's research objectives are as follows:

- To identify the effects of construction constraints on the implementation of planning techniques for achieving sustainable affordable housing in South Africa.
- To establish the influence of stakeholders during the planning process of providing sustainable affordable housing for low-income earners.
- To identify the challenges of implementing planning techniques for the achievement of sustainable affordable housing.
- To establish a framework that will ensure an effective implementation of planning techniques for the achievement of sustainable affordable housing in South Africa.

To ascertain the modalities of achieving sustainable affordable housing delivery during the planning process

### 1.6 Hypotheses

The following are the hypotheses of the study:

**H1:** There is no statistical difference in the perception of construction practitioners on the effects of construction constraints on the implementation of planning techniques for achieving sustainable affordable housing in South Africa.

**H2:** There is no statistical difference in the perception of construction practitioners on the influence of stakeholders during the planning process providing sustainable affordable housing for low-income earners.

**H3:** There is no statistical difference in the perception of construction practitioners on the challenges of implementing planning techniques for the achievement of sustainable affordable housing.

**H4:** There is no statistical difference in the perception of construction practitioners on modalities of achieving sustainable affordable housing delivery during the planning process.

### 1.7 Significance of study

Many developers are reluctant to embrace sustainable housing projects due to limited understanding and the pursuit of cost reduction in developing countries such as South Africa, a situation ascribed to the non-inclusion of cost parameters in sustainability evaluation assessment tools, as noted in Ding (2008). The study establishes a framework for developing sustainable affordable housing for low-income earners using planning techniques. This study, therefore, contributes significantly to the current discourse regarding effective implementation of planning techniques in affordable housing construction to bridge the gaps of previous research and present an approach for providing sustainable affordable housing, a critical necessity as the demand currently exceeds its supply. In addition,

this study develops robust housing construction sustainable affordable planning techniques. This would facilitate the decision-making process for resource providers to housing developers and to end users in construction of sustainable affordable housing to enhance the economic wellbeing of end users. This research is also important for improving housing system through sustainable and affordable housing system in South Africa by giving insight to the planning techniques and implementation.

**1.8 Conceptual framework** : The research project's conceptual framework is presented in Figure 1.1 which captures implementation of planning techniques for achievement of sustainable affordable housing in South Africa and construction stakeholder satisfaction with regard to project delivery. The delivery of sustainable affordable housing should comply with budgeted cost of construction, resources and procurement through effective utilisation of the 3Ms (materials, manpower and machinery) in terms of cost, completion time and specified quality. In addition, the delivery of sustainable affordable housing is dependent on the effective use of planning techniques adopted and the utilisation of the available construction resources to satisfy construction stakeholders and fulfil the needs for project execution.

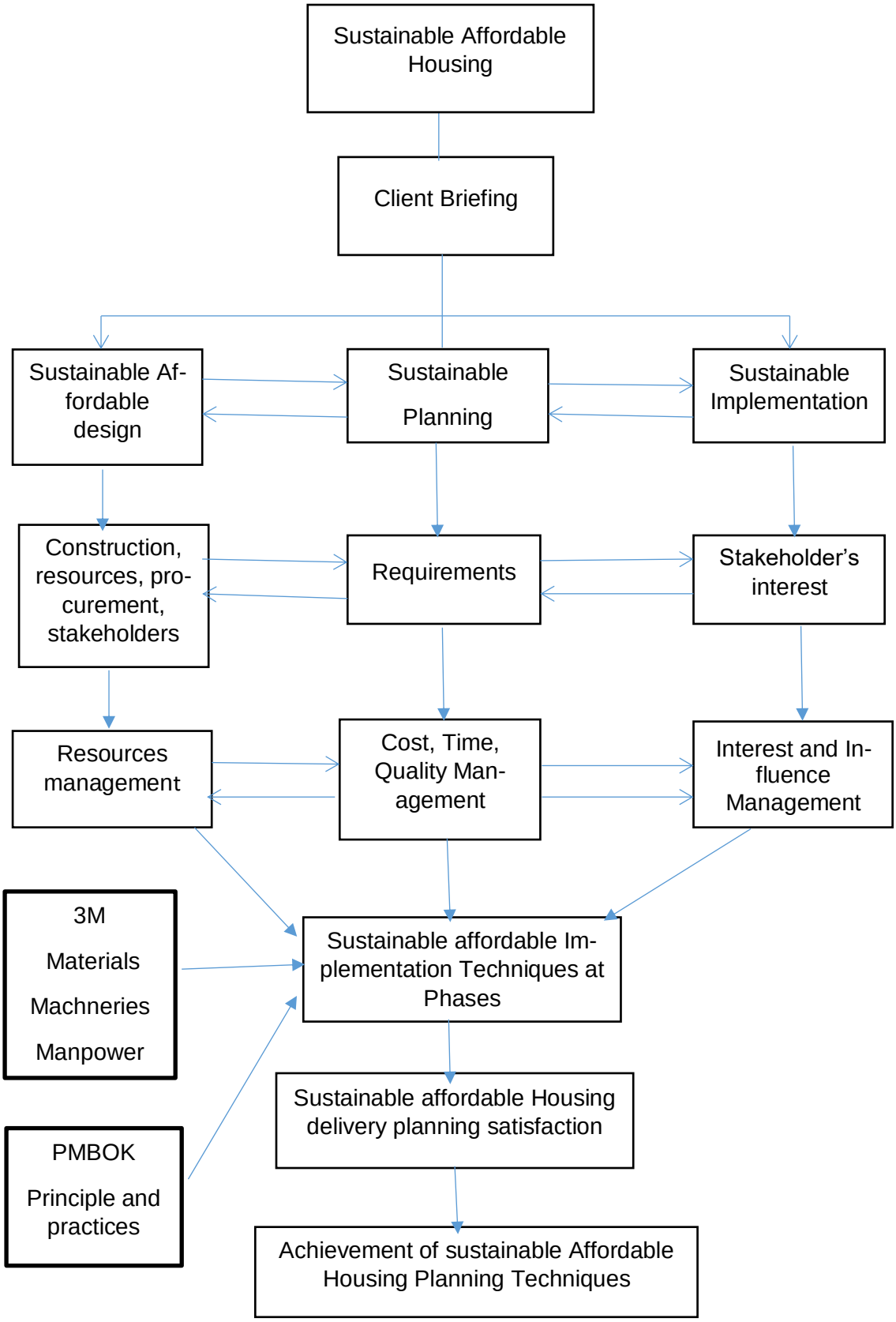


**Figure 1.1 Conceptual framework**

**1.9 Research flow chart:** An initial investigative study was conducted to generate more reliable objectives and precise questions for the study of the achievement of sustainable affordable housing through the effective implementation of planning techniques in South Africa. The study involves a topic selection, an extensive review of existing literature, clear aims and objectives, validity and reliability, a problem statement, conclusions and recommendations relating to the topic. Both qualitative interviews and quantitative questionnaires, as indicated in the research flow chart, was employed to gain understanding of the insightful views of construction professionals in South Africa. A purposive sampling approach was employed for the selection of a population for this study. Visitation was carried out to determine which of the construction companies have experienced qualified stakeholders among their staff members who can participate by adequately answering the questionnaire survey. A survey was conducted among clients, project managers and other construction professionals through the distribution of a close-ended questionnaire to the sample of the population. Findings obtained was used for the research design of the main study. Participant observation was among the methods adopted for group of samples to be researched: views were shared; observations and experiences were recorded.

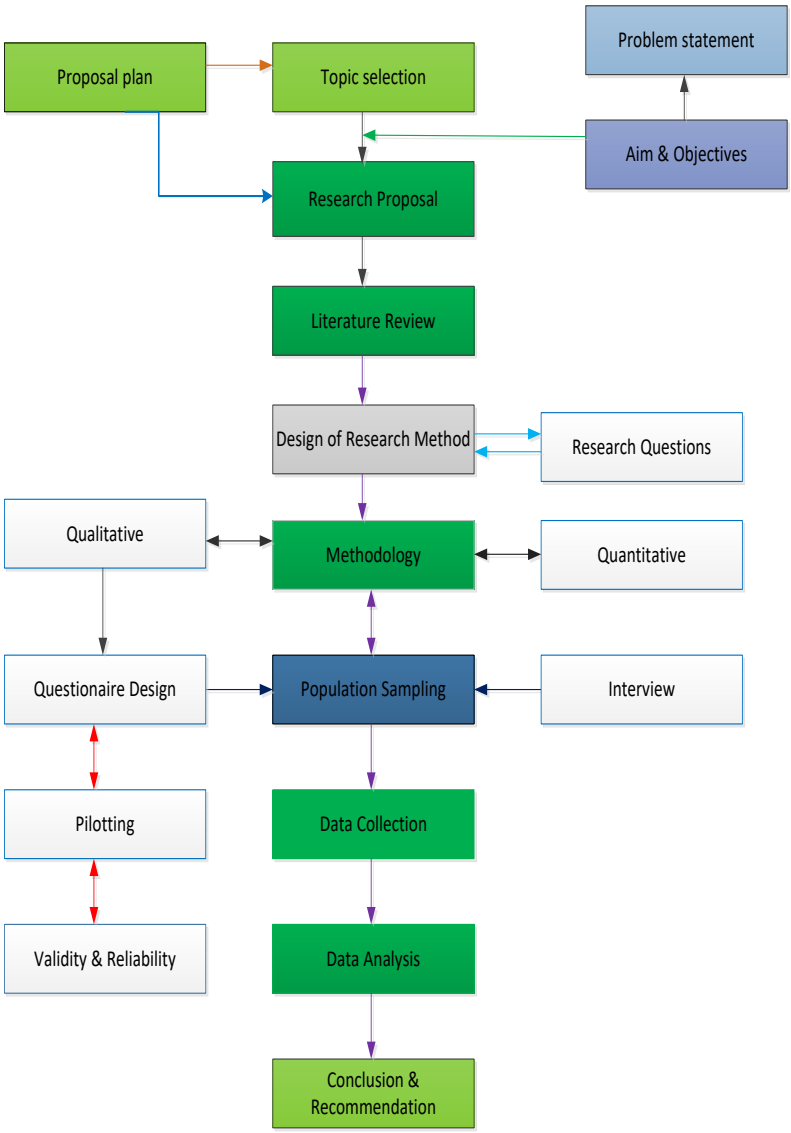


**Figure 1.2: Research flow chart**

### 1.10 Scope of study

This scope of this study covered housing and the planning sector in construction firms in the Western, Northern and Eastern Cape of South Africa.

### 1.11 Assumptions

This study assumes the following:

The economic situation in South Africa is confronted with the challenges of sustainability and affordability during the implementation of planning.

The targeted population are provided relevant information to assist in justifying the study objectives and research questions.

### 1.12 Ethical statement

In terms of complying with internationally accepted ethical standards, all names of participants (individuals and organisations) are stored with utmost confidentiality and will therefore not be recorded on research documents. The study extinguished all forms of plagiarism by acknowledging the authors of all sources of literature referenced or integrated into the study. Moreover, no compensation whatsoever was provided to any participant in the course of the study.

### 1.13 Chapter outline

*Chapter 1 Introduction:* This introductory chapter contains the background of the research study, the problem statement, the significance of the study, the research aim and objectives, the research questions, the scope of the study, and finally, the ethical considerations of the study.

*Chapter 2 Literature Review:* This chapter reviews relevant literature on previous research regarding the factors involved in the implementation of planning techniques for achieving sustainable affordable housing in terms of cost, time and quality. In addition, germane literature relating to the challenges of planning for sustainable affordable housing through construction cost, resources, procurement and stakeholders will be reviewed. The subsequent section reviews literature pertaining to the influence of stakeholders in providing sustainable affordable housing for low-income earners.

*Chapter 3 Research Methodology*: This chapter comprises the research method adopted in the study for achieving the intended aim and objectives. Moreover, this chapter examines the research design, the population and sampling technique, the instruments for data collection, the administration of instruments, and the techniques for data analysis.

*Chapter 4 Data Analysis and Discussion of Findings:* This chapter contains the report on the data analysis, presentation and interpretation represented in both graphical and tabular formats. Additionally, it includes a discussion of the research findings in relation to the review of literature.

*Chapter 5 Conclusion and Recommendations:* This final chapter, based on the analysis of the findings, draws overall conclusions and offers final recommendations with regard to the objectives of the research.

### 1.14 Chapter summary

The supply of durable housing stock, attained at optimum cost and available in the shortest possible time to meet housing demand of clients, present and future, is considered *housing sustainability.* Affordable housing is a type of housing that takes into consideration the wellbeing of the community for which the housing is provided and for which construction entails special efforts to bring adequate shelter within the reach of low-income households. This chapter relates to the emergence of various planning techniques to achieve sustainable and affordable housing. The success of each and every project is rated on time, cost and quality of the end product. The assessed literature revealed how critical it is that clients make the right choices for planning, as reliance on ineffective planning frequently leads to cost overrun, and worst of all, project abandonment which worsens the housing crisis by making housing unaffordable and unsustainable.

The next chapter elucidates the objectives of the study with reference to relevant literature to address the implementation of planning techniques towards sustainable affordable housing and their strong influence on housing; construction constraints such as time, cost and quality effects on sustainable affordable housing; challenges of implementing planning towards achieving sustainable affordable housing; and the influence of stakeholders in providing sustainable affordable housing.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.1 Introduction

Achievement of sustainable affordable housing through planning techniques will be explored in this chapter. The researcher discusses the effective implementation of planning techniques; factors influencing the achievement of sustainable affordable housing through implementation of planning techniques; the effect of management constraints on the achievement of sustainable affordable housing through the effective implementation of planning techniques; the framework, challenges and the influence of stakeholders in providing sustainable affordable housing; and the modalities of achieving sustainable affordable housing during the planning process – all aided by previous research findings and observations.

### 2.1.1 Sustainable affordable housing

*Sustainability* is the capability to meet the needs of the present without compromising the ability of the future generation to achieve their own needs while remaining affordable.

Consequently, this study focuses on the relationship between housing expenditure and household income. Arman, Wilson, Zuo, Zillante and Pullen (2009) explain different type sustainability:

- *Social sustainability:* This includes security, safety and general design of a home.
- *Environmental sustainability*
  - ✓ Water efficiency: A sustainable home saves water which reduces expenses, for example water-saving showers, taps and water tanks for the garden.
  - ✓ Waste efficiency: A proper design and planning can prevent waste during inception and also reduce the need for expensive modifications as needs change.
- *Economic sustainability:* This includes cost-efficient houses with peace of mind and higher resale value.

Smart housing: A smart house is cost-efficient. This means smart features are included in the initial

design and construction, decreasing the cost of changes in the future. Smart design principles and construction material specification has a substantial effect on both initial costs and life cost of the house. (KickStartSearch, 2018)

Resale value: Smart and sustainable home features can attract greater demand: the greater the request, the higher the resale value. This will meet the needs of a high number of people and attract a larger market scale (Green, 2017).

Peace of mind: The design and choice of fixtures and fittings have been carefully measured to ensure the safety and wellbeing of the occupants. This may reduce the risk of health hazards and therefore save on medical expenses and wages lost due to absence from work (UGB, 2016)

Cost-efficiency for our community: Cost-efficient housing means savings for the community by reducing the housing cost on the environment, reducing health hazards, and reducing incidence and cost of crime (Horton, 2005).

In developing countries, such as South Africa, the low-income households struggle with finding adequate shelter, therefore, cost effective housing is feasible option (Tiwari et al., 1999 cited in Tam, 2011), Although the scarcity of affordable housing affect societies at large, it varies across states, cities and income groups. Housing solutions must minimize prices and financed in a way that ensures low-income earners can meet their other necessary needs (World economic forum, 2019).

*Technological sustainability*

Technological sustainability can only be sustainable only if housing takes advantage of local resources produced with unskilled labour and utilising available materials without heavy capital funds. It must be workable and affordable to the community owning qualities such as strength, functionality, durability as these are the basic necessities for technological sustainability.

Unconventional methods, materials and techniques of construction interchanging conventional patterns can reduce the lessening of natural resources and save energy (Reddy & Jagadish, 2001).

Sustainable development is achievable in developed countries, but it is quite challenging to implement in the developing world. It is acknowledged by some construction practitioners involved in housing project that even though there is a rationally high level of acceptance of the concept, planning constraints have activated problems in achieving sustainable housing development (Zainul *et al.,* 2013). Planning mechanisms such as development plans and planning control are agreed to play a crucial role in achieving the goal of sustainable development; therefore, a development plan as organised by the planning authority is the fundamental stage with a listed number of objectives, proposals, approaches and policies for each sector (social housing, commercial, industry) as well as techniques regarding conditions of open space and the provision of community facilities, utilities and infrastructure (Yakob, Yusof & Hamdan, 2015).

### 2.1.2 Characteristics of sustainable affordable housing

According to (Arman, Wilson, Zuo, Zillante and Pullen: 2009), there are several characteristics of affordable housing:

a. It is a dwelling whose mortgage payment should not exceed 30% of a household income.

b. Easy access: Housing location and transportation options often affect the affordability. A distributed housing system often cannot support public transit that is viable, which means households need automobiles. The ideal cost of housing, consequently, is the combined cost of housing and transportation.

c. A sufficient quality and appropriate size for occupants.

d. A place where individual financial obligations and government can be carried out on a regular basis without changed policies.

e. Includes environmental features, for example solar design, water conservation, sun shading, energy efficiency, deconstruction and adequate waste management.

Characteristics ‘a’ to ‘d’ indicate affordability while ‘e’ reflects sustainability.

The concept of sustainability is commonly recognised as focusing on three aspects: social, economic and environment. In realising this goal, the housing sector plays a significant role in all three aspects (Boström, 2012; Zuo & Zhao, 2014). The increasingly high rate of urbanisation globally, especially in developing countries like South Africa, has stressed the urban economy, facilities, and infrastructure, thereby leading to ecological problems (Mabogunje,2015). In South Africa, promoting sustainable housing is a major role of government; however, the concept is uncommon, and its implementation is low resulting from inadequate knowledge and involvement of stakeholders for sustainable and affordable building projects. Other difficulties are a lack of expertise in sustainable housing development by local authorities and housing developers due to cost constraints affecting operation and maintenance (Meyer, 2013; Charles, Schmidheiny & Watts, 2017). Meanwhile, in most sustainable housing countries, this project tends to focus on the perspective of planning techniques for a sustainable housing development. It is evident that planning mechanisms play an important role in attaining sustainable housing (Wheeler, 2013; Hwang & Ng, 2013; Turcu, 2013; Guy & Shove, 2014).

As the need for comfortable environments grows, an assessment is a significant study in determining the beneficial quality of a living environment for a housing development by which the value is largely anticipated through the development plans conveyed and implemented through planning control, Portney,2013). Planning, for example, is a statutory government activity; local authorities are expected to prepare development plans to control and regulate the development of land and building under their influence (Fuseini & Kemp, 2015; Van der Krabben & Jacobs, 2013). The major instruments for monitoring the urbanisation process within South Africa for planning and management are in terms of policies and strategies as defined in the development plans (Rondinelli, 2013; Mabogunje, 2015; Kay & Alder, 2017).Therefore, it is a remarkable plan for government to ensure that the creation of housing policies and strategies as well as housing delivery are socially acceptable, economically

practicable and environmentally friendly for all parties involved (Choguill, 2007; Makinde, 2014; Ab-Dullahi & Aziz, 2017).

### 2.1.3 Sustainable housing development in planning

A vital model for the delivery of sustainable affordable housing is social housing, which offers medium density and affordable rental housing for middle- and low-income households. Social housing contributes to urban spatial patterns as it promotes incorporation and densification in closeness to social and economic facilities. The result of spatial planning is direct in the property development market but indirect for users and investment markets (Adams & Tiesdell, 2010). Any planning system has benefits and cost attached to it, costs which are direct and indirect. Direct cost has a complex system from a private sector while indirect cost is as a result of higher cost of space caused by supply constraints and enforced regulations based on choice of locale. It is with this direct understanding of costs that planners have issues in the property industry. Government housing provisions are available: for example, the Department of Human Settlement social housing programme is funded through the reforming capital grant shifted from the Housing Development Finance programme to be managed by the Social Housing Regulatory Authority (SHRA). The grant was expected to reach R1 billion by 2018/19 to fund the delivery of 17 333 social housing units, (South African government, 2018).

The department's housing entities include the following:

1. National Home Builders Registration (NHBRC)
2. Community Schemes ombud Services
3. Estate Agency Affairs Board
4. Housing Development Agency
5. National Housing Finance Corporation (NHFC)
6. Rural Housing Loan Fund
7. Social Housing Regulatory Fund
8. Comprehensive housing plan (Breaking New Ground Plan)
9. Rental housing for the poor
10. Government employees housing scheme (GEHS)
11. Emergency housing
12. Integrated Residential Development Programme (IRDP)
13. National Urban and Housing Reconstruction Agency (NURCHA)

14. Subsidies

### 2.2 Challenges of achieving sustainable affordable in housing development

Planning perspective for sustainability is the most important element to consider in the planning of the urban areas (McCormick, Anderberg, Coenen & Neij, 2013; Hansen & Pauleit, 2014). But the concept is more acceptable in the city, but less consideration has been set in the planning of sustainable housing itself (Ahvenniemi, Huovila, Pinto-Seppä & Airaksinen, 2017). In South Africa, there are initiatives by the government in promoting sustainable development applied for city development (Albino, Berardi & Dangelico, 2015). However, a city is determined to be unsustainable if one critical indicator – housing – in not sustainable (Choguill, 2007; Phillis, Kouikoglou & Verdugo, 2017). Most sustainability theories rely on three (3) main aspects to be considered: social, economic and environmental aspects (GhaffarianHoseini *et al.,* 2013; Santoyo-Castelazo & Azapagic, 2014). However, it is a daunting task to find a balance between those three elements for housing development. As housing development may occur and support the financial structure of the country, it can also influence negatively on the environmental and social aspects from the development itself (Neirotti *et al.,* 2014). Based on the number of literature reviews surrounding sustainability which focus on housing developments in urban areas, stated below are several identified challenges related planning viewpoints.

#### 2.2.1 Provision of public open space

For housing in urban regions, the most important matter concerns the provision of public open space within residential neighbourhood meeting the needs of various groups within the population (Gómez-Baggethun & Barton, 2013). Carley and Christie (2017) suggest that pressure on land in terms of size and price in urban areas has truly engendered problems in gaining access to open space, a situation which unfortunately impacts disadvantaged people. Public land is highly significant for public advantage, if manged properly and preserved as a vital resource for dwellers which allows for sustainable development on fair scale (Manandhar & Joshi, 2015)

#### 2.2.2 Lack of coordination between stakeholders

To implement sustainable housing, one of the challenges cited by housing developers is the lack of coordination amongst local authorities as they struggle for approval for house planning necessities and procedures (Hwang & Ng, 2013; Green & Haines, 2015). Among the difficulties encountered are the development plans, planning standards and rules, procedures for planning tenders, planning decisions, communication and correspondence (Chadwick, 2013; Lichfield, Kettle & Whitbread, 2016). Housing developers who are contributors towards the implementation of sustainable housing admit that these challenges have become major issues for them (GhaffarianHoseini *et al.,* 2013; Boons, Montalvo, Quist & Wagner (2013).

### 2.2.3 Social equity and justice

Urban housing has encountered the issue of poverty which mainly affects poor people living in an environment (O'Laughlin, Bernstein, Cousins & Peters, 2013). Although the key goal of housing policies is to fulfil the simple needs of people of all status (Ball, 2017), when it comes to practice, poor people remain behind in finding access to better quality of life (Tidd & Bessant, 2018; Porter & Kramer, 2019). For instance, while affordable housing has been provided by the government to supply the needs of low- and medium-income earners, when it comes to quality of the house and the living conditions within the area, the result is disappointing (Chen, Zhang, Yang & Yu, 2013; Opoko & Oluwatayo, 2014). With the belief that no class should be side-lined in the development process, the lower class, not just the upper class, must be beneficiaries of proper and satisfactory housing (Olotuah & Bobadoye, 2010; Olotuah & Taiwo, 2013; Ihuah, Kakulu & Eaton, 2014).

### 2.2.4 Market challenges

Sustainable housing requires ecological building materials, aesthetic design and energy saving products that are eco-friendly are expensive; hence, the chances of applying them to low-standard, low-cost projects are minimal. Developers faces problems in acquiring green products in the local market due to low-acceptance of local building materials by the buyers based on the notion that products from foreign countries are relatively higher in quality (Ayedun & Oluwatobi, 2011). Nonetheless, the lack of reimbursement for importers of building materials may end in incurrence of additional cost to import this material. The high cost of importing green materials and technology is an element affecting sustainability products (Abidin, Yusof & Othman, 2013). In some cases, there is a belief that each sustainable housing project has been well- planned and designed in detail to comply to target buyers' financial status, expectations and interest, again, to the disadvantage of low-income earners, as it was determined that target buyers are primarily high-income earners and foreigners. These population groups can easily acquire sustainable houses, as these reflect their lifestyle. Nonetheless, local developers have to contract with local buyers ranging from low-, medium-low and also medium-high income earners. So the challenge lies in shaping ways to make sustainable housing affordable across social classes. One way is that houses be designed perfectly with good use of natural resources instead expensive products explained (Abidin *et al.,* 2013).

### 2.2.5 Professional challenges

Project stakeholder interest for sustainable practices is the core factor that guides team members. They have the obligation to show their leadership for achieving affordability and sustainability in housing projects. The inadequacy of new knowledge on green technologies and materials among developers could also be considered a key challenge to the industry (McMurray& Islam,&,Siwar & Fien: 2014)There is a significant gap in the level of sustainability knowledge between well established

companies and small-sized companies. The current generation faces difficulties in dispersing theoretical understanding of sustainability knowledge into practice due to the lack of environmental approachability in its education until about a decade ago. Thus, developers tend to not acknowledge ideas of the young generations (Goh, Seow & Goh, 2015). The lack of willingness to provide affordable and sustainable housing by the government and developers further compounds the challenges (Abidin *et al.,* 2013). Profits are created by targeting low- to medium-cost houses which still dominate the industry. Developers, contented with their business marketability, are disinclined to commit to something new (Manly, 2004).

Many developers are ready to pursue sustainability practices but it results in additional project cost. Consequentially, the number of housing units built is inadequate to ensure that every unit built has the potential to be sold (Abidin, 2013). Big developers have greater financial capacity, better experience and higher obligation from top management and the required expertise to pursue sustainable practices. These developers are more informed about sustainability practices by executing proper planning, design and allocation of budget. However, the majority of developers are mostly from medium- and small-sized companies.

The companies are aware of sustainability matters, but they believe sustainable practices may impact their profit margin. This contradicts the claim that company size will not affect the capability to integrate affordable housing and sustainable practices. They are able to implement sustainable practices by integrating sustainable elements in their small- or medium- projects by concentrating on the design and orientation of the building, providing more green spaces and improving social needs through upgraded facilities. Many developers are reluctant to invent their own methods and accept newest, as these may incur additional cost (Williams &Dair:2007). In fact, developers may accept sustainability practices if consultants can deliver a good design within the project budget. At the same time, if buyers request affordable and sustainable housing, there will be more developers on the green team.

### 2.2.6 Housing need and house buyers wants

The request for housing should be centred on needs rather than wants. Overconsumption of housing will lead to environmental decline by which wealthy people are more fascinated by living in suburban residential developments and leaving the poor in the city centre (Hall & Pfeiffer, 2013; Low, Gleeson, Green & Radovic, 2016). Hillside development has ended up as unsafe and discourages the sustainable housing to be achieved (Yakob, Yusof & Hamdan, 2015).

In addition, an escalating housing price is primarily based on housing wants rather than needs which affects the urban poor living in squatter areas (Tunas & Peresthu, 2010).

### 2.2.7 Squatters settlement

Urban-rural migration often results in rapid urban growth. The motivating factors are related to more task opportunities created by industrialisation programmes, better urban community facilities and better urban living environment (Cloke, 2013; Gilbert, 2014; Chadwick, 2016; Hugo, 2017). Most urban low-income earners only find the formal low-cost housing programmes accessible (Marx, Stoker & Suri, 2013; Hall, 2014) The supply of low- cost housing helps satisfy the demand of rapid growth in the number of migrants into cities (Opoko & Oluwatayo, 2014; Stren, 2019) as squatter settlements are rather economical to build .This situation, consequently, affects the living condition of the people as they suffer from poor sanitation, insufficient waste collection, poor drainage and uncertainty of tenure (Ajibade & McBean, 2014; Meikle, 2014).

### 2.2.8 Construction financing

Financing sustainable construction has been recognised as a major issue for housing development (Lutzkendorf & Lorenz, 2011) This assertion identifies the importance of a practicable financing mechanism for a housing construction project, to qualify the low-income earners for access to sustainable affordable means of financing a housing project. There has been much discussion on the impact of government in funding housing construction and the role of mortgages in financing housing, but a common apprehension is about the form of aid to low-income earners, new occupants. However, Persson (2009) insists that there are important chances for financial institutions and business undertakings to implement processes such as lending procedures for sustainable development in the housing and construction sector.

### 2.2.9 Technological challenges

Rapid development of sustainable technologies and practices means that skills become inadequate to implement sustainable practices (Goh *et al.,* 2015). But as knowledge and local expertise in green technology are still low and lacking, the integration of affordable and sustainable housing requires expertise from construction practitioners. Inadequacy in numbers of experts hinders developers from integrating the concept of affordability and sustainability in their project developments.

Developers must adopt foreign expertise in implementing these sustainable practices, which results in complete dependency on foreign experts while also incurring additional costs. This practice unfortunately hinders local expertise from developing their skills. The challenges encountered when acquiring green technology and materials from local markets resorts in the developers importing these products; this means higher production costs. Most buyers believe that adopting locally manufactured green products would inhibit the rate of implementing sustainable practices (Saleh & Alalouch, 2015).

### 2.2.10 Societal challenges

The government is one of the foremost institutions that has a major impact on the development of construction industry. The government's demand for the provision of affordable and sustainable housing induces pressure on construction practitioners. Government should play an important role in integrating affordable and sustainable housing by strongly administering legislations, devising new strategies or giving incentives to developers who accept sustainability in their projects (Ayedun & Oluwatobi, 2011). These factors would inspire construction practitioners to explore the latest technology and knowledge. Government should also encourage the integration of affordable and sustainable housing by strongly applying systems such as Industrialised Building Systems (IBS).

## 2.3 Planning techniques for sustainable affordable housing

Sustainable housing development in planning is measurable through its mechanisms. In accordance to the Town and Country Planning Acts, it has recognised three (3) mechanisms to assist planning successful and reliable housing through developmental plan systems and appeal board systems (Sharifi & Murayama, 2013; Hall, 2014). However, for the purpose of this research work, only two planning mechanisms are reviewed as the role of land use planning system in managing housing was practically exercised through the activities of forward planning and development control (Harris & McCaffer, 2013; Healey, 2013).

Furthermore, the system of land use planning in South Africa comprises of a framework of development plans which form the foundation on which applications for development are determined (Suzuki, Cervero & Iuchi, 2013; Cummings & Worley, 2014). The development plans, which comprise local plans and structure, are organised by local planning authorities to determine types and locations of land use for housing development (Scholten & Stillwell, 2013; Pacione, 2013).

The basic purpose of planning sustainable and affordable housing is to guide project execution as it is usually the most challenging and underrated process in managing project. Planning must be helpful and genuine therefore relevant effort and time must be within the planning procedure (Schwalbe, 2007) The PMBOK Guide has over 50 documents a design or project team can effectively use for planning; however, projects are unique so project managers and their project team must decide the techniques that are best for their project. The following describes project planning techniques which are related to the nine project management knowledge areas

i. *Project scope management planning technique:* These techniques and tools includes scope statement, work statement, scope management plans, requirement analyses, scope change controls and scope verification techniques. (Rory, 2009) The project *scope management* plan refers specifically to the input/output mechanism that consists of a formalised document that details exactly how a project scope will be defined, the means to be undertaken to develop the project scope, how this project scope will ultimately be verified, and exactly how any and all components of the work breakdown

structure will eventually be created and defined (Kumar, 2019) The project scope management plan also will provide information and assistance in determining exactly how the actual scope of the project will ultimately be controlled in the management process by the project management team or project management team leader. The actual project scope management plan, as with most project management components, could be a formally written document, or it can also be an informally written document. The detail level can vary widely as well, depending on needs dictated by the project (Watt, 2019).

ii. *Project time management planning technique:* These are critical-path analyses, crashing, schedule performance measurement, project network diagram, fast tracking and Gantt charts.Project *time management planning technique* refers to a component of overall project management in which a timeline is analysed and developed for the completion of a project or deliverable. The project time management process is dynamic and may require input from several different teams, each with individual project time management processes, in order to integrate the various interdependent component parts of the project to achieve the project deliverables. The processes are recurrent within each work package of the project and occur at least once within the project (Rory, 2009). This process is called develop project management plan process. The output from this integrated team effort, called the schedule management plan, is a subset of the overall project. These tasks are then prioritised, dependencies linked, and then placed on a timeline management plan (DBW, 2020). Time management is vital for all participants in the construction process, as well as lenders, owners, architects, contractors, and subcontractors. Construction is a multifaceted process, involving various activities and participants throughout the whole undertaking. The obligatory tasks, as well as the responsibilities of the owner, architects, contractors and subcontractors, may be planned in many different ways to deliver the preferred result (Ayemba, 2017).

iii. *Project cost management planning technique:* These include project portfolio management, net present value, return on investment, payback analyses, earned value management, cost management plans and cost baselines. *Project cost management* is means keeping a project within its defined budget. It is an essential part of project management. Cost estimating, cost budgeting and cost control are all cost-related processes that interact with each other and with other areas concerning project management. All of these processes require effort and a working knowledge of costs of things. Depending on the complexity of the project, this might require more than one person, and may occur more than once during the life of a project (Alby, 2019).

Project cost management can be very simple or complex. If scrimping in one part of the project can increase a maintenance cost after the end of the project, then that maintenance cost should be included in the project cost management strategy. This approach, sometimes called life cycle costing, can reduce the cost of a project and improve the quality of the deliverable. But project management

should also consider what the project stakeholders think about the cost of the project as they will measure cost in different ways and at different times. This, according to Tom Alby, is like looking at a brick from a different angle (Alby, 2019).

Cost estimating and cost budgeting, while two different processes, are closely linked. On small projects they are often undertake by the same person and because of this, influencing cost is easiest early in the project, so it is important to define the budget in the scope of a project at the beginning. This also includes creating a cost management plan, which has several benefits (Watt, 2019). Cost processes include cost estimating to determine the needed financial commitment for all resources required to complete the job. Cost budgeting creates a cost baseline and cost control works to manage the fluctuation of costs throughout the project

iv. *Project quality management planning technique:* These include quality metrics, quality control charts, pareto diagrams, checklists, fishbone diagram, statistical methods and maturity models. *Project quality management* (PQM) is a crucial aspect of the performing organisation, integral to project management. It includes the processes and activities that determine the quality policies, objectives and responsibilities necessary to assure that project requirements are met. (Rory, 2009) Project quality management implements the organisation's quality management system via policies, procedures and continuous improvement activities, as appropriate. Processes critical to the quality management system include quality planning, quality assurance and quality control (Alby, 2019).

*Quality planning,* an integral part of project management, identifies relevant quality standards and determines how they can best be satisfied. *Quality assurance* ensures that project management utilises the quality processes needed to meet project requirements in a planned and systematic manner (Alby, 2019). *Quality control* monitors specific project outputs and determines compliance with applicable standards. It also identifies project risk factors, their mitigation, and looks for ways to prevent and eliminate unsatisfactory performance (Alby, 2019).

The ones listed above comprise the four core knowledge areas because they meet specific project objectives, while the remainder listed below are the four other knowledge areas called the 'facilitating knowledge areas'; they are the necessary knowledge areas for effective planning techniques to be implemented for achieving sustainable and affordable housing:

v. *Human resource management planning technique:* This entails proper listening, project organisational charts, resource histogram, team building exercises, responsible assignment matrices and motivation. Project human resource management involves organising and managing a project team. The team is typically comprised of people with specific skills and responsibilities. The project team, also known as project staff, should be involved in plans and decision making from the beginning of

the project. Team members should feel invested in the outcome of the project. This will increase loyalty and commitment to project goals and objectives. The number of team members and their responsibilities can be altered as the project develops (Alby, 2019).

The project management team, also called the core, executive, or leadership team, is responsible for project planning, controlling, closing and takes directives from the project team. Smaller project responsibilities can be shared by the team or designated by the project manager. The project management team and the project sponsor work together to secure funding, simplify scope questions and influence team members (Alby, 2019).

Project human resource management processes include human resource planning, acquiring the project team, developing the project team and managing the team. Processes are used multiple times, usually occurring at least once in a project or several times in different phases if the project entails many phases. In reality, processes intersect with each other and with other phases and are not as definite and concrete (Alby, 2019).

Project human resource management planning may be required if more experienced members are added to the team. The project management team should also prepare for risk management and changes to project duration (Alby, 2019).

vi. *Communication management planning technique:* This consist of conflict management, communications media selection, status and progress reports, virtual communication templates, project website, kick off meetings.*communications management planning tecniques* plays an important role in keeping all members of the project management team on the same page. Without communication among all team members and project stakeholders, a breakdown in processes is likely, which could have a negative impact on the final product (Alby, 2019).

The project manager must know the communication processes involved in effective project management. First, there should be planning to determine what information needs to be communicated to all stakeholders in the project. Next, that information must be made readily available to stakeholders and generated in a timely fashion. Performance must also be accounted for by reporting the project status, measuring progress and forecasting. Finally, communication with project stakeholders must be managed so that all requirements are met and issues are promptly resolved. Interactions and overlap among the communication processes are inevitable and expected throughout all phases of project management (Alby, 2019).

vii. *Risk management planning technique:* This includes risk registers, probability/impact matrices, risk rankings and risk management plans. *Project risk management* is a branch of the discipline of project management that deals with identifying and mitigating project risk. The desired outcome of risk management is to increase the probability and maximise the result of positive events. The goals

of risk management are to increase the effect of positive events and decrease the effects of negative events in the building production processes.

Likewise, risk is a future occurrence (Khan & Burnes, 2007; Lavastre, Gunasekaran & Spalanzani, 2012; Carvalho & Rabechini Jr, 2015). Risk is an unexpected event or condition that, if it occurs, has an impact on building production objectives, objectives which should include scope, schedule, cost and quality (Alby, 2019).

viii. *Procurement management planning technique:* This consist of contracts, requests for proposals or quotes, source selections, supplier evaluation matrices and make-or-buy analyses. *Procurement management* includes buying or procuring goods and services that are needed for a building production from outside the construction company (Caldwell, Roehrich & Davies, 2009; Greenhalgh & Squires, 2011; Monczka, Handfield, Giunipero & Patterson, 2015). Simply put, procurement management is involved with the means of generating revenue, so that the overall organisational goal of profitability can be achieved (Kumar, 2010; Christopher, 2016). The construction company begins by deciding what to produce, before deciding how to market its products (Lavender, 2011; Imhmed, 2016). Procurement management includes the processes necessary to buy or acquire products, services or results needed from outside the building production team. Procurement management can be either the buyer or seller of the product, services or results of a building production processes (Greenhalgh & Squires, 2011; Monczka *et al.,* 2015).

Furthermore, procurement management involves contract management and changes any control needed to develop, manage, contract or buy orders issued by accredited building construction team members (Robichaud & Anantatmula, 2010; Sebastian, 2011; Harris & McCaffer, 2013; Kerzner, 2017). Similarly, it involves planning procurement through recognising potential and promising sellers, giving details of the approach, selecting a seller, awarding a contract, establishing a procedure of managing procurement interactions, monitoring contract performance and also allowing changes and corrections as needed (PMBOK, 2010; Monczka *et al.,* 2015).

ix. *Integration management planning technique:* This ninth knowledge area, coordinating other knowledge areas throughout a projects life's span, comprises project management methodologies, project charters, project management, lesson-learned reports, software, project selection methods, change control boards and project review meetings

The processes and activities needed to identify, define, combine and coordinate process and project management activities within the project management group are included in the project integration management knowledge area. Characteristics of unification, consolidation, articulation and integrative actions crucial to project completion fall within the context of *integration management* (O'Reilly, 2013).

Decisions related to choices such as concentration of resources, coordination of work efforts, and anticipation of potential problems are addressed under integration. Other considerations, including the balancing of competing goals and exploration of alternative actions, are also within the domain of integration. Real world applications involving coordinated efforts of project integration management components are not often defined by boundaries, because an overlap is to be expected. Interaction of these individual processes requires effective integration in project management (O'Reilly, 2013).

There is really no single way to manage a project. Experienced project managers apply their skills, knowledge and processes uniquely to each situation, depending on its circumstances, variables and aims. The fact that a particular process or method was not utilised in a project does not mean that it was not considered. On the contrary, project integration management and team management are charged with assessing the applicability of all processes and the level of implementation of those deemed appropriate and necessary towards the success of the project when formulating the overall project integration management plan (Watt, 2019).

### 2.4 Stakeholders for sustainable affordable housing

A project is deemed successful when objectives are met and stakeholder expectations are exceeded. Stakeholders are individuals who are actively involved and have interest in the project for profit or loss. Clients are the stakeholders who are most positively affected as they are direct benefactors of a project, while a project may negatively affect residents who live close to a new building, both during and after a project, due to construction noise and busy-ness (Watt 2014)

I. *Internal stakeholders*

Internal stakeholders are direct stakeholders involved in a housing project. They are individuals within an organisation who are customers for projects that meet the needs of internal demands. They retain the decision to accept or reject the project manager's work clients (public or private), such as the project manager, structural engineer, subcontractor, quantity surveyor, architect, site foreman or building service engineer. During the inception, the project manager must placate the client's satisfaction and concerns and keep clients informed (Qstuts, 2020).

a. Resource managers

Resource managers sometimes find themselves in a situation like borrowing resources, so good relationships help recruit the best people and equipment for the project. Unavailability of skilled employees can lead to dysfunctionality; shortage of skilled staff can be damaging to a project (Bailey, 2016).

b. Contractors, subcontractors, and suppliers or housing developers

The construction industry is typically made up of group of entities working as consultants, contractors, suppliers, manufacturers, foreman, network consultants, carpenters, electricians, architects, subcontractors. If there is a lack the skill or resources available in-house, work is contracted out to contractors or subcontractors (Emuze & Smallwood, 2014).

Supervising suppliers or contractors requires expertise, likewise managing project team member. issues can arise with work quality, cost overruns and schedules. Many projects centre on goods provided by external suppliers. If there is a late delivery in the supply of goods or of poor-quality goods, or if there is price inflation, a project may suffer

II. External stakeholders

These are individuals not working directly with the project team but are affected somehow by the actions and outcomes of the project; for example, residents or community, suppliers and public groups and creditors are all external stakeholders. Stakeholders possess different levels of power that can influence the course of a project, either as a threat or a benefit (Gibson, 2000).

a. Government

Executing projects in heavily regulated areas for example, a project manager must respect government regulations and departments. These can include all or some government authorities from the federal, provincial, municipal and international level (Watt, 2014)

b. Non-governmental associations (NGO)

These are non-profit organisations working throughout South Africa to ensure equality while eradicating poverty; creating opportunities to access basic services such as land and tenure rights; and promoting affordable housing while promoting access to finance. They support communities and facilitate actions around disaster or crisis management through dialogue with the communities and the government (Tal, 2014). Examples include the following:

1. Development action group (DAG)

2. National Association of Social Housing Organisation (NASHO)

3. Centre for Affordable Housing Finance in Africa (CHAF)

4. Development plans for housing

### 2.5. Structure plans

A structure plan is a document written regarding the regulations and proposals related to the general development of land use, covering elements of the social, economic and physical environment of an area and supported with figures, images and illustrations (Harris & McCaffer, 2013; Ghai & Vivian,

2014; Daniels, 2017). The process of making the plans involves public participation before it been publicised and gazetted. In the context of housing, the preparation of development plans as a mechanism for forward planning will assess the existing housing conditions, formulate housing regulations and also determine future housing requirements for the whole structure plan area in general (Rameli 2009: Makinde, 2014; Ball, 2017; Murdoch & Abram, 2017; Balchin & Rhoden, 2019).

### 2.5.1. Local plans

However, at the local level, there are two (2) plans provided: a local plan and a special area plan. The features of the local plan are much more specific than the structure plan which consists of detailed planning guidelines such as allowable density, building height and setbacks; and the lot value based on proposals for land use such as housing, commercial, industry, facilities and open space. There are numbers of sustainability studies which are practiced in planning, one of which is a Sustainability Assessment (SA).

An SA is an assessment method to execute sustainability level and achievement in certain strategies, policies, plans and projects under development plans (Ponrahono, Musa, Omar, Abdullah & Muda, 2011). This method is conducted before the decision has been made by the authority in gazetting the local plan. The broad housing regulation and policies as listed in a structure plan will be more comprehensive in the preparation of the local plan. Moreover, the local plan will then proceed with the forecasting of future housing requirements, followed by the total housing land area determination and distribution of suitable land locations for imminent housing development (Rameli, 2011).

### 2.5.2 Planning control in housing development

Referring to the development process, the housing project begins with land acquisition and ends with the selling of houses built. Therefore, planning control enters at the process of getting statutory approvals (Turk & Altes, 2010; Goldman, 2011; Valtonen, Falkenbach & van der Krabben, 2017). Within the development process, it has been argued by housing developers that planning constraints only surfaces when an application for housing approval is submitted to the local planning authorities or to land use offices (Pacione, 2013; Healey, 2013; Crook, Henneberry & Whitehead, 2015). However, considering application for the layout approval, planning offices entail guidelines and regulations which include planning standards and policies (Wefering, Rupprecht, Bührmann & Böhler-Baedeker, 2013; Needham, Buitelaar & Hartmann, 2018)

. For instance, when the local planning authorities evaluate a planning permission application, the authorities must ascertain that the proposed development is in conformity to a current local plan or one under preparation (Healey, 2013; Bradley & Sparling (2017). Normally, the effectiveness of a housing planning control process is measured in compliance to the proposed land use region and low-cost housing policy as listed in the development plans, and abides with the planning conditions

such as allowable housing density, category of housing and type of housing development (Syphard, Massada, Butsic & Keeley, 2013; Yakob, Yusof & Hamdan, 2015; Kleemann et al., 2017).

### 2.5.3 Challenges in the provision of affordable housing

The primary constraints to obtain affordable houses can be regarded as a financial, social and institutional framework (Makinde, 2014; Lin, De Meulder, Cai, Hu & Lai, 2014; Aalbers, Loon & Fernandez, 2017; Ball, 2017). The financial factors tackle the country's middle-class, the high cost of infrastructures, low level investments, difficulties in accessing financial resources and the escalating cost of building materials (Opoko & Oluwatayo, 2014; Weber, Staub-Bisang & Alfen, 2016). All these factors make it difficult for the lower- and middle-class to afford housing. The challenges not only include financial factors but social factors as well, such as population explosion, rapid rural to urban migration and higher poverty levels (De Brauw, Mueller & Lee, 2014; Ezeh *et al.,* 2017).

Daniel and Hunt (2014) suggest that institutional frameworks including housing policies have failed to create a conclusive environment for investment in affordable housing. Indeed, the land issues in urban areas in South Africa have been raised in recent years (Shackleton, 2013; Cotula, 2013). The high numbers of people in urban areas have generated a high demand for land, causing prices in residential areas to skyrocket (Zhang, 2016; Tian, Ge & Li, 2017). To identify the key challenges in the provision of affordable housing in South Africa, this study will investigate the key aspects involved in the provision of affordable housing.

One critical aspect is land, as land in urban areas is highly valued and is mostly in the hands of the central government and the local authorities. This has made land inaccessible to most people, including the poor and middle-class who need it most but do not find it affordable. According to Nabutola (2004), the high demand of land with competing interest groups and individuals has hiked the prices.

## 2.6 Effect of stakeholders on sustainable affordable housing

Various interest groups are involved in a housing scheme from inception to completion. The White Paper on housing policy (Government Gazette, 2012) identifies a number of stakeholders including government parastatals, the private sector, representatives of the homeless and other community-based organisations (CBOs), and non-governmental organisations (NGOs) (Vosloo, 2012; Bogopa, 2013; Udo-Udoma, 2014). However, stakeholders are grouped into two broad categories: end users and service providers of affordable housing (Nelson *et al.,* 2014; Mosannenzadeh *et al.,* 2017; Goodman, Korsunova & Halme, 2017; Czischke, 2018).

### 2.6.1 End user

After independence from colonial powers, many developing countries promoted self-reliance amongst themselves (Lal, 2012; Bendix, 2017). This practice was to be most prevalent in area where people house themselves and therefore play a greater role than any other stakeholder in the delivery of their

houses (self-help housing) (Takey & de Carvalho, 2015; Muller & Turner, 2017; Bardach & Patashnik, 2019). Another factor which is encouraging end user involvement comes from non-governmental organisations, especially international funders such as the World Bank. Indeed, as a result of these factors, a practise began for end users to play a major role in housing delivery (Fowler, 2013; Adlard, 2014; Charter & Tischner, 2017).

The end user is often viewed as the pivotal stakeholder in low-cost housing delivery to the extent that the term *popular control* has been coined to mean direct control by the end user (Makinde, 2014; Kibert, 2016; Isa, 2016; Czischke, 2018), with emphasis on people making their own choices on housing. Isa (2016) suggests that *popular control* affords a bottom-up approach to the housing problem, thus ensuring amongst others, collective solutions to problems, development of methods of approach which are contextual, the strengthening of community relations, community control of resources and capacity building.

The higher the involvement of the owner in the delivery process, the higher the satisfaction drawn from housing (Bradley, 2014; Isa, 2016; Jaiyeoba & Aklanoglu, 2018). The degree of involvement of end users in low-cost residential houses ranges from total self-help in building the units to representation by a community leader or a non-governmental body (Warburton, 2013; Mathéy, 2014; Begum, 2015; Cheshire, 2016; Thani, Ubisi, Hanyane & Mampa, 2018). Self-help is a process where individuals or groups uplift their quality of life by using their own resources, such as labour, financial savings and management ability (Landry, 2012; Bredenoord & van Lindert, 2014; Gillespie, 2018; Bardach & Patashnik, 2019). Project participants may however receive financial, technical or other assistance from a community organisation, an NGO, the government or private sector (Abbott, 2013; Bryson, 2018; Porter & Kramer, 2019). The end user can also participate indirectly by yielding to representation by a community-based organisation (CBO) or a non-governmental organisation.

### 2.6.2 Service provider

The government has always been viewed as having the sole responsibility to provide housing for its people. Government lay down rules and develop policy which facilitates the delivery of low-cost housing (Daly, 2013; Duffield, 2014; Abdullahi & Aziz, 2017; Garriga, Hedlund, Tang & Wang, 2017). While some governments have decided to get involved in the actual operations, it is noted that the action has proven undesirable (Coase, 2013; Ball, 2017).

Bottelberg (2011) believes that government departments operate on a less urgent note, larger scale and also at a physical and social distance from the people they serve. "The role of state should be as enabler and articulator of people's initiatives, encouraging a 'bottom-up' process of planning and management, rather than taking a technocratic role of imposing its ideas on people" (Sun, Lu, yen, Che, Shou, Wang & Oeser, 2018).

## 2.7 Perceptions of key stakeholders on housing delivery and service provision

### 2.7.1 Community-based organisations (CBO)

Community-based organisations have emerged in the developing world as agents of development and housing delivery (Rondinelli, 2013; Arrossi *et al.,* 2014; Shatkin, 2016) to take on the challenges of the conventional methods of housing delivery (Simpson, 2014; Carroll & Buchholtz, 2014; Porter & Kramer, 2019). Community-based organisations have emerged upon the realisation that the state and the market cannot both meet the people's needs, so they try to fill in the gap. Community-based organisations work on a basis of mutual help (Huxham & Vangen, 2013; Seyfang & Longhurst, 2013).

They raise funds for house building and mutually collaborate to build houses. Although community-based organisations generally have men as their prominent leaders, they are generally women's organisations (Young, 2013; Porio, 2013; Bredenoord & van Lindert, 2014; Onyemaechi & Samy, 2016).

### 2.7.2 Department of Housing (DOH)

The DOH is significantly involved in funding low-cost housing projects. Since 2010, focus has been on the number of houses constructed, although before 2012, building norms and standards were not adhered to (Abidin, Yusof & Othman, 2013; Zhang, Skitmore & Peng, 2014; Wang, Toppinen & Juslin, 2014). These norms and standards are based on the National Building Regulations and Building Standard Act, 1977 (Act 103 of 1977).

The Act is translated into a code of practice (SANS 10400) which is the application of the national building regulations (NHBRC) (Botes, 2013; Mazibuko, 2016; Greyling, 2016). Since 2010, the housing department has focussed on sustainable human settlements through the Breaking New Ground (BNG) policy to implement inclusionary housing which brings high, medium- and low-income earners together (Klug, Rubin & Todes, 2013; Dawson & McLaren, 2014; Ehebrecht, 2015; Kutama, 2017).

### 2.7.3 Built environment support group (BESG)

BESG was primarily involved in policy development before 1994. From 1994 to 2002, it was more involved in RDP housing by providing technical support to homeowners in housing developments. NGOs have contributed 5% in the delivery of housing in South Africa. Since 2002, as a result of the Municipal Systems Act and the Public Finance Management Act, NGOs and private companies are expected to follow the same procurement procedures for projects from the municipality (Government of South Africa, 2019).

The municipality became both the regulator and the developer. This resulted in a change in the role of BESGs into community service implementers from technical support. BESG creates CBOs for support. BESG is of the view that pre-co``nstruction activities like bulldozing whole areas allocated for housing without consideration of issues such as biodiversity conservation impacts negatively on environmental sustainability of the low-cost housing projects. Another factor making the low-cost

housing projects unsustainable is a lack of cooperation in planning, development and maintenance of the projects by different government departments and other stakeholders.

There is also a need for energy efficiency in the buildings by providing ceiling boards. Other factors include a lack of exposure on issues relating to health and maintenance. BESG insists that good land in the city should be provided, standing against the allocation of projects at the border of the city where settlements are far away from jobs and other public facilities. Some of the plantations and open spaces centrally located in the city could be available for housing development.

### 2.7.4 Project management and sustainable affordable housing

*Project management* is the application of knowledge, tools, skills and techniques to project activities to meet housing project requirements. It has always been practiced informally but began to emerge as a distinct profession in the mid-20th century. Project management is concerned with managing discrete packages of housing building work to achieve specific goals.

The way the housing work is managed depends upon a wide variety of factors. Project management is aimed at producing end-results that will effect some changes for the benefit of the organisation that initiated the housing project. It entails the introduction, planning and control of a range of tasks required to deliver this end result – one of which is housing. Project management is broadly classified into two categories: project management process and project management knowledge areas.

### 2.7.5 Project management process

Every housing project requires a series of processes to bring it to fruition. These processes are quite consistent, regardless of the industry or the type of deliverable.

These process groups are typically defined as follows.

#### 2.7.5.1 Initiation process

The *initiation process* is where all housing projects begin, housing project value is determined, as well as feasibility assessed before the housing project is approved or rejected. It is used to define the requirements needed for building production processes by the client, architect and project manager. Lavender (2011) supports the argument that for a housing project to be completed, the initiating processes are crucial to ensure that all requirements are met. Client satisfaction and acceptance of the building and its products are primarily considered at this stage. All experiences in this stage are documented and all construction resources are reassigned (Rumane, 2019; Kerzner, 2017; Sinha, Gupta & Kutnar, 2017; Halpin, Lucko & Senior, 2017). Similarly, in the close-out phase of building production processes, a team must initiate activities to ensure that all the work will be completed, and that the client will accept the building and its products (Powell, Alfnes, Strandhagen & Dreyer, 2013; Hardin &

McCool, 2015; Halpin *et al.,* 2017). Likewise, the construction team will document experience acquired from the production and construction resources will be reassigned to another construction site or the company's main office (Clough *et al.,* 2015; Kerzner, 2017; Fewings & Henjewele, 2019).

The deliverable time of the building is determined at the initiating process. To that end, budgeted costs will be estimated and the project manager and construction team will work toward this budgeted cost to ensure that the building and its product are delivered within that budget (Bryde, Broquetas & Volm, 2013; Harrison & Lock, 2017; Kerzner, 2017; Meredith, Mantel Jr. & Shafer, 2017). PMBOK (2010) confirmed that it is a process performed to define a new housing process or a new phase of an existing housing. Similarly, Lavender (2011) argues positively that goals of construction processes must be firmly established before there is any input of resources to initiate the cycle of building production processes.

#### 2.7.5.2 Planning process

Once the project is approved, the next step is assembling a project team and to commence planning on ways to manage the project so goals can be attained within the stipulated budget and time. The project *planning process* will include the kind of resources needed along with financing and materials. The plan also gives the team direction. This is to maintain a workable outline to achieve the requirements needed for the building during production processes. A building production plan is generated to define each knowledge area in relation to the building during the production process at that point in time. These processes are also applied in accounting for changing conditions in construction and in an organisation. Building production processes are frequently revised during each phase of the construction cycle (Calvert *et al.,* 2012). Since this is a development stage, construction resources required for the production processes are determined at this stage. Likewise, cost, time, scope and quality are modified to enhance efficient production processes. Also, risk procurement is well-established at the planning stage in relation to the budgeted cost available.

At this development stage, all nine management knowledge areas are planned in accordance with the budgeted cost for the production processes. Walker (2012) confirms that planning, coordination and control of a project from conception to completion on behalf of a client requires the identification of the client's objectives, such as utility, function, quality, time and costs. Walker (2012) further suggests that the quality of tools and techniques employed by the contractor and the representative of the client are determined by the knowledge acquired by the project team from previous projects. Clough *et al.* (2015) confirm that planning is the process of devising of a workable outline of operations so that when carried out, these will accomplish the successful establishment of an objective. According to PMBOK (2010), the planning process group involves establishing the scope for the building production processes, redefining the objectives for its quick and smooth success, and defining a

course of actions and procedures required to attain the objectives that the building production processes was undertaken to deliver to the client.

#### 2.7.5.3 Execution processes

*Execution processes* are employed to ascertain that the nine knowledge areas are in line with building production processes, and to produce the deliverable output of the stage that the construction is currently in, or the deliverability of the whole production process within the budgeted cost. This executing process includes providing leadership, developing the project team, guaranteeing product quality, authenticating building scope and managing building production processes. Similarly, execution processes are responsible for information dissemination across all ranges of the workforce involved in production and procuring resources and delivering the building and its products (Calvert *et al.,* 2012). Likewise, PMBOK (2010) supports the argument that management of building production involves managing the project team to achieve the project objectives.

Also, Walker (2012) contends that a project manager should be able to solve problems instantly relating to building production and management problems. Further, according to Walker (2012), construction management processes require all construction team members on site, irrespective of the titles of the people in the process. PMBOK (2010) confirms that the executing process group are responsible for completing the work defined in the building production process management plan to satisfy the building specifications.

#### 2.7.5.4 Controlling and monitoring processes

Calvert *et al.* (2012) confirm that *controlling processes* are charged with the responsibility of guaranteeing that goals are met. Likewise, building production processes must be frequently monitored and this progress is measured against the construction plan to ensure corrective activities are implemented where necessary. Controlling processes comprise performance and status reviews during production processes. Controlling processes are also used to monitored and identify changes and to manage in agreement with the construction plan.

Similarly, PMBOK (2010) confirms that monitoring and controlling process groups are processes necessary for tracking, reviewing and regulating the progress and performance of the building production processes. According to Walker (2012), there is an absolute relationship between integration, monitoring, controlling and achieving efficient building production processes. Walker (2012) agrees that the management of the building production process is subject to external factors, elements outside the processes. If changes occur on the effects, the monitoring and controlling processes demand a response.

#### 2.7.5.5 Closing-out processes

*Closing-out processes* validate the acceptance of the building project and bring it to a logical and conclusive end. The close-out is introduced by the initiating group to bring the production to an end of each construction phase or at the end of the entire building production process. Also, closing out involves documenting construction files, keeping records of experiences gained as well as receiving official acceptance of the building and its products delivered.

### 2.8. Construction constraints affecting sustainable affordable housing

#### 2.8.1 Time constraints

At its most basic, the schedule is the estimated amount of time allotted to complete a project or produce a deliverable. Usually, this is figured out by first noting down all the tasks necessary to move from start to the finish of the project. Time as a constraint shows projects can be constrained by how long it should take to complete the project and the project's schedule (Westland, 2018). As time involves key dates on the project schedule, it is therefore important to conform to each date: penalties may be involved for failure to meet the agreed dates of completion. Delay in project completion is typically associated with contractor faults such as inadequate planning, poor site management, late payment of completed work, late supervision, slow decision making and failure to provide necessary equipment. However, not all delays area contractor's fault, as there are other time constraints imposed by other stakeholders such as inadequate financing of the client, planning permission expiry dates and changes in building regulations (DBW, 2020).

Cost estimating and cost budgeting, while two different processes, are closely linked. On small projects they are often undertake by the same person and because of this, influencing cost is easiest early in the project, so it is important to define the budget in the scope of a project at the beginning. This also includes creating a cost management plan, which has several benefits (Watt, 2019). Cost processes include cost estimating to determine the needed financial commitment for all resources required to complete the job. Cost budgeting creates a cost baseline and cost control works to manage the fluctuation of costs throughout the project

#### 2.8.2 Cost as construction constraints

Reducing a project's cost requires a reduction in scope or an increase in time. The financial commitment of the project depends on several variables with construction resources involved, from materials to manpower, which also include machinery costs. There are other factors that can affect a project which must be considered in the budget (Westland, 2018).

Cost is clearly a constraint that affects project progress, since it may result in a profit loss to the contractor (Kasimu, 2012). Estimating budget involves considering all costs: lab, material, equipment, factory, administrative, software and contractors, for example. Factors leading to cost constraints are

the nature of the project, resource availability, service availability and procurement, and low financial budgets.

### 2.8.3 Quality constraints

Quality constraints in construction typically involve ensuring compliance with minimum standards of material and workmanship in order to ensure the performance of the facility according to the design (O'Brien, 2013; De Wilde, 2014; Manap, Goh & Syahrom, 2017; Rumane, 2019). These minimum standards are contained in the building specifications (Hendrickson, 2019). For purposes of insuring compliance, random samples and statistical methods are commonly used as a basis for accepting or rejecting completed work and batches of materials (Rumane, 2013; De Wilde, 2014; Manap *et al.,* 2017). Materials obtained from suppliers or work performed by an organisation is inspected and passed as acceptable if the estimated defective percentage is within the acceptable quality level (Evans & Lindsay, 2013; Fox, M.J., 2013; Mitra, 2016).

Problems with materials or goods are corrected after product delivery (Safa, Shahi, Haas & Hipel, 2014; Weckenmann, Akkasoglu & Werner, 2015). The best-known formal certification for quality improvement is the International Organisation for Standardisation ISO 9000 standard. The ISO 9000 emphasises good documentation, quality goals and a series of cycles of planning, implementation and review (Heras-Saizarbitoria & Boiral, 2013; Oakland, 2014; Jovanović & Filipović, 2016; Rumane, 2017). Rodriguez (2019) suggests that there are many scenarios that require the issuance of a non-conformance report (NCR) for critical quality control:

- Project not executed as indicated in the approved documents for issuance
- Project fails to meet project specifications
- Performed using non-approved standards and codes
- Test results show that materials do not meet established and approved standards
- Material used that has not been approved as a substitute
- Inaccurate and inconsistency of design documents
- Quality defects identified by the project team, for example damaged or low-quality materials

## 2.9. Cost construction

Construction of a house is a costly process depending on the size of the the kind of project, for example the cost of a hostel development compared to a project for low-cost housing development have different values and targets for the community that is provided housing (Hegedüs, Horváth & Somogyi, 2014; Robson & McCartan, 2016; Oke & Aigbavboa, 2017).

There are expenses incurred by a contractor for material, labour, equipment, financing, services, utilities, plus overheads and contractor profit. Construction costs are part of overall cost incurred during

construction. In other words, construction costs are those costs incurred by the actual construction work (Design buildings, 2020)

The costs of construction to a client include both the initial capital cost and operation and maintenance costs. Each of these key cost types consists of a number of cost components.

Othman 2016 argued that the capital cost for a construction project includes the expenses linked to the initial establishment of the facility explained

- Land acquisition
- Feasibility studies and planning
- Engineering and Architectural design
- Construction, including materials, equipment and labour
- Field supervision of construction
- Insurance and taxes
- Owner's general office overhead
- Equipment and furnishings
- Inspection and testing

Operation and maintenance cost includes

- Land rent
- Functioning staff
- Labour and materials for repairs and maintenance
- renovation

**2.10 Cost of resources**

There are several different types of resources (cost) in construction.

*Material cost*

Seasonally, prices of material can fluctuate as a result of natural disasters and heightened construction activity. Material cost is the amount of money invested in or cost of materials used to execute construction work (Ellis, 2013).

*Manpower cost or labour cost*

Manpower cost or labour cost is the sum of all wages paid to employees, as well as the cost of employee benefits and payroll taxes paid by an employer. The cost of labour is broken into direct and

indirect (overhead) costs: direct cost includes wages for the employees that produce a product, including workers; while indirect costs are associated with support labour, such as employees who maintain equipment (DWB, 2020).

Construction labor productivity is most commonly research topic for construction field researcher due to of labor cost are around 30-50% of total cost of project. (Gupta & Kansal, 2014). In addition, the cost of labour is affected by minimum wage laws and union agreements, which would raise the costs of hiring unskilled labour (Pheng & Hou, 2019).

*Machinery cost*

Machinery cost includes operational costs, operating cost, overheads and profit. The use of construction equipment on a project allows greater productivity and enhanced quality but there is a considerable capital investment required in obtaining the machine emphasis (Anvuur & Kumaraswamy (2006)

### 2.10.1 Cost of stakeholders

The cost of stakeholders are fees referred to as payments made by the client to consultants for work or services on terms of agreement which is paid in instalments, at milestones or at early stages. The main consultant team for building project will include the following: architect fees, structural or civil engineers and services engineers, while larger project requires additional consultant for cost control and management.

Other experts such as project manager, contractor and cost consultant are on management fee contracts (subcontractor); hence, specialists are assigned depending on the nature of the project, for example an environmental consultant, legal adviser, interior designer, access consultants, fire engineers and planning consultant. Other fees to be paid on most projects include planning fees and building regulation fees (DWB, 2020).

### 2.10.2 Cost of procurement

The cost of procurement includes buying goods and services or produce inputs (for example, a make or buy decision plan). Selecting the exact contractor and agreeing on a price is complex and requires binding contractual measures or the arrangement of assigning a contractor. These contractors generally assign sub-contractors rather than employing direct labour. The costs of procuring these inputs, and confirming that they conform to specification are high (Hughes, Hillebrandt, Greenwood & Greenwood:2005).

## 2.11 Affordable housing design

It is important for the South Africa government to aim at a higher quality design house for the health and the safety of the people living in the house (Serag *et al.,* 2013; Neirotti *et al.,* 2014). This is

applicable to the most recent development on the Cape Gateway Breaking New Ground housing developments project. On the social side, it has been acceptable and a proven success due to the fact that people are accepting such developments without any major complaints concerning the development design and development quality, as well as development than the RDP housing scheme that were provided at a particular time (Manomano, 2013; Ogunde, 2013; Buffel *et al*., 2014; Botha, 2015).

A good design of affordable housing development for the purpose it is planned for in its surroundings is one of the main characteristics of a development. There is a need for clearly specified materials to suit the site characteristics of a particular province in South Africa to ensure that the quality is achieved and attainable (Van der Ryn & Cowan, 2013; Dessein *et al.,* 2015; Miller, Hauer & Werner, 2015). The South Africa governmental authority should impose restrictions on the designs to eliminate any possibility of low-quality designs that do not appeal to masses for the intended development. This was common in the previous policies for housing development in South Africa, as well as with designs that are out of scale (Hart, 2013; Fukuyama, 2014).

Guidelines should be provided as much as possible for the development of a scheme, roads and layouts as a regulation to suit the surrounding neighbouring development (Ellis, 2013; Heragu, 2018).There is still a long way to go with housing in South Africa. This is because housing is still a need for the majority of low-income earners and all the people still settling throughout informal locations in various parts of the country (Hall & Pfeiffer, 2013; Shackleton *et al.,* 2015; Costanza *et al.,* 2017). As design and construction of low-cost housing is a standard procedure, there must be careful planning for the number of houses that can be provided at a specific time, with a clear indication of budget (Harris & McCaffer, 2013; Blakely & Leigh, 2013; Kerzner, 2017).

There are currently better technological methods of construction that are faster and more efficient to implement for increasing the number of low-cost houses, but the main problem is that South Africa as a developing country suffers from high unemployment and is dependent on local material; therefore, it retains the original methodologies of constructing low-cost housing (Bhalla, 2016; Mawere, 2017; Cheres, 2018). The material being mostly local helps the unemployed with the manufacture of quality material. As technology advances, it is most likely to integrate construction methods that change and adapt with technology, with the implementation of newly researched material for good quality construction as well as for good environmental conditions (Myers, 2013; Schwalbe, 2015; Vezzoli, Ceschin, Diehl & Kohtala, 2015).

### 2.11.1 Materials

Houses developed in different provinces do not automatically consist of the same building materials (Pasquini, Cowling & Ziervogel, 2013; Carley & Christie, 2017). It is more economical to build houses with locally purchased materials, and these vary per province. When government constructed the first

affordable houses, recycled material was applied and focused on quantity at the lowest cost rather than quality, but in recent projects more consideration was given to sustainability of the developments by using materials from the local environment and also involving local community in the projects (Lehmann, 2013; Sameh, 2014; Yean Yng Ling & Song Anh Nguyen, 2013; Allen, Thallon & Schreyer, 2017). For recent developments in low-cost housing, building materials tend to be less expensive due to the use of locally available materials and essential labour cost due to proper time schedules of work. Cost of reduction is attained by the choice of more effective materials or by a better-quality design (Allwood, Ashby, Gutowski & Worrell, 2013; Alinaitwe, Apolot & Tindiwensi, 2013; Willis, 2018).

### 2.11.2 Cost of housing material and procurement

There has been execution of affordable materials and technologies in low-income, mixed-income and funded housing sectors (Talen, 2013; Chaskin & Joseph, 2013; Shapurjee & Charlton, 2013; Shackleton *et al.,* 2014). Additionally, Human Settlements Review in 2010 shows that 2.9 million housing units were provided for South African low-income earners between 1994 and 2009. But studies conducted during this period indicate that only 17 000 of these units were constructed using substituted building materials or advanced systems (Opoko & Oluwatayo, 2014; Mahadea, 2014; Adegun & Adedeji, 2017). This constitutes only 0.06%. Low-income residential developments can be significantly upgraded by considering affordable building material selections (Shackleton *et al.,* 2014; Alaidroos & Krarti, 2015; Garland *et al.,* 2013). Up to 60% of total housing delivery costs can be ascribed to engineering design and construction materials, clearly modifying the exploration and implementation of more effective changes for the sake of improving the use of financial resources (Perera, Rameezdeen, Chileshe & Hosseini, 2014; Ngigi, 2016; Ganiyu, 2016). The use of affordable building materials could excel the building process considerably. A 40 m² house may be built in four to seven days, using affordable materials, compared to the average thirty-day period required to build a unit of the same size using orthodox brick and mortar construction (El-Gohary & Aziz, 2013; Safa *et al.,* 2014). Given the difficulties experienced in South African housing development and the urgency related to supplying homes for the disadvantaged, time savings can be of substantial advantage (Roberts & O'Donoghue, 2013; Strauss & Liebenberg, 2014; Govender & Reddy, 2014).

# CHAPTER THREE

# METHODOLOGY

## 3.1 Preamble

Based on the research objectives, the preceding chapter provided a review of theoretical and empirical literature for achieving the aim of the research. This chapter presents the methodology used for the data collection and analysis processes. Leedy and Ormrod (2010) describe *research methodology* as an approach in a study that explains and orders the step-by-step process in conducting research, from data collection to data analysis and conclusion.

This chapter begins with a general outline of various types of research methods, followed by the specific research design adopted for this study. Prior to the approval of a research design, the research problem and questions are considered ultimate in selecting a suitable methodology for the research. This chapter also provides a brief description in respect of sampling techniques, data collection approach, process of analysis, the basis for these selections and significantly, the test of validity and reliability of the research tool.

## 3.2 Research Design

Research design is a complete process of acquiring, analysing and interpreting data with the goal of reaching a conclusion that increases the knowledge of a study (Leedy & Ormrod, 2010). Leedy and Ormrod (2010) further explain that the primary functions of research methodology are to set standards for data collection and to collate the data after their collection and give interpretation. Research is a repeated process of study in nature; it involves several ambiguous and logical steps in reaching a complete solution to the research questions. Moreover, Biggam (2015) highlights the significance of relationships between the research methodologies, methods of data collection and the techniques of data analysis, explaining that the principal concerns of a researcher in methodology designs for solving research problems are as follows:

- What data are to be collected (research concept)?
- Why are those specific data being collected (significance)?
- Where will the data be collected (target population)?
- When will the data collection be coordinated?
- How will the data be collected and analysed?

According to Kothari (2004), the quantitative research approach is primarily the measurement of quantities, numbers and amounts. The quantitative research approach is an orderly process of using numerical data from a selected sample group of a population to generalise findings to the population of study (Maree, 2007). Therefore, this method applies the statistical approach of analysis, presenting the results arithmetically (O'Leary, 2017). According to Thomas (2003), the quantitative research

method allows the researchers to attain predictable results from a population within a short period of time at low cost; Flick (2015) agrees, stating that this research approach is categorised as three (3) fundamentals: precise objectivity, arithmetical result (data) and generalisability.

As a result, the collection of a quantitative data often comprises the use of a closed-ended questionnaire (Creswell & Clark, 2007). Notably, numerous approaches have been identified for conducting quantitative research comprising theoretical studies, descriptive research, developmental studies (case studies and surveys) and correlational studies (Leedy *et al.,* 2010).

### 3.2.1 Qualitative research approach

Leedy *et al.* (2005) explain that qualitative research is an extensive approach to research which includes several approaches, techniques and philosophies. The qualitative research approach comprises the use and collection of various experimental data, for example observational, interview and historical studies (Creswell & Clark, 2007). Moreover, a qualitative research approach is an act of collecting comprehensive descriptive data regarding a specific phenomenon with the aim of improving knowledge (O'Leary, 2017). Likewise, according to Flick (2015), this approach is fundamentally concerned with acquiring an intent understanding of the social, cultural, and behavioural patterns of people in an environment by relating with the participants of the study. Significantly, *qualitative research methodology* is a term which shows the relationship between ranges of a research model, with paradigms including ontology, nomothetic, positivism and ethnography (Creswell, Ebersohn, Eloff, Ferreira, Ivankova, Jansen, Pietersen, Clark & Westhuizen, Nieuwenhuis:2007). Table 3.1 summarises the characteristics of both qualitative and quantitative research approaches.

**Table 3.1: Characteristics of qualitative and quantitative research approaches**

| | Quantitative | Qualitative |
|---|---|---|
| **Aim** | The aim is to count things in an effort to explain what is observed | The aim is a complete, detailed description of what is observed |
| **Purpose** | Generalisation, prediction, spontaneous explanation | Contextualisation, interpretation, understanding perspectives |
| **Tools** | Researchers use tools and surveys to collect arithmetical data | Researcher is the data gathering instrument |
| **Data collection** | Adopting a structured approach | Unstructured approach |
| **Output** | Data is presented in the form of numbers and statistics | The data is presented in the form of words, pictures or objects |
| **Sample** | Usually, a large number of cases representing the population of interest; respondents may be selected at random | Commonly a small number of non-representative cases; respondents are selected base on skill |
| **Objective/ Subjective** | Finds precise measurement and analysis | Subjective: individual interpretation of events is essential |

| | | |
|---|---|---|
| **Researcher role** | Researcher tends to remain factually separated from the subject matter. | Researcher tends to become subjectively occupied in the subject matter |
| **Analysis** | Uses statistical analysis such as descriptive and inferential statistics | Interpretive using content and systematic analysis |

**(Source: Macdonald & Headlam, 2007)**

### 3.2.2 Mixed method research

Mixed method research entails the implementation of philosophical assumptions in the collection and analysis of both quantitative and qualitative data in a single research work (Creswell & Clark, 2007). In addition, implementation of this combined state of qualitative and quantitative provides a better understanding of the research focus (Creswell *et al.,* 2007). The mixed research approach gives the researcher an opportunity to increases the validity of the research where one method covers up for the lapses of the other without any room for personal bias (Henn, Weinstein & Foard, 2006). Thus, a mixed method improves better integrates a variety of realistic and theoretical perspectives, which has been identified as a challenge of applying a quantitative and qualitative approach separately (Creswell, 2011). The advantages of integrating the qualitative and quantitative method postulated by Creswell (2007) are as follows:

- Mixed method research offers solutions to questions that the qualitative or quantitative method cannot solve unaided or individually;
- Mixed method research provides the researcher a broad perspective regarding the area of study; and
- The researcher is encouraged to utilise various paradigms linked to both research methods i.e., qualitative and quantitative methods.

Irrespective of the advantages of the mixed method research, researchers face some challenges in the course of their research. The challenges according to Creswell *et al.* (2011) include the following:

- It complicates the process of data collection in research;
- The procedure of collecting and analysing multiple data is resource- and time-consuming;
- It requires multidisciplinary and specialised team work for data interpretation; and
- The sampling size contains the design and data collection.

## 3.3 Research approach

### 3.3.1 Deductive research approach

The deductive research method entails the researcher using theory at the beginning of the study, generating hypothesis from the theory and then testing the hypothesis (Dahlberg & McCaig, 2010).

According to Dahlberg and McCraig (2010) it is described as a 'top-down' research approach. The applicable theory is consulted deliberately to guide the formulation of research questions (Punch, 2013). The factual content in conclusion of a deductive method is primarily used in quantitative information research (Bryman, 2016).

### 3.3.2 Inductive research approach

The inductive research method begins with the collection of flexible empirical data. This method allows for the change of questions to introduce new questions at any point in the study Dahlberg (2010). This approach, a 'bottom up' research method, contributes to knowledge of reality and eventually produces a theory. The genuine evidence supporting the theory leads to a conclusion with supporting statements for the conclusion as the discovered reality becomes clearer (Mouton, 1996). Bryman (2016) contends that the inductive research method generates, rather than tests, a theory and is mainly used in qualitative research. According to Punch (2013), a researcher can begin the research process with an inductive investigative stage and then generate a theory to be tested in a deductive descriptive stage.

## 3.4 Research strategies

### 3.4.1 Experimental designs

An experimental design research strategy requires a difficult and precise search for cause and effect. Experimental design requires researchers to deliberately vary an independent variable, for example the key determinant in the study, to determine the impact on the determinant variable such as the main object of study inquiry (O'Leary, 2017). Experimental design is often held up as a standard because it produces considerable confidence in the strength and credibility of causal findings (Bryman, 2016). The design comprises goal-directed acts performed upon study groups for the purpose of analysing the impact of one on the other (Flick, 2015). Experimental design involves at least two experimental groups. However, Kumar (2012) enumerates a number of challenges associated with the experimental design including the following:

- Matching increase in difficulty when carried out on more than one variable;
- Variables that are hard to measure, such as attitude, pose a challenge, and
- Selecting a variable to serve as the basis of matching may sometimes be challenging.

### 3.4.2 Survey research

*Survey research* is defined as the process of data collection by asking a range of individuals the same questions related to their characteristics, attitude, ways of living or opinion through a questionnaire administration (O'Leary, 2017). This form of research is carried out purposely to afford the researcher statistical information, either on specific challenges that require improvement or to test the strength of

an existing theory (Punch, 2013). A survey researcher selects the kind of population that best suits an investigation of the research topic, designs a research instrument and devises a means of administering the instrument (Bryman, 2016). Dahlberg *et al.* (2010) argue that the response rate is an important factor to be considered for a survey to be statistically effective and allow study conclusions to be generalizable to the research population. Babbie (2013) suggests that survey research is the best method for collecting data from a study population that is too large to observe directly. Thus, survey research, according to (Maree & Peterson: 2007), is characterised by the following: large sample size; many variables measured to generate related hypothesis for testing; and results that are generalised.

### 3.4.3 Historical research

Leedy *et al.* (2010) define *historical research* as an effort undertaken by a researcher to interpret historic events through the collection and analysing of historic documents or oral histories. Similarly, Walliman (2017) defines historical research as a systematic and objective process of locating, evaluating and integrating research findings to reach an accurate conclusion derived from past events. Likewise, (Pieterson et al:2007). define historical research as a systematic holistic process of describing, analysing and interpreting past events based on information derived from a selected population. Walliman (2017) categorises the importance of historic research to a researcher as follows:

- It provides results to existing problems that occurred in the past;
- It highlights the importance and defects of interfaces in the pattern of a selected population (by asking *how* and *why* things occur); and
- It creates room for the re-evaluation of the past collated data supporting theories, hypothesis or generalised conclusions to give more understanding to present and future developments.

According to (Nieuwenhuis, Ferreira, Ivankova ,Elof, Jasen, creswell, Westhuizen & clark :2007) historical research requires the researcher to give critical, analytical scrutiny of minutes, reports or documents regarding events or incidents. The author enumerates four types of historical research in terms of data sources which are very useful for general research, as follows:

- Primary sources (archived document or original sources)
- Secondary sources (works of other scholars on focus of study i.e. literature review)
- Running records (documentaries maintained by organisations)
- Recollection (oral histories and autobiographies).

### 3.4.4 Comparative research

According to Walliman (2017), comparative research is frequently used simultaneously with historical research. Comparative research, a regular process of searching for the similarities and differences between phenomenon over a specific period of time (Nieuwenhuis et al:2007) explained involves the

process of defining the research concepts, itemising them as operative variables and generating hypothetical relationships between the variables before carrying out a test on hypothesis (Schwartz and Yanow: 2013). Thus, a comparative researcher is required to compare the experiences of different respondents of different backgrounds, based on a situation at a particular time. (Nieuwenhuis et al, 2007) suggests that comparative research offers first-hand accounts of events which are usually reported by the observers, also contending that the content of information resulting from this strategy of research is validated if not exaggerated.

### 3.4.5 Action research

Leedy *et al.* (2010) define *action research* as applied research which is aimed at finding solutions to the original problems of a specific group of people by using a common resource. Mcniff and Whitehead (2010) define action research as a form of analysis conducted by professional practitioners to evaluate and improve the existing work practices by resolving issues relating to their job. The fundamental aim of an action researcher as an intermediary is to assist in planning and implementing effective solutions to problems suffered by the participants (Nieuwenhuis et al 2007). Though, to successfully conduct action research, it is required of the researcher to possess the ability to understand and interpret problems and to give possible solutions (Kumar, 2012). According to (Nieuwenhuis et al :2007) highlight the following as characteristics of an action research:

- It seeks to develop solutions to practical issues;
- It is designed to create a change;
- It is an interactive approach to knowledge development;
- It is a recurring research process of planning, solution implementation and reasoning, and
- It requires the participation of the research sample and the researchers.

### 3.4.6 Descriptive research

*Descriptive research* has been described as methods to obtain information to devise hypotheses and proposing associations (American Dietetic Association, 2008). It provides background information concerning an event by examining the situation to form what the norm is. Observation is one of the methods applied to collect data under descriptive research; information can be collected through interviews, questionnaires and visual recording instruments (Walliman, 2006).

## 3.5 Questionnaire design

According to Adler and Clark (2008), questionnaires are tools used for data collection comprising questions and statements structured to obtain information from research respondents without oral communication. Although questionnaires are designed to be as flexible as possible, they must be

used suitably to address relevant issues of the research (Flick, 2015). Questionnaire design phase is a very significant phase of a research because it aids the realisation of the research objectives (Maree, 2007). Thus, the process of questionnaire design requires the researchers to take into consideration the type of data to collect and the method of data analysis to be implemented. Furthermore, Dahlberg and McCaig (2010) support that the effect of inadequately designed questionnaires obtaining inappropriate or inadequate information in research. Therefore, designing an adequate questionnaire requires the following to be given careful attention by the researchers, as itemised by Maree (2007):

- Total appearance of the questionnaire i.e., quality of paper and font size;
- Question sequence i.e., easy to answer questions first;
- Clear and adequate response categories; and
- Wordings of question i.e., carefully selected clear words.

Maree (2007) explains that questionnaires are of various forms which are mainly divided into two categories: open-ended questions and closed-ended questions.

### 3.5.1 Open-ended questions

Open-ended questions are questions asked without a specific guide for a pattern for answering the question. These forms of questions are usually designed with participants' straight opinions in mind (Maree, 2007). Therefore, respondents are permitted to give comments and express their opinions (Kumar, 2012). However, Hopkins (2008) contends that although the close-ended questions are generally used to test research hypothesis, the open-ended questions are most suitable in generating a research hypothesis. Hopkins explains that open-ended questions tend to explore and determine validity and reliability of the questionnaire. Maree (2007) outlines the followings as the advantages and disadvantages of open-ended questions:

### 3.5.2 Closed-ended questions

Closed-ended questions are structured questions seeking to obtain integrated responses from participants. According to Maree (2007), closed-ended questionnaires provide a set of serial questions, requesting respondents to choose the most appropriate answers. Kumar (2012) affirms that the use of closed-ended questions in research gives the researchers the benefits of obtaining sufficient information to reach a more general conclusion. Leedy and Ormrod (2010) also support that applying a closed-ended question in research has several advantages.

Nevertheless, despite the numerous advantages of closed-ended questions, Maree (2007) also identifies several disadvantages of closed-ended questions.

**Table 3.2: Advantages and disadvantages of closed-ended question in research**

| Advantages | Disadvantages |
|---|---|
| Questions are short, precise and easy to answer | Answers are very simple with no background details |
| Coding and statistical analysis are easily done | Respondents may be persuaded to give answers they would never given |
| | Answering the questions are too easy, so answers given may mis-inform researchers |
| | Respondent opinion might not be an option to choose from |
| | Questionnaires are frequently too long |

### 3.6 Research design

A research design process involves planning and strategizing approaches required in conducting research (Punch, 2013). Research design is a holistic process which describes the general procedure of solving a research problem within a specific period of time (i.e., data collection, data analysis and selection of relevant empirical materials) (Leedy *et al.,* 2010). In particular, the selection of a research design relevant to the existent study is dependent on the phenomenon being studied, study participants, location of the survey and the researcher's survey experience (Kumar, 2012). Punch (2013) and Walliman (2017) identify the following as characteristics of a reliable research design:

- Research design must aim at obtaining assessable data (data should be statistically based);
- Research design must be replicable by other researchers within the same constraints; and
- Research design must state the suitable data analysis to be undertaken, and why.

#### 3.6.1 Research design for this study

#### 3.6.2 Exploratory study

An exploratory study is an essential part of a research questionnaire design to gain more understanding into the research problem and to provide solutions to the problems (Dahlberg *et al.,* 2010). Hence, Creswell (2011) recommends pre-testing of a questionnaire, including groups within the lager group of possible participants. Piloting the research tool helps determine the possibility of answering the research questions using the data generated from the questionnaires, before proceeding to the main research study. A questionnaire used for this exploratory study was piloted amongst construction stakeholders and post-graduate students from the Department of Construction Management and Quantity Surveying, Cape Peninsula University of Technology, to verify the significance of the tool for the research. According to Neuman (2000), the use of pilot study questionnaire can improve the reliability of the research study.

### 3.6.3 Population and sample size

The space of units from which a sample is to be selected is called a *population* (Bryman, 2016). A sample population does not only refer to people being sampled in a study, but mainly depends on the nature of the researcher's study. O'Leary (2017) defines *population* as the total involvement of a defined class, objects or events. For the purpose of this research, the poor implementation of housing problems faced by low-income earners due to unaffordable and unsustainable housing systems is the identified issue that the research aims to address. Hence, the population for this study consists of construction workers, construction professionals and government officials involved in the construction of sustainable affordable housing in South Africa.

The sample frame is a list of elements comprising the population of a study (Babbie, 2013). Flick (2015) suggests that the sample of a study should be a minimised representation of the population in terms of heterogeneity of the elements and representativeness of the variables. However, according to O'Leary (2017), the larger the sample in a quantitative research project, the better it is represented and therefore the more generalizable the conclusions are. Thus, the sample frame for the research is an adequate representation of construction professionals in both private and public firms and construction workers in South Africa. Most survey participants are construction professionals with extensive construction knowledge and formal educational background,contract managers, project managers, , architects, quantity surveyors and consulting engineers are the selected sample to represent the population for the purpose of this study. The 102 construction workers that constitute the sample for the research, as previously highlighted, are tasked with responsibilities on construction sites and therefore are arguably a good representation of the South African construction workforce.

### 3.6.4 Research sampling technique

According to O'Leary, (2017) the process of selecting elements of population to be included in research is referred to as *sampling.* O'Leary (2017) suggests that a significant number of research samples are representative sample distributions and process characteristics that allow findings to be generalised to the entire population. Population samples make the research process manageable. The research adopts convenient and purposive sampling techniques. Considering that the complex nature of construction operations leads to busy schedules of project participants, questionnaires were administered to construction professionals in South African provinces based on accessibility to construction sites and availability of construction professionals on sites. Struwig and Stead (2013) define *convenient sampling* as a sampling technique adopted on the basis of availability and accessibility of respondents. However, construction site supervisors interviewed were purposively selected on the basis of the direct working relationship between site supervisors and construction operative. Participant site supervisors interviewed were experienced in construction, with adequate years of

supervisory responsibilities in the construction sector. The experience of the site supervisors is arguably a helpful instrument to assess the validity of data obtained from construction professionals. Richards and Morse (2012) define *purposive sampling* as a sampling technique that enables researcher to select study participants with respect to their characteristics, i.e., participants with right information. Mertens (2014) further argues that a purposive sampling strategy is a system where the researcher deliberately chooses a sample for a study, having a clear purpose in mind. According to O'Leary (2017), an adequate sample frame and large sample size prevents unbiased research, represents a population and presents a generalizable finding with respect to the population

### 3.7. Data collection techniques

Data collection techniques entail the exploration of different sources of data for a research project. The framework presented in this research study is an outcome of secondary and primary data collected, as presented in the next chapter. A mixed method approach was applied to this research, these are quantitative data and qualitative data, Struwig *et al*. (2007) note that two describes the sources of data collection in a research study are primary and secondary data. A triangulated data collection technique was adopted for this research as this study considered different types of data and determines the sources of data that best achieve the aim of the research (Creswell & Clark, 2017).The sources of information for the review of literature included textbooks, journal articles, conference proceedings, reports, dissertations and theses.. Leedy *et al.* (2005) explain that qualitative research is an extensive approach to research which includes several approaches, techniques and philosophies. The qualitative research approach comprises the use and collection of various experimental data, for example observational, interview and historical studies (Creswell & Clark, 2007). Notably, numerous approaches have been identified for conducting quantitative research comprising theoretical studies, descriptive research, developmental studies (case studies and surveys) and correlational studies (Leedy&Ormrod).

#### 3.7.1 Secondary data collection

*Secondary data* are easily accessible data obtained from research conducted by other researchers (Struwig *et al.,* 2007). Furthermore, secondary data can also be referred to as a literature review in research. O'Leary (2017) stresses the importance of accessing past innovations for the production of new knowledge. Melville and Goddard (2004) note that the secondary data (literature review) is obtainable in two different forms: a preliminary and a comprehensive review. A preliminary review was adopted in Chapter 1 of this study to develop the study's framework, while the comprehensive review of literature was conducted in Chapter 2 of this study to evaluate and extend the views of other researchers on comparatively relevant topics. The data obtained from past research revealed diverse effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing in South Africa, the influence of stakeholders in providing sustainable affordable

housing for low-income earners as well as a significant number of factors explored from the existing literature to assist in the design of questionnaire The sources of information for the secondary data are textbooks, journal articles, conference proceedings, reports, dissertations and thesis. Secondary data are easily accessible data obtained from research conducted by other researchers (Struwig & Stead, 2007)

### 3.7.2 Primary data collection

According to Leedy *et al.* (2010), the most effective information obtained in a research is *primary data*. This method of data collection involves researchers making certain that the questions are designed for respondents in a clear and understandable manner to elicit thorough and fitting information (Kumar, 2012). The primary data for the study were collected through the administration of quantitative questionnaires to survey respondents as well as through interviews conducted face-to-face with site supervisors, while the questionnaires were administered to respondents by hand and via the internet (via SurveyMonkey). which is an adequate representation of construction professionals in both private and public firms and construction workers in South Africa such as project managers, architects, quantity surveyors, real estate surveyor, site engineer. This method of data collection involves researchers making certain that the questions are designed for respondents in a clear and understandable manner to elicit thorough and fitting information (Kumar, 2012)

### 3.7.3 Interview

This method of data collection is qualitative in nature and commonly open-ended. However, Flick (2015) is of opinion that when conducting qualitative interviews, there should be dialogue between the interviewer and interviewee. According to Leedy *et al*. (2010), interviews in a survey are designed in two forms – structured and semi-structured – depending on the purpose of the survey. Furthermore, Kumar (2012) explains that interviews provide the researcher a level of impulsiveness, flexibility and authority to dialogue and interact with survey respondents. The semi-structured qualitative interview was chosen for the purpose of this research study, due to the flexibility of semi-structured interviews.

The respondents were informed prior to the meeting of the focus of the interview and the relevance of the research study, giving respondents sufficient time to prepare in advance. The interview was tape-recorded with the permission from the respondents. A total of three (3) construction sites were selected for the data validation. Interviews were conducted with construction stakeholders on each of the construction sites selected for data validation, as construction stakeholders are in the best position to disclose the effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing in South Africa. Emphatically, project managers have important knowledge of the effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing. Semi-structured interviews are designed for a number of

valuable tasks, mostly when more than a few of the open-ended questions require follow-up queries. The following are to be considered in an interview context:

If you need to ask, open-ended questions and want to know the independent thoughts of each individual in a group.

Asking questions on topics that your respondent might not be comfortable answering about and among peers.

### 3.7.4 Unstructured interviews

This type of interview is usually unstructured, is an informal discussion; the interviewer will likely go into in-depth discussion with the participant. However, in this type of unstructured interview, it is likely that the researcher will have a selected range of topics and objectives to cover during the interview (Willis, 2018). Unstructured interviews were used extensively to gather information and data for the achievement of sustainable affordable housing through effective implementation of planning techniques. Likewise, MacDonald and Headlam (2007) confirm that the method of interview is unplanned questions; issues are addressed by the researcher as they arise.

### 3.7.5 Questionnaire design

The most significant aspect of any survey is the questionnaire design (Kumar, 2012). A research questionnaire with close-ended questions is designed in consonance with the study objectives as well as the information derived from the reviewed literature. For this study, the questionnaire was structured in sections, each section addressing a particular objective. Table 3.2 illustrates the relationship between the sections and the study objectives. The first section of the questionnaire enquires about biographical information of the survey participants. The second section of the questionnaire comprises three sub-sections which address the first objective of the research with the aim of identifying the effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing in South Africa. A five-point Likert scale (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree) was adopted to evaluate the three constraints, namely cost, time and quality. The third section of the questionnaire is to establish the influence of stakeholders in providing sustainable affordable housing for low-income earners. The perceptions of the stakeholders were also examined on a five-point Likert scale (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree). The fourth section identifies the challenges of implementing planning towards the achievement of sustainable affordable housing. The challenges were evaluated based on a five-point Likert scale (1 – Not critical, 2 – Less critical, 3 – Neutral, 4 – Critical, 5 – Very critical). The final and fifth section addresses the final objective of the research study, to ascertain the modalities of achieving sustainable affordable housing delivery during the planning process. Perspective of respondents regarding these modalities were assessed based on a five-point Likert scale (1 – Not important, 2 – Somewhat important, 3 – Important, 4 – Very important, 5 – Extremely important).

**Table 3.3: Questionnaire design**

| Section | Section title | Section objective |
|---|---|---|
| 1 | Biographical information | |
| 2 | Effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing | Objective 1 |
| 3 | Influence of stakeholders in providing sustainable affordable housing for low-income earners | Objective 2 |
| 4 | Challenges of implementing planning towards the achievement of sustainable affordable housing | Objective 3 |
| 5 | Modalities of achieving sustainable affordable housing delivery during the planning process | Objective 4 |

### 3.7.6 Data analysis for the study

Data analysis includes tabulating, data testing, categorising and examining results to address the purpose of a study (Yin, 2003). In this study, the quantitative data gathered were coded and captured using the Statistical Package for Social Sciences (SPSS) software. The quantitative data were analysed accordingly using both descriptive and inferential statistics. Likewise, qualitative data were analysed technically by content analysis.

### 3.7.7 Descriptive statistics

*Descriptive statistics* in research analysis can be defined as the process of showing a set of quantitative data in clear formats, for example, tables and charts (Lapa & Quartaroli, 2009). Thus, Struwig *et al.* (2007) suggest that the purpose of using statistical tools in data analysis is to display a straight forward picture of a large amount of data. Leedy *et al.* (2010) highlight the three predominate terms used in descriptive statistical data analysis: central tendency measurement, dispersion measurements and frequency distributions. This study adopted the use of frequency distribution and central tendency measurement techniques for analysing the quantitative data obtained in the survey using mean and standard deviations.

### 3.7.8 Inferential statistics

*Inferential statistical methods* are defined as part of a statistical procedure that draws conclusions from samples obtained in a group to a larger population. Inferential statistical methods involve the testing of differences between group means and relationships between variables (Teddie & Tashakkori, 2009). This method is applied in this study because hypotheses testing between two variables is required.

### 3.8 Content analysis

*Content analysis* mainly involves the coding and transcribing of human communication (oral or written) or other sources of communication (Leedy *et al.,* 2010). According to Flick (2015), this method includes the summary of content, while inappropriate words are omitted. For the most part, content analysis is an effective method for answering a substantial research question. When compared with analysis of questionnaires, content analysis takes more time in terms of data processing and transcribing (Thomas, 2003). Content analysis adopts the inductive approach in exploring the advantages and disadvantages of a text or statement to support or oppose a theory in context. This study reported a summary of the relevant contents in the transcribed data obtained from the interviewees, whereas irrelevant information was omitted in the reporting process.

### 3.9 Validity and reliability of the data

Validity and reliability of the research tool impact the authenticity of research. The principles of validity and reliability vary depending on the type of the research undertaken.

#### 3.9.1 Validity

*Validity* of research describes the originality of the survey tool and therefore the research findings (Struwig *et al.,* 2007). Leedy (2010) explains that the validity of a research is the extent to which the instrument used measures what it is supposed to measure. Overall, validity refers to the credibility of research finding (Struwig *et al.,* 2007).

#### 3.9.2 Reliability

Research *reliability* explains the solidity of a research result when used at different times or administered to different subjects from the population (Leedy *et al*., 2010). The major reason for conducting a reliability test is to reduce the inaccuracy in a survey (Srivastava & Thomson, 2009). The Cronbach's alpha coefficient test is one such statistical tool often applied for evaluating the reliability of data (Girden & Kabacoff, 2010). Consequently, in the framework of this study, the reliability of the questionnaire was guaranteed by testing the questionnaire using Cronbach's alpha coefficient. It is agreed that the closer the coefficient is to 1, the more reliable the survey instrument is, with the best Cronbach's coefficient value above 0.7.

#### 3.9.3Testing the reliability of research instruments

The reliability of the questions in the survey were tested with Cronbach's alpha coefficient test, through the application of the SPSS software, to confirm their reliability. The Cronbach's alpha reliability test is an estimate of the internal consistency associated with scores that can be derived from the scale or composite score (Cronbach, 1951;). According to Maree (2007), the Cronbach's alpha coefficient could be interpreted as high reliability (0.9); moderate reliability (0.80); and low reliability

(0.70). The results presented in Table 4.2 indicate that the internal consistency in the scale ranges between moderately reliable to highly reliable as the least and highest Cronbach alpha values are 0.7645 and 0.9357, respectively.

**Table 3.4 Reliability test**

| Variable | Number of Items | Cronbach's alpha coefficient |
|---|---|---|
| Cost constraint | 10 | 0.9204 |
| Time constraint | 9 | 0.9357 |
| Quality constraint | 6 | 0.9295 |
| Clients | 4 | 0.8613 |
| Resource manager | 4 | 0.9122 |
| Project manager | 6 | 0.9044 |
| Contractor & subcontractor | 5 | 0.8506 |
| Government | 5 | 0.9110 |
| Suppliers | 4 | 0.9019 |
| Non-governmental association | 5 | 0.9325 |
| Market challenges | 5 | 0.8557 |
| Professional challenges | 5 | 0.8809 |
| Societal challenges | 5 | 0.9333 |
| Technological challenges | 5 | 0.8987 |
| Time management | 7 | 0.9149 |
| Quality management planning technique | 5 | 0.9083 |
| Integration & leadership management technique | 5 | 0.9084 |
| Communication management technique | 4 | 0.7645 |
| Risk management technique | 3 | 0.8388 |
| Scope management technique | 4 | 0.9068 |
| Cost management technique | 6 | 0.9059 |
| Human resources management techniques | 4 | 0.8536 |

### 3.10 Chapter summary

This chapter provides a comprehensive overview of the research methodology adopted in this restudy. A mixed research approach, that is, quantitative and qualitative, was adopted to achieve the aim and objectives of the study. The quantitative research questionnaire was structured and designed to produce the observations of construction professionals in both public and private firms and stakeholders on the framework to enhance effective implementation of planning techniques towards achievement of sustainable affordable housing in South Africa. Literature reviews, interviews and questionnaires were used for the collection of both primary and secondary data for the study. The approaches used for questionnaire administration were both ‘online’ and ‘hand-in’ approach. Subsequently, the reliability of the findings and results were tested using Cronbach’s alpha coefficient reliability test.

# CHAPTER FOUR

# RESULTS AND DISCUSSION OF FINDINGS

## 4.1 Preambles

The chapter analyses the primary data collected from the participants using a questionnaire survey. The first section outlines how the pilot study was conducted and the response rate regarding the survey. The demographic data of the respondents – including gender, age, level of education and current position – are explained in the next section. The analysis of the test of reliability of the research instruments was also presented. The subsequent section presents the interpretation of the results in respect to the effects of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing in South Africa and the influence of stakeholders during the planning process in providing sustainable affordable housing for low-income earners. In addition, the challenges of implementing planning techniques towards the achievement of sustainable affordable housing and the modalities of achieving sustainable affordable housing delivery during the planning process have been discussed. The results obtained were interpreted and discussed before conclusions and recommendations are drawn in chapter five.

## 4.2 Pilot study

To substantiate the appropriateness and clarity of the questionnaires to be distributed, the research questionnaire was piloted among South African construction professionals. The respondents were requested to read the research instrument and make necessary comments. A total of 28 questionnaires were administered to construction professionals in the Western, Eastern and Northern Cape provinces. The inputs of the construction professionals were duly considered, and necessary adjustments were made in fine-tuning the original questionnaire.

## 4.3 Response rate of the survey

Data was collected through a questionnaire survey in the Western, Eastern and Northern Cape provinces. It is instructive to note that a total of 300 questionnaires were administered electronically to construction practioners (architects, clients, project managers, contract managers, site managers, structural engineers, quantity surveyors, site engineers and contractors) in the three (3) provinces. Due to Covid-19 lockdown rules coinciding with data collection, a series of emails were sent as reminders and countless phone calls were made as follow ups to improve the response rate. However only 102 respondents duly completed and returned the survey electronically, representing 34% of the response rate.

### 4.4 Background profile of respondents

As indicated in Table 4.1 below with regard to gender, 80.4% of the respondents were males while 19.6% were females. It is evident that the percentage of male respondents is higher than their female counterparts. However, the information provided by the respondents does not pose any gender discrimination for the purpose of the research. With regard to the age group of the respondents, it is observed that the age group with the lowest percentage (1%) falls within 51-60 years of age. The highest percentage (52.0%) of respondents are aged between 31-40 years old. The second highest percentage (18.6%) of respondent are aged between 25-30 years, while 16.7% of the respondents fall within the ages of 25 years and below, and finally, 11.8% of the respondents' ages fall within the 41-50 years' age group. An overview of the result indicates that 87.2% of respondents were not older than 40 years of age, while a nominal estimate of 12.8% were above 40 years of age. This confirms that majority of survey respondents are relatively young.

It is evident from Table 4.1 that the qualification levels of the respondents were categorised into masters, bachelor's, post-graduate diploma, and diploma qualifications. As evidenced, respondents holding a diploma certificate represent 17.8% of the total participants; 18.8% hold a postgraduate diploma; respondents with a bachelor's degree in their various fields represent 47.5%; while master's degree holders represent 15.8% of the respondents. This signifies that majority of participants are bachelor's degree holders. It can also be inferred that respondents are knowledgeable and competent practitioners in the construction industry, wherein their judgement on issues relating to sustainable affordable housing is relevant and reliable.

In addition, the results in Table 4.1 illustrate the characteristics of the respondents from different industries. The information was accumulated from the public and private sectors of the construction industry. It is evident that 66.7% of the respondents work in the private sector; 13.7% are public sector workers; and 18.6% work in both the private and public sector. In respect of the position or professions of the respondents, 48% of the respondents are quantity surveyors; 23.5% are project managers; and 4.9% of the respondents are real estate managers. Furthermore, 7.8% of the respondents are consulting engineers; 2.9% of the respondents are architects; and 11.8% are in other professions such as contractors and subcontractors. The table below makes clear that most of the respondents are quantity surveyors, amongst other professions that participated in the survey exercise.

**Table 4.1: Background profile of respondents**

| Variable | Frequency | Percentage |
|---|---|---|
| **Gender** | | |
| Male | 82 | 80.4 |
| Female | 20 | 19.6 |
| **Total** | 102 | 100.0% |
| **Age** | | |
| <25 years | 17 | 16.7 |
| 25-30 years | 19 | 18.6 |
| 31-40 years | 53 | 52.0 |
| 41-50 years | 12 | 11.8 |
| 51-60 years | 1 | 1.0 |
| **Total** | 102 | 100% |
| **Level of education** | | |
| Master's | 16 | 15.8 |
| Bachelor's degree | 48 | 47.5 |
| Post-graduate diploma | 19 | 18.8 |
| Diploma | 18 | 17.8 |
| Total | 101 | 100% |
| **Industry** | | |
| Private | 68 | 66.7 |
| Public | 14 | 13.9 |
| Both | 19 | 18.8 |
| **Total** | 101 | 100% |
| **Position** | | |
| Quantity Surveyors | 49 | 48.5 |
| Project Managers | 24 | 23.8 |
| Real Estate Agents | 05 | 5.0 |
| Consulting Engineers | 08 | 7.9 |
| Architects | 03 | 2.9 |
| Others | 12 | 11.9 |
| **Total** | 101 | 100% |

### 4.5 Interpretation of the results

The study was undertaken to proffer solutions in terms of achieving sustainable affordable housing through effective implementation of planning techniques from the findings of the following: the effects of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing delivery in South Africa; the influence of stakeholders during the planning process in providing sustainable affordable housing for low-income earners; the challenges of implementing planning techniques towards the achievement of sustainable affordable housing; and modalities of achieving sustainable affordable housing delivery during the planning process.

### 4.5.1 Effects of construction constraints towards sustainable affordable housing delivery

The construction constraints were subdivided into three (3) categories: cost, time and quality. Table 4.3 indicates that the respondents were asked to measure the effects of the construction constraints using a five-point Likert scale (1 – Strongly Disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly Agree). With respect to cost constraints, the results indicated that fluctuation in prices of materials is ranked first with a mean score (MS) of 4.07; cash flow and financial difficulties faced by contractors is ranked second, with an MS of 3.91; followed by change in the scope of the project, with an MS of 3.85. The least ranked factors associated with cost constraints was poor site management and supervision by the contractor, with an MS of 3.45. Notably, all the mean scores (MS) for the cost constraint factors are above the mid-point MS of 3.00, verifying that the respondents tend to agree with the factors.

With regard to factors arising as the effects of construction constraints in terms of time, late payments for completed work (MS = 3.89), poor work planning leading to low labour productivity (MS=3.79) and lack of communication between parties involved in the project (MS=3.76) are ranked first, second and third, respectively. Changes in building regulations (MS=3.21) is the least ranked factor associated with time constraints. It is evident that all the time constraint factors had an MS above the midpoint of 3.00, suggesting that the respondents tend to agree with the factors.

With reference to quality constraint, the use of damaged and low-quality materials had the highest mean score (3.75), ranking first. This is closely followed by non-adherence to specifications and lack of cooperation between parties involved in a contract, with an MS of 3.73. However, the lack of cooperation between parties involved in a contract is ranked second as the standard deviation (1.18) is lower compared to that of non-adherence to specifications which is ranked third. Failure to document changes and practices is the least ranked factor associated with quality constraint. Evidently, all the mean scores (MS) are above the midpoint of 3.00, confirming a consensus amongst the respondents that all the factors may negatively influence the implementation of planning towards sustainable housing delivery.

**Table 4.2: Effect of construction constraints in the implementation of planning**

| Variable | N | SD | D | N | A | SA | MS | SD | Rank |
|---|---|---|---|---|---|---|---|---|---|
| **Cost constraint** | | % | % | % | % | % | | | |
| Fluctuation in prices of materials | 99 | 4.0 | 4.0 | 8.1 | 48.5 | 35.4 | 4.07 | 0.98 | 1 |
| Cash flow and financial difficulties faced by contractors | 100 | 8.0 | 6.0 | 13.0 | 33.0 | 40.0 | 3.91 | 1.22 | 2 |
| Change in the scope of the project | 99 | 6.1 | 6.1 | 12.1 | 48.5 | 27.3 | 3.85 | 1.08 | 3 |
| Appointment of incompetent project team | 98 | 12.2 | 5.1 | 8.2 | 40.8 | 33.7 | 3.79 | 1.3 | 4 |
| Incorrect planning and scheduling by contractors | 98 | 11.2 | 7.1 | 8.2 | 42.9 | 30.6 | 3.74 | 1.28 | 5 |
| Frequent design changes | 101 | 6.9 | 7.9 | 15.8 | 45.5 | 23.8 | 3.71 | 1.13 | 6 |
| Unforeseen ground conditions due to inadequate soil investigation | 100 | 8.0 | 8.0 | 17.0 | 44.0 | 23.0 | 3.66 | 1.16 | 7 |
| Delay in material procurement | 100 | 10.0 | 11.0 | 11.0 | 43.0 | 25.0 | 3.62 | 1.25 | 8 |
| Low speed of decisions making | 99 | 10.1 | 10.1 | 17.2 | 41.4 | 21.2 | 3.54 | 1.22 | 9 |
| Poor site management and supervision by the contractor | 100 | 14.0 | 9.0 | 15.0 | 42.0 | 20.0 | 3.45 | 1.3 | 10 |
| **Time constraint** | | | | | | | | | |
| Late payments for completed work | 99 | 7.1 | 8.1 | 6.1 | 46.5 | 32.3 | 3.89 | 1.16 | 1 |
| Poor work planning leading to low labour productivity | 99 | 6.1 | 9.1 | 12.1 | 45.5 | 27.3 | 3.79 | 1.13 | 2 |
| Lack of communication between parties involved in the project involved in the project | 99 | 9.1 | 10.1 | 9.1 | 39.4 | 32.3 | 3.76 | 1.26 | 3 |
| Inadequate clientele finance | 99 | 9.1 | 8.1 | 13.1 | 39.4 | 30.3 | 3.74 | 1.23 | 4 |
| Shortage of material leading to temporary work stoppage | 99 | 10.1 | 7.1 | 13.1 | 42.4 | 27.3 | 3.70 | 1.23 | 5 |
| Inadequate equipment availability | 98 | 9.2 | 6.1 | 20.4 | 37.8 | 26.5) | 3.66 | 1.2 | 6 |
| Late supervision and slowness in making decisions | 96 | 11.2 | 6.1 | 21.4 | 46.9 | 14.3) | 3.47 | 1.16 | 7 |
| Mistakes during the construction stage due to limited timelines | 97 | 10.3 | 15.5 | 17.5 | 36.1 | 20.6 | 3.41 | 1.26 | 8 |
| Changes in building regulations | 101 | 9.4 | 17.7 | 28.1 | 32.3 | 12.5 | 3.21 | 1.16 | 9 |
| **Quality constraint** | | | | | | | | | |
| Use of damaged and low-quality materials | 100 | 7.0 | 7.0 | 11.0 | 34.0 | 41.0 | 3.75 | 1.2 | 1 |
| Non-adherence to specifications | 100 | 10.9 | 4.0 | 11.9 | 47.5 | 25.7 | 3.73 | 1.21 | 2 |
| Lack of cooperation between parties involved in a contract | 100 | 10.0 | 5.0 | 11.0 | 50.0 | 24.0 | 3.73 | 1.18 | 3 |
| Unnecessary and inconsistency of design document | 100 | 10.0 | 6.0 | 15.0 | 52.0 | 17.0 | 3.60 | 1.15 | 4 |
| Non-conformance to codes and standards | 101 | 7.9 | 8.9 | 22.8 | 37.6 | 22.8 | 3.58 | 1.17 | 5 |
| Failure to document changes and practices | 100 | 10.9 | 8.9 | 16.8 | 54.5 | 8.9 | 3.42 | 1.12 | 6 |

### 4.5.2 Influence of stakeholders in providing sustainable affordable housing

The survey findings are recorded in Table 4.4 using a five-point Likert scale (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly agree). It is evident that the stakeholders were classified as internal and external stakeholders. The internal stakeholders were sub-categorised into various groups such as clients, resource manager, project manager, contractor and sub-contractors. In respect of clients as internal stakeholders, invest in the building project, with an MS of 4.09, is ranked first. Ensuring that suitable management arrangements are made for the project and ensuring that relevant permissions are secured in partnership with the professionals appointed for the project were at par with the same MS=3.97 and SD=0.90: these two factors are ranked second. All the mean scores (MS) for clients as part of the stakeholders are above the mid-point MS of 3.00, implying that the respondents tend to agree with the factors.

With reference to resource managers, the findings show that selecting and appointing a competent and resourced principal contractor is ranked first with an MS of 4.15, assigning people to a project based on skills, availability, previous experience and project budget (MS=4.11) is ranked second, and selecting the appropriate equipment for the project, with an MS of 4.01, is ranked third. Supporting project managers in on-going resource management effort is the least ranked factor, with an MS of 3.95. Significantly, all the mean scores (MS) for resource managers are above the mid-point of 3.00; therefore, this indicates that the respondents agreed with the factors listed.

Regarding project manager, establishing effective communication among all project participants with an MS of 4.29 is ranked first, planning all crucial project development and implementation details is ranked second with an MS of 4.13, and predicting possible changes and developing risk mitigation strategies ranked third with an MS of 4.09. The least ranked factor, determining material and equipment requirements and planning their procurement recorded had an MS of 4.00. Evidently, all the mean scores (MS) for factors associated with project manager are above the mid-point 3.00, suggesting that the respondents agreed with the factors listed.

With regard to contractor and subcontractor, coordinating health and safety-related matters while construction works are undertaken has a lower standard deviation of 0.94 and ranked first with an MS of 4.10. Ensuring that the project complies with the required legal and regulatory framework is ranked second with the higher standard deviation of 1.00 and an MS of 4.10. The third ranked factor associated with contractor and subcontractor is responsible for actual physical construction of the project (MS=4.08). The least ranked factor, reduction in overall cost of project, recorded an MS of 3.82. It is notable that the mean scores (MS) for contractor and subcontractor-related factors are above the mid-point of 3.00 which signifies that respondents agree with the listed factors.

In respect of government as external stakeholders, the findings indicate that assisting in the provision of infrastructure project is ranked first with an MS of 4.21. Approving building permits is ranked second

with an MS of 4.17, closely followed by facilitating the process of acquiring sustainable affordable housing with an MS of 4.14. The least ranked factor, providing funding and subsidy schemes for eligible low-income household recorded a MS of 4.06. It is evident that the mean scores (MS) for the factors relating to government are above the mid-point of 3.00, indicating that the respondents agreed to all the government-related factors.

With reference to suppliers, outsourcing green materials and products that are available locally, with an MS of 4.31, is ranked first, ensuring timely delivery of construction materials with an MS of 4.13 is ranked second, followed by supplying good quality products to ensure good workmanship with an MS of 4.03, ranked third. The least ranked factor, providing construction materials to customers and PPE not available in the local market, recorded an MS of 3.90. It is evident that the means cores (MS) for all the factors relating to suppliers are above the mid-point of 3.00 which implies that the respondents agreed that the factors may influence supplier decisions in achieving sustainable affordable housing for low-income earners.

With regard to non-governmental association, the descriptive statistics indicate that building spaces where people can become healthier, better educated, and increase economic mobility, with an MS of 4.01, is ranked first, providing wellbeing and social welfare for house occupants with an MS of 3.99 is ranked second, and alerting the government on housing problems with an MS of 3.96 is ranked third. The least ranked factor, promoting affordable housing while promoting access to finance, recorded an MS of 3.95. It is noticeable that all the mean scores (MS) relating to non-governmental association is above the mid-point of 3.00, verifying a consensus amongst the respondents that all the factors are important.

**Table 4.3: Influence of stakeholders in providing sustainable affordable housing for low-income earners**

| **Variables** | **N** | **SD** | **D** | **N** | **A** | **SA** | **MS** | **SD** | **RANK** |
|---|---|---|---|---|---|---|---|---|---|
| Clients | | % | % | % | % | % | | | |
| Invest in the building project | 100 | 3.0 | 3.0 | 11.0 | 48.0 | 38.0 | 4.09 | 0.92 | 1 |
| Ensuring that the relevant permissions are secured in partnership with the professionals appointed for the project | 73 | 2.0 | 5.0 | 15.0 | 50.0 | 28.0 | 3.97 | 0.90 | 2 |
| Ensure that suitable management arrangements are made for the project | 73 | 2.0 | 5.0 | 15.0 | 50.0 | 29.7 | 3.97 | 0.99 | 3 |
| Financier of the project and eventual owner | 100 | 2.0 | 6.1 | 16.2 | 45.5 | 30.3 | 3.96 | 0.95 | 4 |
| **Resource manager** | | | | | | | | | |
| Selecting and appointing a competent and resourced principal contractor | 72 | 1.1 | 3.9 | 5.9 | 32.4 | 27.5 | 4.15 | 0.9 | 1 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Assigning people to project based on skills, availability, previous experience, and project budget | 74 | 4.9 | 1.0 | 7.8 | 26.5 | 32.4 | 4.11 | 1.11 | 2 |
| Selecting the appropriate equipment for the project | 73 | 2.0 | 3.9 | 11.8 | 27.5 | 26.5 | 4.01 | 1.01 | 3 |
| Supporting project managers in on-going resource management effort | 73 | 4.9 | 3.9 | 5.9 | 36.3 | 21.6 | 3.95 | 1.05 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Project managers** | | | | | | | | | |
| Establishing effective communication among all project participants | 99 | 4.9 | 2 .2 | 1.0 | 36.3 | 50.0 | 4.29 | 0.99 | 1 |
| Planning all crucial project development and implementation details | 100 | 4.0 | 6 .0 | 6.0 | 41.4 | 43 .0 | 4.13 | 1.04 | 2 |
| Predicting possible changes and developing risk mitigation strategies | 100 | 4 0 | 3 .0 | 11 .0 | 48 .5 | 34.3 | 4.09 | 0.97 | 3 |
| Managing dispute that may occur on construction sites | 99 | 5.1 | 1 .1 | 5 .1 | 37 .4 | 51.5 | 4.06 | 0.99 | 4 |
| Meeting any legal and regulatory issue | 99 | 3.9 | 2.9 | 10.8 | 47.1 | 36.4 | 4.04 | 1.1 | 5 |
| Determining the material and equipment requirements and planning their procurement | 101 | 4 .9 | 8.8 | 3 .9 | 45 .1 | 36.6 | 4.00 | 0.99 | 6 |
| **Contractor & subcontractor** | | | | | | | | | |
| Ensure that the project complies with the required legal and regulatory framework | 100 | 2.0 | 8 | 9 | 40 .0 | 41.0 | 4.10 | 1 | 1 |
| Coordinating health and safety-related matters while construction works are being undertaken | 100 | 1.0 | 8.0 | 14.0 | 37.0 | 41.0 | 4.10 | 0.96 | 2 |
| Responsible for actual physical construction of the project | 100 | 2.0 | 6.0 | 11.0 | 44.0 | 37.0 | 4.08 | 0.95 | 3 |
| Mitigation of project risk | 98 | 5.0 | 6.0 | 11.0 | 50 | 31.0 | 3.98 | 0.99 | 4 |
| Reduction in overall cost of project | 100 | 1.0 | 13.0 | 18.0 | 39 | 29.0 | 3.82 | 1.03 | 5 |
| **External Stakeholders** | | | | | | | | | |
| **Government** | | | | | | | | | |
| Assist in the provision of infrastructure project | 98 | 5.1 | 3.1 | 7.1 | 34 .7 | 50.0 | 4.21 | 1.06 | 1 |
| Approving building permits | 96 | 5.2 | 3.1 | 9.4 | 34.4 | 47.9 | 4.17 | 1.07 | 2 |
| Facilitating the process of acquiring sustainable affordable housing | 99 | 3.0 | 5.0 | 7.7 | 44 .4 | 40.4 | 4.14 | 0.97 | 3 |
| Providing building regulations and codes | 98 | 6.1 | 5 .1 | 7.1 | 37.8 | 43 .9 | 4.08 | 1.13 | 4 |
| Providing funding and subsidy schemes for eligible low-income household | 97 | 2.1 | 6.2 | 10 .3 | 46.4 | 35.1 | 4.06 | 0.94 | 5 |
| **Suppliers** | | | | | | | | | |
| Outsourcing green materials and products that are not available locally | 98 | 2.9 | 7 .8 | 10.8 | 36.3 | 38.2 | 4.31 | 1.06 | 1 |
| Ensuring timely delivery of construc tion materials to prevent inflation of prices | 100 | 3.9 | 5 .9 | 4.9 | 42.2 | 41.1 | 4.13 | 1.03 | 2 |
| Supplying good quality products to ensure good workmanship | 97 | 1.0 | 5.0 | 5.9 | 32.4 | 50.0 | 4.03 | 0.92 | 3 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Providing construction materials to customers and PPE not available in the local market | 98 | 4.0 | 5.1 | 18.2 | 48.8 | 31.33 | 3.90 | 0.99 | 4 |
| **Non-governmental Association** | | | | | | | | | |
| Build spaces where people can become healthier, better educated, and increase economic mobility | 99 | 2.0 | 6.1 | 12.1 | 49 | 31.3 | 4.01 | 0.93 | 1 |
| Providing wellbeing and social welfare for house occupants | 98 | 3.1 | 3.1 | 17.4 | 44.9 | 31.6 | 3.99 | 0.95 | 2 |
| Alerting the government on housing problems | 98 | 1.1 | 6.1 | 18.4 | 44.9 | 29.6 | 3.96 | 0.91 | 3 |
| Promoting affordable housing while promoting access to finance | 100 | 4.0 | 5 .0 | 16 .0 | 42 0 | 33 .0 | 3.95 | 1.03 | 4 |

### 4.5.3 Challenges of implementing planning for the achievement of sustainable housing delivery

The survey requested that the respondents assess the challenges of implementing planning towards the achievement of sustainable affordable housing delivery using a five-point Likert scale (1 – Not critical, 2 – Less critical, 3 – Neutral, 4 – Critical, and 5 – Very critical). Table 4.4. shows that market challenges such as higher cost of construction materials with an MS of 4.17 is ranked first, lack of tax waiver for importers on building materials with an MS of 3.96 is ranked second, and scarcity of local green building with an MS of 3.81 is ranked third. The least ranked factor, limited experience with the use of non-traditional procurement method, had an MS of 3.73. It is evident that all the mean scores (MS) are above the mid-point of 3.0, indicating that respondents agreed with the factors listed.

With regard to professional challenges, financial capability of developers with an MS of 4.02 is ranked first, lack of coordination and monitoring between local authorities with an MS of 3.88 is ranked second, and poor communication amongst stakeholders with an MS of 3.87 is ranked third. The least ranked factor, lack of commitment of stakeholders, recorded an MS of 3.77. It is evident that the mean scores (MS) for all the factors are above the mid-point of 3.0, confirming that respondents agreed with the factors.

Regarding societal challenges, the findings indicate that poor remuneration and low minimum wage of citizens resulting in low purchasing power is ranked first with an MS of 3.93, inaccessibility to low and cheap housing financing scheme is ranked second with an MS of 3.88, and lack of political commitment by the government with an MS of 3.86 is ranked third. The least ranked factor, lack of government incentives and tax waiver for low-income earners, recorded an MS of 3.77. As the mean scores (MS) for all factors are above the mid-point of 3.0, the respondents evidently agreed with the factors.

With respect to technological challenges, respondents agreed that uncertainty in sustainability technologies performance with an MS of 3.6 is ranked first, green technologies keep changing, with an

MS of 3.64, is ranked second, closely followed by misunderstanding of sustainable technological operation, with an MS of 3.61. The least ranked factor, unavailability of soft technology, recorded an MS of 3.50. It is evident that the mean scores (MS) for all factors are above the mid-point of 3.0, indicating that the respondents tended to agree with all the factors.

**Table 4.4: Challenges of implementing planning for the achievement of sustainable housing delivery**

| Variable | | NC % | LC % | N % | C % | VC % | Mean score % | SD % | Rank % |
|---|---|---|---|---|---|---|---|---|---|
| **Market challenges** | | | | | | | | | |
| Higher cost of construction materials | 100 | 5.0 | 8.0 | 2.0 | 35.0 | 50.0 | 4.17 | 1.13 | 1 |
| Lack of tax waiver for importers on building materials | 99 | 4.4 | 4.4 | 15.2 | 45.5 | 31.3 | 3.96 | 0.99 | 2 |
| Scarcity of local green building | 98 | 4.1 | 13.3 | 13.3 | 36.7 | 32.7 | 3.81 | 1.15 | 3 |
| Non acceptance of local building materials to the disadvantage of low- income earners | 98 | 2.0 | 9.2 | 21.4 | 41.8 | 25.5 | 3.80 | 0.99 | 4 |
| Limited experience with the use of non-traditional procurement method | 99 | 4.0 | 10.1 | 18.2 | 44.4 | 23.2 | 3.73 | 1.06 | 5 |
| **Professional challenges** | | | | | | | | | |
| Financial capability of developers | 98 | 4.1 | 10.2 | 6.1 | 38.8 | 40.8 | 4.02 | 1.12 | 1 |
| Lack of coordination and monitoring between local authorities | 99 | 3.0 | 7.1 | 17 .2 | 44.4 | 28.3 | 3.88 | 1 | 2 |
| Poor communication amongst stakeholders | 98 | 5.1 | 8.2 | 10.2 | 47.1 | 28.6 | 3.87 | 1.08 | 3 |
| Lack of knowledge and awareness among stakeholder | 99 | 4.0 | 13.1 | 12.1 | 40.4 | 30.3 | 3.80 | 1.13 | 4 |
| Lack of commitment of stakeholders | 100 | 3.0 | 16.6 | 14.0 | 42.0 | 25.5 | 3.77 | 1.11 | 5 |
| **Societal challenges** | | | | | | | | | |
| Poor remuneration and low minimum wage of citizens resulting in low purchasing power | 99 | 7.1 | 7.1 | 12.1 | 33.3 | 40.4 | 3.93 | 1.21 | 1 |
| Inaccessibility to low and cheap housing financing scheme | 99 | 3.0 | 10.1 | 13.1 | 43.4 | 30.3 | 3.88 | 1.05 | 2 |
| Lack of political commitment by the government | 100 | 7.0 | 11.0 | 11.0 | 31.0 | 40.0 | 3.86 | 1.26 | 3 |
| Ineffective mortgage system | 99 | 9.1 | 6.1 | 9.1 | 43.4 | 33.4 | 3.84 | 1.21 | 4 |
| Lack of government incentives and tax waiver for low-income earners | 100 | 6.1 | 11.0 | 11.0 | 44.0 | 28.0 | 3.77 | 1.15 | 5 |
| **Technological challenges** | | | | | | | | | |
| Uncertainty in sustainability technologies performance | 100 | 9.0 | 9.0 | 11.0 | 46.0 | 25.0 | 3.69 | 1.20 | 1 |
| Green technologies keep changing | 100 | 8.0 | 8.0 | 18.0 | 44.0 | 22.0 | 3.64 | 1.15 | 2 |
| Misunderstanding of sustainable technological operation | 100 | 7.0 | 13.0 | 12.0 | 48.0 | 20.0 | 3.61 | 1.15 | 3 |
| Lack of adequate local green technology | 100 | 7.0 | 18.0 | 19.0 | 28.0 | 28.0 | 3.52 | 1.27 | 4 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Unavailability of soft technology | 100 | 8.0 | 19.0 | 14.0 | 33.0 | 26.0 | 3.50 | 1.28 | 5 |

### 4.5.4 Modalities of achieving sustainable housing delivery during the planning process

Respondents were asked to evaluate the modalities of achieving sustainable affordable housing delivery during the planning process using a Likert scale (1 – Not important, 2 – Somewhat important, 3 – Important, 4 – Very important, 5 – Extremely important). The findings as presented in Table 4.5 show that time, quality, integration, leadership, scope, cost, human, risk, and communication management techniques are modalities of achieving sustainable housing delivery during the planning process.

With reference to time management modality, regular monitoring of the progress of work is ranked first with an MS of 4.33, timely response by project team on requested information is ranked second with an MS of 4.26, and strategic planning to recover time lost is ranked third with an MS of 4.22. The least ranked factor, prioritising time management as part of the culture of the firm, recorded an MS of 3.94. Notably, all the mean scores (MS) for the time management factors are above the mid-point MS of 3.00, showing that respondents tended to agree with the factors relating to time management.

With regard to quality management planning techniques, quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change is ranked first with an MS of 4.33, quality planning to ensure that the building services or product is fit for the purpose is ranked second with an MS of 4.22, and quality of design specification is ranked third with an MS of 4.16. Documenting the quality requirements and results required to effectively manage project for quality assurance recorded an MS of 3.91 and is the least ranked factor associated with time management. It is noticeable that all the mean scores (MS) for quality management planning are above the mid-point MS of 3.00, showing that the respondents tended to agree with the factors.

With respect to integration and leadership management techniques, delegating work appropriately, with an MS (4.27), was ranked first, improving team performance by overcoming the project team dysfunctions with an MS of (4.03) was ranked second, and developing in the project team willingness and desire to work towards common objectives, with an MS of (3.92), was ranked third. The least ranked factor was documenting various planning assumptions and communicating with the client, with an MS of 3.86. Notably, all the mean scores (MS) for the leadership and integration management factors are above the mid-point MS of 3.00; this implies that the respondents agreed with the factors.

With regards to risk management techniques, estimating the risk that can affect the project schedule had an MS of 4.07 and ranked first; communicating risk register such as a spread sheet or analysis software reports for risk identification and listing, with an MS of 4.03 was ranked second; followed by brainstorming sessions with the team and experts on risk associated with the building project, with an MS of 3.96, ranked third. Evidently all the mean scores (MS) for risk management factors are above

the mid-point MS of 3.00, implying that respondents agreed with the factors as modalities of achieving sustainable affordable housing.

With reference to communication management techniques, the ability to analyse a problem and reach sound conclusions, with as MS of 4.20, was ranked first; developing interpersonal skills for good relationship with the project team, with an MS of 4.19, was ranked second; closely followed by adopting written communication in keeping project team adequately informed with an MS of 4.07 which ranked third. Using oral communications in keeping project team adequately informed, with an MS of 3.51, was the least ranked factor. Evidently, as all the mean scores (MS) for the communication management factors are above the mid-point MS of 3.00, respondents tended to agree with the factors.

With respect to scope management techniques, preparing detailed scope of work, with an MS of 4.06, was ranked first; providing information and assistance in determining and controlling the project scope, with an MS of 4.07, was ranked second; and applying scope planning such as initiation closely followed by planning, definition with various output and input with an MS of 3.98 was ranked third. The least ranked factor is defining boundaries and deliverables, with an MS of 3.93. It is evident that the mean scores (MS) for scope management factors are above the mid-point of 3.0, confirming that respondents agreed with the factors. The literature stated that cost management techniques as effective budget planning at tender stage, with an MS of 4.25, was ranked first; providing a highly accurate estimate to help control the project from execution to close out, with an MS of 4.20, was ranked second; providing a cost budget to determine the total cost of funding required to execute building project, with an MS of 4.15, was ranked third. Managing cost through effective allocation of budget to each activity is the least ranked factor with an MS of 4.10. Significantly, all the mean scores (MS) for the cost management factors are above the mid-point MS of 3.00; respondents tended to agree with the factors.

With reference human resource management, preparing organisational charts to assign roles and responsibilities, with an MS of 3.86, was ranked first; ensuring the needs of stakeholders, with an MS of 3.81, was ranked second; followed by planning future needs of employees skilled and unskilled labour, with an MS of 3.80, ranking third. Recruiting more staff to increase productivity, with an MS of 3.48, was the least ranked factor. Notably, all the mean scores (MS) for the human resources management factors are above the mid-point MS of 3.00. This shows consensus amongst the respondents who agreed that all the factors are modalities of achieving sustainable affordable housing is during the delivery process.

**Table 4.5: Modalities of achieving sustainable affordable housing delivery during the planning process**

| Time Management | N | NI | SI | I | VI | EI | Mean score | SD | Rank |
|---|---|---|---|---|---|---|---|---|---|
| | | % | % | % | % | % | | | |
| Regular monitoring of the progress of work | 98 | 3.1 | 3.1 | 9.2 | 27.6 | 57.0 | 4.33 | 0.98 | 1 |
| Timely response by project team on requested information | 98 | 2.0 | 2.0 | 12.0 | 38.0 | 47.0 | 4.28 | 0.89 | 2 |
| Strategic planning to recover lost time | 96 | 1.0 | 7.3 | 5.2 | 41.7 | 44.8 | 4.22 | 0.92 | 3 |
| Effective communication and administration of contract instruction timeously | 99 | 3 | 3.0 | 11.1 | 40.4 | 42.4 | 4.16 | 0.96 | 4 |
| Ability to plan and schedule work and measure results | 99 | 1.0 | 6.1 | 13.1 | 37.4 | 42.4 | 4.14 | 0.94 | 5 |
| Ability to work under pressure to meet tight deadlines and adapt to changes | 98 | 2.0 | 5.1 | 13.3 | 37.8 | 41.8 | 4.12 | 0.97 | 6 |
| Prioritising time management as part of culture of the firm | 99 | 3.0 | 7.1 | 91.2 | 36.4 | 34.3 | 3.94 | 1.05 | 7 |
| **Quality management techniques** | | | | | | | | | |
| Quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change | 99 | 2.0 | 1.1 | 10.1 | 35.4 | 51.5 | 4.33 | 0.86 | 1 |
| Quality planning to ensure that the building services or product is fit for the purpose | 99 | 1.0 | 4.0 | 9.1 | 43.4 | 42,4 | 4.22 | 0.85 | 2 |
| Quality of design specification | 100 | 2.0 | 4.0 | 14.0 | 36.0 | 44.0 | 4.16 | 0.95 | 3 |
| Adopting appropriate construction methods and processes to achieve quality workmanship | 99 | 2.0 | 4.0 | 13.1 | 41.1 | 39.4 | 4.12 | 0.93 | 4 |
| Documenting the quality requirements and results required to effectively manage project for quality assurance | 97 | 3.1 | 6.2 | 14.4 | 48.5 | 26.8 | 3.91 | 0.97 | 5 |
| **Integration and leadership management technique** | | | | | | | | | |
| Delegating work appropriately | 98 | 2.0 | 1.0 | 12.1 | 37.8 | 46.9 | 4.27 | 0.87 | 1 |
| Improving team performance by overcoming the project team dysfunctions | 97 | 1(1) | 7.2 | 17.15 | 36.1 | 37.1 | 4.03 | 0.97 | 2 |
| Developing in the project team willingness and desire to work towards common objectives | 100 | 1(1) | 7.0 | 22.0 | 39.0 | 31.0 | 3.92 | 0.95 | 3 |
| Increasing the effect of positive events and decrease the effect of negative events in the building production processes | 99 | 2(2) | 9.1 | 20.2 | 39.4 | 29.3 | 3.85 | 1.01 | 4 |
| Documenting various planning assumptions and communicating with the client | 99 | 3(3) | 5.1 | 22.2 | 42.4 | 27.3 | 3.80 | 0.98 | 5 |
| **Communication management techniques** | | | | | | | | | |
| Developing interpersonal skills for good relationship with the project team | 100 | 0.0 | 4.0 | 2.2 | 10.0 | 39.0 | 4.19 | 0.98 | 2 |
| Adopting written communication in keeping project team adequately informed | 98 | 2.0 | 7.1 | 10.2 | 42.9 | 37.8 | 4.07 | 0.98 | 3 |
| Using oral communications in keeping project team adequately informed | 99 | 7.1 | 16.2 | 23.2 | 26.3 | 27.3 | 3.51 | 1.25 | 4 |
| **Risk management technique** | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Estimating the risk that can affect the project schedule | 99 | 2.0 | 2.0 | 23.2 | 32.3 | 40.4 | 4.07 | 0.95 | 1 |
| Communicating risk register such as a spread sheet or analysis software reports for risk identification and listing | 99 | 0.0 | 5.1 | 15.2 | 51.2 | 28.3 | 4.03 | 0.8 | 2 |
| Brainstorming sessions with the team and experts on risk associated with the building project | 100 | 0.0 | 3.0 | 16.0 | 5.5 | 45.0 | 3.96 | 0.97 | 3 |
| **Scope management techniques** | | | | | | | | | |
| Preparing detailed scope of work | 100 | 2.9 | 2.0 | 21.6 | 31.4 | 40.2 | 4.06 | 0.99 | 1 |
| Providing information and assistance in determining and controlling the project scope | 99 | 1.1 | 5.1 | 16.2 | 41.4 | 36.4 | 4.07 | 0.90 | 2 |
| Applying scope planning such as initiation, planning, /definition with various output and input | 99 | 2.0 | 5.1 | 20.0 | 38.4 | 34.3 | 3.98 | 0.96 | 3 |
| Defining boundaries and deliverables | 98 | 4.1 | 3.1 | 16.3 | 48.2 | 27.6 | 3.93 | 0.96 | 4 |
| **Cost management techniques** | | | | | | | | | |
| Effective budget planning at tender stage | 99 | 0.0 | 0.0 | 12.7 | 34.3 | 50.0 | 4.25 | 0.99 | 1 |
| Providing highly accurate estimate to help control the project from execution to close out | 99 | 0.0 | 0.0 | 12.7 | 39.2 | 43.1 | 4.20 | 0.94 | 2 |
| Providing a cost budget to determine the total cost of funding required to execute building project | 98 | 44.9 | 40+.8 | 13.3 | 1.0 | 1.0 | 4.15 | 1.02 | 3 |
| Avoiding or minimising wastage on construction site | 98 | 42.2 | 41.2 | 1.0 | 10.9 | 1.0 | 4.17 | 0.98 | 4 |
| Monitoring and controlling cost as project cost increases | 100 | 47.1 | 34.3 | 14.7 | 2.0 | 0.0 | 4.10 | 1.09 | 5 |
| Managing cost through effective allocation of budget to each activity | 99 | 0.0 | 2.0 | 14.1 | 39.4 | 44.4 | 4.10 | 1.09 | 6 |
| **Human resource management techniques** | | | | | | | | | |
| Preparing organisational charts to assign roles and responsibilities | 101 | 4.0 | 5.0 | 19.8 | 40.6 | 29.7 | 3.86 | 1.04 | 2 |
| Ensuring the needs of stakeholders | 100 | 4.0 | 8.0 | 16.0 | 47.0 | 25.0 | 3.81 | 1.03 | 1 |
| Planning future needs of employee, skilled and unskilled labour | 100 | 4.0 | 5.0 | 22.0 | 45.0 | 24.0 | 3.80 | 0.99 | 3 |
| Recruiting more staff to increase productivity | 95 | 5.3 | 14.7 | 28.4 | 29.5 | 22.1 | 3.48 | 1.15 | 4 |

The term *affordable housing* is complex and diverse but can be generally defined in economic terms, according to Sharifzai, Kitagawa, Habib and Halimee (2016). There are several discussions with explanations related to affordable housing. Sivam and Karuppannan (2008) define affordable housing as small housing units built with low-cost materials and land. Affordable housing can also be defined as a house that occupants or low-income earners can acquire within a certain period, which commonly ranges between 15 to 30 years (Sharifzai *et al.,* 2012). A common exercise in measuring affordable housing includes consideration of house cost at a value less than 30% of the household income of the occupants (Disney, 2007). However, measurements of affordability vary between regions and

states, but the most accepted type of affordability is the ratio between a household's income and the housing cost (Whitehead *et al.,* 2009).

### 4.5.5 Market challenges

The results emanating from the survey showed that higher cost of construction materials, lack of tax waiver for importers on building materials, and scarcity of local green building are the top three ranked challenging factors. This finding is akin to the normative literature and supported by Abidin,Yusof and Othman (2013) who explain that target buyers are mostly foreigners and high-income earners who can effortlessly purchase sustainable houses, as these replicate their lifestyle. Goh *et al.* (2015) highlighted that many local developers have to deal with a range of local buyers such as low-, medium- and high-income earners. These challenges lie in finding ways to make sustainable housing affordable for low-income earners. References suggest that houses should be designed appropriately by increasing natural resources as a substitute for expensive products

### 4.5.6 Professional challenges

The results obtained from the survey show that the financial capability of developers, lack of coordination and monitoring between local authorities, and poor communication amongst stakeholders are the top three ranked factors associated with professional challenges. With respect to financial capability of developers, many stakeholders are interested in sustainability practices but are afraid of additional project cost and the under-purchasing of housing units. Large housing developers or stakeholders have greater financial capability, more experience, and possess the required expertise and commitment from the top management (McMurray *et al.,* 2014). However, small and medium developers tend to struggle in term of finances, impacting their ability to execute housing projects. With respect to lack of coordination and monitoring between local authorities, this finding is akin to the normative literature as supported by the (Department of housing white paper, 1995) Government created statutory advisory and policy execution, coordinating bodies for housing, with stakeholder representation for policy development and fund allocation to monitor and evaluate the performance of the housing sector, the planning policies and strategies.

In reference to poor communication amongst stakeholders, poor communication has numerous effects and consequences in construction industry such as cost overruns, time overruns, dispute and project failure. It was established that ineffective communication leads to unproductive (Gamil & Rahman :2017)

### 4.5.7 Societal challenges

The results obtained from the survey show that poor remuneration and low minimum wage of citizens resulting in low purchasing power, inaccessibility to low and cheap housing financing scheme, and lack of political commitment by the government are the most significant societal-related challenges. With reference poor remuneration and low minimum wage of citizens resulting in low purchasing power, according to Saleh and Alalouch (2015) the government should ensure incentives to developers who wish to pursue sustainability in their projects,

With reference to inaccessibility to low and cheap housing, government should play a vital role in providing affordable and sustainable housing by strongly enforcing legislation and devising new policies (Saleh & Alalouch, 2015). Regarding lack of political commitment by the government, stakeholders do not highlight sustainability problems due to the lack of supervision by the government, according to Alias,Sin& Aziz, (2010)

(2010). They often observe that environmental safety is the sole duty of the government, as emphasised by Saleh and Alalouch (2015), and changes in government policies as housing developers are solely interested in implementing the sustainable affordable housing concept. Therefore, most sustainable housing development plans take an inordinate length of time and involve complexities like gaining approval of local councils explained (Goh *et al.,* 2015) which can be regarded as lack of political commitment by the government. In fact, this is one of the major findings which hinders project stakeholders from undertaking sustainable affordable housing projects.

### 4.5.8 Technological challenges

The results emanating from this survey show that uncertainty in sustainability technologies performance, green technologies keep changing, and misunderstanding of sustainable technological operation are the major technological-related challenges. With regard to uncertainty in sustainability technologies performance, this is supported by Saleh and Alalouch (2015) who claim that the main challenge in terms of implementing sustainable affordable housing is the uncertainty among project stakeholders regarding the performance of green products and technologies. Goh *et al.* (2015) add that low expertise prevents stakeholders from introducing a sustainability and affordability concept in their project execution. According to Goh *et al.* (2015), stakeholders must hire foreign expertise to implement sustainable affordable housing practice. Regrettably, this will lead to difficulty for developing local expertise and thereby increase dependence on foreign experts and incur additional cost. The challenges of acquiring green technology and materials from the local market leads to importation of green products by stakeholders, which results in inflation of product prices. Moreover, most buyers believe that if construction uses local green products, the progress of sustainable practice will be slow, as explained by Saleh and Alalouch (2015).

With reference to green technology keeps changing, Abidin *et al.* (2010) suggest this is due to the deficiency, low knowledge and low local expertise in green technology. The practice of sustainable and affordable housing requires expertise in construction. Saleh and Alalouch (2015) insist that housing developers must demand custom-made products to suit their local climate because most times imported green products and materials are produced based on a country's climate. This normally incurs additional costs in spite of delivery expenses with respect to misunderstanding of sustainable technological operation.

With respect to misunderstanding of sustainable technological operations, Saleh and Alalouch (2015) emphasise that these challenges delay stakeholders from implementing sustainable affordable practices in housing projects. Hence, the government as a main influence should encourage stakeholders who are construction practitioners, research and educational institutions, and development bodies to provide more durable local green building materials and technology at lesser cost, and sustainable affordable technology training should be introduced to increase and distribute knowledge on sustainability.

### 4.5.9 Modalities of achieving sustainable housing delivery during the planning process

#### 4.5.9.1 Time management

The results obtained from the survey showed the modalities of achieving sustainable affordable housing during planning are regular monitoring of progress of work, timely response by project team on requested information, and strategic planning to recover time lost. With reference to regular monitoring of progress of work, the project team needs to know, in an accurate manner, how is the project progressing, and the stages of work in comparison to the initial plans, before deadlines are met or budgets are prepared and followed (Jour, Majid & Memon, 2006). With reference to timely response by project team on requested information, this is consistent to the normative literature and supported by Westland (2006) who defines *time management* as the process of controlling and recording time spent on a project. With reference to strategic planning to recover time lost, McGraw and Leonoudakis (2021) explain that the process of maintaining allocation of time considers to the overall conduct of the project through the stages of work from the inception to the finish, through time planning and estimating, time scheduling and control. Project time management requires tools and policies to create a method for monitoring and measuring project output. Stakeholders must be able to manage time by utilising the tool.

#### 4.5.9.2 Quality management planning technique

The findings obtained in the survey revealed quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change, quality planning to ensure that the building service or product is fit for the purpose, and quality of design specification as the top ranked factors.

With respect to quality control through monitoring and recording the results of project delivery, to assess performance and recommend necessary change (Mane, 2015) stresses that quality control is a critical factor in ensuring the successful completion of construction projects. Defects in constructed services can result in very huge costs likewise minor defects, re-construction may be necessary and facility operations compromised explained (PMI, 2013) Quality of construction projects, as well as project success, can be regarded as the fulfilment of expectations of the project participants. Concerning assessing performance and recommending necessary changes Mane (2015) opines that quality management system is a continuing process of improvement involving all aspects of the business. The broader aim of applying quality management techniques is to avoid mistakes *before* they occur through quality planning, quality control and quality assurance. This process helps reduce errors in project work with commitment and teamwork for continuous improvement starting with the project manager down through the entire team. Monitoring is an important part of quality control. The quality tools used in this process can help project managers in various ways as well as differentiating between normal noise or unusual communication, effective communication, understanding graphical analysis, and making better decisions based on sound data and facts explained Rever (2007)

Regarding quality planning to ensure that the building service or product is fit for the purpose, the finding is akin to the normative literature and supported by Lydia (2010) who contends that guidelines to ensure the quality in planning are to ensure that all relevant parties and stakeholders are included in the task of quality planning for the construction project and establish and define the purpose of the quality system. In the plan, it is important to minimise the effort required to amend documents by adopting appropriate construction methods, organising a quality management team to produce effective plan, ensuring that the whole quality planning task continuously focuses on customer requirements.

With reference to quality of design specification, quality of design and documentation has a major impact on the overall performance and efficiency of construction projects while designers provide the graphic and written representations which permits contractors and subcontractors to change concepts and ideas into reality, it is the efficiency through this transformation that defines the level of project performance (Tilley Mcfallan & Tucker :1999)

#### 4.5.9.3 Integration and leadership management technique

The results emanating from the survey reveal the top ranked factors for leadership management techniques as delegating work appropriately, improving team performance by overcoming the project team dysfunctions, and developing in the project team willingness and desire to work towards common objectives.

With respect to delegating work appropriately, this is consistent with the normative literature as reported by Enshassi, Mohamed and Abushaban (2009). The authors posit that integration

management must assign the project team with major roles and responsibilities towards the project because operating as a separate or distinct parts is more challenging than working as project team. Regarding improving team performance by overcoming the project team dysfunctions, Ofori (2006) finds that the South African construction industry has been attentive to management and yet is still lacking leadership skills, clarifying that this orientation by South African construction industry is resulting in a shortage of skilful project leader regardless of the large number of project managers and other stakeholders. However, lately, there has been an increase in acceptance of the importance of leadership delivering relevant construction projects This makes projects and construction managers important to the development of any construction project, suggesting they have fundamental influence and responsibility for project success.

With reference to developing in the project team a willingness and desire to work towards common objectives, Petrie (2014) claims that majority of construction managers are established from job experience, mentoring, training and coaching. According to Shi and Li (2010), this coordination retains the value of relationships between team members.

#### 4.5.9.4 Communication management technique

The results obtained from the analysis showed an ability to analyse a problem and reaching sound conclusions, developing interpersonal skills for good relationship with the project team, and adopting written communication in keeping project team adequately informed as the top ranked factors. Concerning ability to analyse a problem and reaching sound conclusions, a project manager needs the abilities to analyze and identify problems so that he/she can identify problems, develop alternative, evaluate and choose the relevant solutions. (Saleh, Djalil & Firdausy : 2018)

With reference to developing interpersonal skills for good relationship with the project team, communication management process helps to establish a connection between individuals and necessary information for ascertaining communication goal (Caltrans, 2007) Regarding, adopting written communication in keeping project team adequately, this finding is akin to the normative literature supported by Dinsmore and Cabanis-Brewin (2014) that using effective and active written or oral communication skills as project managers is a well-recognised manner to overcome challenges during the project execution. It is the project manager's responsibility to specify messages to be sent, interpreted and to whom in an understandable manner for the receiver.

#### 4.5.9.5 Risk management technique

The results emanating from the survey show that estimating the risk that can affect the project schedule, communicating risk register such as a spreadsheet or analysis software report for risk identification and listing, and brainstorming sessions with the team and experts on associated risk are the top ranked factors listed for risk management.

With respect to estimating the risk that can affect the project schedule, risks are generally considered incidences that influence the principal objectives of a particular project (time, cost, quality). This is consistent with the normative literature reported by PMI (2013): the construction industry faces greater risks in comparison to other industries. With characteristics such as lengthy duration of project and complex processes, poor financial power, environmental restrictions and organisational structures that are dynamic (Taylan, Bafail, Abdulaal & Kabli, 2014), when dealing with risks, the majority of construction industries have a poor reputation. Most are unable to meet required cost targets and proposed deadlines, which affects each member of the project team (PMI, 2013).

With reference to communicating risk register such as a spreadsheet or analysis, software reports for risk identification and listing, the risk register is a document containing results of several risk management processes such as identification number, rank, name, description, category, and the root cause of each risk event. According to Schwalbe (2009), this register is to help reduce risk difficulties and increase the chances of successful a project (Goh *et al.* 2015). There are three stages of methods to manage risk in construction: risk identification, risk analysis and evaluation, and risk response The application of the risk management process helps improve the routine of the construction project management.

Regarding brainstorming sessions with the team and experts on risk associated with the building project, the project team should examine project documents, project policies and risk categories and lessons learned from past projects, thereby creating templates for a risk management plan. This is referred to as brainstorming, explains Schwalbe (2009); alongside other management techniques it is the project manager's responsibility to ensure team members have a full understanding of all risk within the scope of work and the potential consequences (Rory, 2009).

#### 4.5.9.6 Scope management technique

The results obtained from the analysis showed preparing detailed scopes of work, providing information and assistance in determining and controlling the project scope, and applying scope planning such as initiation, planning, and definition with various output and input.

With reference to preparing a detailed scope of work, this finding is akin to the normative literature supported by Derenskaya (2018) as work is to be performed to get a product, service or results with planned features and functions and work description.

With regards to providing information and assistance in determining and controlling the project scope, Burke (2007) explains that for analysing the needs of project participants, the project scope contains information on what it will deliver, produce and where the work packages start and finish since most project seems to appear with uncertain definition. It formally recognises that a new project exists and continues to the nest phase, which is initiation.

With respect to applying scope planning such as initiation, planning, definition with various output and input, Burke (2007) claims that scope definition outlines the content of the project approached and explains how it will solve the client's needs. PMI (2013) defines *scope planning* as developing a written scope statement as a source for future project decision; analysing the results of scope planning such as assets, environmental factors, description of project scope, identification of input and output of each stage of work; and that initiation is the process of recognising the existence of a new project or continuation of an existing project. There are inputs and outputs, tools and techniques to initiation such as project description, strategic plan, project selection methods, expert judgement, project charter, project manager constraints; while the inputs and outputs, tools and techniques of scope planning entail product description, project charter, constraints, assumptions, product analysis, benefit cost analysis, alternative identification, expert, scope statement, supporting detail and a scope management plan.

#### 4.5.9.7 Cost management technique

The results obtained from the survey showed effective budget planning at tender stage, providing highly accurate estimate to help control the project from execution to close out, and providing a cost budget to determine the total cost of funding required to execute a building project are the top ranked factors for cost management.

Regarding effective budget planning at tender stage, Miri (2015) suggests that active stakeholders are very interested in accurately estimated project costs when contractors propose a cost for projects, and after approval it is usually implemented based on available funds in the tender, so it is vital to offer a cost that covers shared overhead and meets planned profits. Price competition is allowed.

With reference to providing highly accurate estimate to help control the project from execution to close out, according to Schwalbe (2009) cost management techniques include the processes required for a project team to complete a project within approved budget with planning tasks such as cost estimating. This is developing estimates or approximations of cost to complete a project. Cost budgeting is the allocation of overall cost estimate to individual tasks to create a baseline for measuring performance, with main documents containing cost estimates and cost baseline.

With respect to providing a cost budget to determine the total cost of funding required to execute building, this is consistent with the according to Miri (2015). One of the challenges in the field of construction management is the failure to set up a system for recording the actual cost of certain project activities for implementing planning tasks. There are consequences for neglecting some costs while stakeholders may have to deal with unexpected and harsh results. Project costs include the cost of sub-projects, costs of current issues, and costs stipulated in the agreement. Cost management techniques are management processes that deal with planning, controlling (project cost), cost finding, analysis, forecasting and evaluation (Zhen, 2008).

#### 4.5.9.8 Human resources management techniques

The results emanating from the survey show preparing organisational charts to assign roles and responsibilities, ensuring the needs of stakeholders, and planning future needs of employees, skilled and unskilled labour as the top ranked factors.

With respect to preparing organisational charts to assign roles and responsibilities, this is consistent with the normative literature (Schwalbe, 2009). It is generally viewed that people are the most important assets on a project as they determine the success and failure of a project; this technique is concerned with making effective use of people involved with a project with tools such as organisational charts, a graphic representation of how authority and responsibility are circulated on a project.

Concerning ensuring the needs of stakeholders, according to Othman, Idrus and Napiah (2012), the training of staff for the development of human resources within an organisation starts by recognising training needs through job analysis, performance assessment and organisational analysis. When training needs have been identified, the next step is to organise training programmes with methods such as simulation exercises, case studies and role-playing, to train for the execution of a sustainable development project.

Regarding planning future needs of employees for both skilled and unskilled labour, Schwalbe (2009) emphasises that one important factor in implementing human resource techniques in the construction field is the need for effective training. Managers must monitor and measure the performance of their workers.

### 4.7 Testing of hypotheses

#### 4.7.1 Test for normality

The test for normality was to check whether the data distribution is normally distributed. Pallant (2010) argues that the presence of a non-significant outcome (i.e., significant value greater than 0.05) indicates normality. Table 4.6 test for normality results show that all variables obtained significance values of 0.00 for both Kolmogorov and Smirnov tests, below the 0.05 threshold recommended by Pallant (2010). This suggests the violation of the assumption of normality; hence, the non-parametric statistical tests, including the Kruskal-Wallis and Mann-Whitney, were adjudged suitably to test hypotheses (Table 4.7) of the test of normality for the data distribution.

**Table 4.6: Tests for normality**

| Tests of normality | | | | | | |
|---|---|---|---|---|---|---|
| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
| | Statistic | Df | Sig. | Statistic | Df | Sig. |
| Cost constraint | 0.211 | 70 | 0.000 | .794 | 70 | 0.000 |
| Time constraint | 0.200 | 70 | 0.000 | .855 | 70 | 0.000 |
| Quality constraint | 0.221 | 70 | 0.000 | .812 | 70 | 0.000 |
| Clients | 0.222 | 70 | 0.000 | .820 | 70 | 0.000 |
| Resource manager | 0.184 | 70 | 0.000 | .823 | 70 | 0.000 |
| Project manager | 0.239 | 70 | 0.000 | .792 | 70 | 0.000 |
| Government | 0.212 | 70 | 0.000 | .812 | 70 | 0.000 |
| Contractor | 0.232 | 70 | 0.000 | .842 | 70 | 0.000 |
| Suppliers | 0.193 | 70 | 0.000 | .834 | 70 | 0.000 |
| NGO | 0.212 | 70 | 0.000 | .841 | 70 | 0.000 |
| Market challenges | 0.195 | 70 | 0.000 | .902 | 70 | 0.000 |
| Professional challenges | 0.151 | 70 | 0.000 | .910 | 70 | 0.000 |
| Society challenges | .219 | 70 | 0.000 | .878 | 70 | 0.000 |
| Technological challenges | .155 | 70 | .000 | .912 | 70 | 0.000 |
| Time management | 0.192 | 70 | 0.000 | .859 | 70 | 0.000 |
| Quality management | 0.180 | 70 | 0.000 | .843 | 70 | 0.000 |
| Integration management | 0.157 | 70 | 0.000 | .906 | 70 | 0.000 |
| Communication management | 0.167 | 70 | 0.000 | .892 | 70 | 0.000 |
| Risks management | 0.195 | 70 | 0.000 | .882 | 70 | 0.000 |
| Scope management. | 0.186 | 70 | 0.000 | .898 | 70 | 0.000 |
| Cost management | 0.160 | 70 | 0.000 | .846 | 70 | 0.000 |
| Human resources management | 0.151 | 70 | 0.000 | .928 | 70 | 0.001 |

### 4.7.2 Hypotheses testing

The responses obtained from the questionnaire were analysed. Closed-ended questions were interpreted using the Statistical Package for Social Sciences (SPSS) by means of frequencies, descriptive statistics and inferential statistics. The reliability of scaled questions was tested with the use of Cronbach's alpha coefficient. The value of the coefficient was 0.84, indicating that the responses to scaled questions were reliable. Thus, the study hypothesised as follows:

**H1.** There is no statistical difference in the perception of construction professional on the effects of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing in South Africa.

**H2.** There is no statistical difference in the perception of construction professionals on the influence of stakeholders during the planning process of providing sustainable affordable housing for low-income earners.

**H3.** There is no statistical difference in the perception of construction professionals regarding the challenges of implementing planning techniques towards the achievement of sustainable affordable housing.

**H4.** There is no statistical difference in the perception of construction professionals on modalities of achieving sustainable affordable housing delivery during the planning process.

### 4.7.3 Effects of construction constraints on the implementation of planning towards sustainable affordable housing delivery

The construction constraints were subdivided into three (3) areas: cost, time and quality. Using the Kruskal Wallis test (see Table 4.7), the test of statistics for cost, time and quality constraints was computed. In respect of cost, it is shown that H(5)=9.769, p=0.082; in reference to time constraint, it is evident that H(5)=6.854, p=0,232; whereas the result for quality constraint indicates that H(5)=4.059, p=0.541. The results from the test of statistics show no significant statistical difference between the different professions and the effects of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing. This implies that there is no significant statistical difference existing in the rating of the variables with regard to time, cost and quality constraints across the different professions, including architects, real estate, quantity surveyors, consulting engineers and others based on the perceptions of the respondents. The hypothesis which states that 'there is no statistical difference in the perception of construction practitioners on the effects of construction constraints on the implementation of planning is accepted.

**Table 4.7 Effects of construction constraints on the implementation of planning**

| **Test statistics[a,b]** | | | |
|---|---|---|---|
| | Cost | Time | Quality |
| Kruskal-Wallis H | 9.769 | 6.854 | 4.059 |
| Df | 5 | 5 | 5 |
| Asymp. Sig. | 0.082 | 0.232 | 0.541 |
| a. Kruskal Wallis Test | | | |
| b. Grouping Variable: Please indicate which of the following best describes your profession | | | |

(p-value >0.05)

### 4.7.4 Influence of stakeholders in providing sustainable affordable housing for low-income earners.

The results obtained from analysis showed that stakeholders responsible for providing sustainable affordable housing for low-income earners were categorised as internal and external stakeholders. The Kruskal-Wallis test was computed to examine the perceptions of construction professionals on

the influence of both the internal and external stakeholders during the planning process in providing sustainable affordable housing for low-income earners.

With respect to internal stakeholders, clients recorded the following test results: H5=4.676, p=0.457; resource managers recorded the following: H5=5.688, p=0.338; project manager recorded the following: H5=0.967, p=0.965; and contractors recorded the following: H5=0.967, p=0.965.

With reference to external stakeholders, government recorded the following results: H5=4.83, p=0.437; suppliers recorded the following: H5=1.929, p= 0.8599; whereas non-governmental organisation recorded the following test results: H5=3.104, p=0.684. Given that the p values for all variables are greater than 0.05, there is no significant statistical difference between the different professionals regarding the influence of both the internal and external stakeholders in terms of providing sustainable affordable housing for low-income earners. Therefore, the hypothesis which states that 'there is no statistical difference in the perception of construction professionals on the influences of stakeholder in providing sustainable affordable housing for low-income earners' proves that construction practitioners in general are beginning to appreciate sustainability and acknowledge the benefits of sustainable affordable building (Abidin, 2009).

**Table 4.8: Influences of stakeholders in providing sustainable affordable housing for low-income earners**

| **Test statistics** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Clients | Resource manager | Project manager | Contractors | Government | Suppliers | Non-governmental association |
| Kruskal-Wallis H | 4.676 | 5.688 | 0.967 | 0.967 | 4.830 | 1.929 | 3.104 |
| Df | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Asymp. Sig. | 0.457 | 0.338 | 0..965 | 0.965 | 0.437 | 0.859 | 0.684 |
| a. Kruskal-Wallis Test | | | | | | | |
| b. Grouping Variable: Please indicate which of the following best describes your profession | | | | | | | |

(p-value >0.05)

### 4.7.5 Challenges of implementing planning towards the achievement of sustainable housing delivery

The results obtained from analysis revealed a plethora of challenges in implementing planning: market challenges, professional challenges, societal challenges and technological challenges. Market challenges recorded the following test results: H5=2.854, p=0.722; professional challenges recorded the following test results: H5=3.478, p=0.627; societal challenges recorded the following: H5=2.311, p=0.805; and technological challenges recorded the following: H5=3.819, p=0.576. This is consistent

with the normative literature. (Aghimien, Adegbembo, Aghimien & Awodele :2018) conducted a Kruskal-Wallis test study; a non-parametric test used in testing the significant difference in the perception of three or more categories of respondents. Results showed that at 95% confidence level, there is no significant difference in the view of the three categories of respondents, as a significant p-value above 0.05 was derived for all the factors. It is evident that that the respondents all have similar view as to the challenges of sustainable construction within the education sector, which is similar to the challenges of implementing planning towards the achievement of sustainable housing delivery. There is no significant statistical difference between the different professionals regarding the challenges of implementing of planning which suggests strong agreement among construction stakeholders regarding the identified factors.

**Table 4.9: Challenges of implementing planning towards the achievement of sustainable housing delivery**

| **Test statistics** | | | | |
|---|---|---|---|---|
| Challenges | Market | Professional | Societal | Technological |
| Kruskal-Wallis H | 2.854 | 3.478 | 2.311 | 3.819 |
| Df | 5 | 5 | 5 | 5 |
| Asymp. Sig. | 0.722 | 0.627 | 0.805 | 0.576 |
| a. Kruskal-Wallis Test | | | | |
| b. Grouping Variable: Please indicate which of the following best describes your profession | | | | |

### 4.7.6 Modalities of achieving sustainable affordable housing delivery during the planning process

The result emanating from the survey showed management techniques: time management, quality management techniques, integration and leadership management techniques, scope management techniques and human resources management. Time management recorded the following test results: H5=3.142, p=0.678; quality management recorded the following test results: H5=1.401, p-0.924; integrity and leadership management techniques recorded the following test results: H5=3.869, p=0.5609; communication management recorded the following test results: H5=2.69, p =0.766; risk management recorded the following test results: H5-3.003, p=0.572; scope management recorded the following: H5=3.843, p=0.572; and human resource management recorded the following: H5=2.453, P=0.78.

This finding is akin to the normative literature, supported by Yugue & Maximiano (2012) that there may be significant differences between various projects, while the management techniques used in their management are similar. For example, project management techniques can be applied to specific situations, according to the essential nature of the situation and conscious choice; however,

knowledge and practices of project management techniques do not apply uniformly to all projects (PMI 2008) Yugue & Maximiano (2012) contends that the results of the Kruskal-Wallis test indicate that the frequency of use of the project management processes and techniques relates to the factors of planning, while people management varies in accordance with the complexity of stages of the projects at hand. The other processes and techniques did not present any significant difference in their frequency as observed due to the different levels of project complexity. Given that the p values for all variables are greater than 0.05, there is no significant statistical difference between the different professionals regarding the modalities of achieving sustainable affordable housing delivery; there is agreement among construction stakeholders regarding the variables provided

**Table 4.10: Modalities of achieving sustainable affordable housing delivery during the planning process**

| **Test statistics** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Management techniques | Time | Quality | Integrity & leadership | Communication | Risk | Cost | Human |
| Kruskal-Wallis H | 3.142 | 1.401 | 3.865 | 2.569 | 3.003 | 3.843 | 2.453 |
| Df | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| Asymp. Sig. | 0.678 | 0.924 | 0.569 | 0.766 | 0.700 | 0.572 | 0.784 |
| a. Kruskal-Wallis Test | | | | | | | |
| b. Grouping Variable: Please indicate which of the following best describes your profession | | | | | | | |

### 4.8 Content analysis

#### Interview with respondent A

On 6 May 2021, an interview was conducted with a project manager at 2.00 pm lasting for 20 minutes during the lockdown period. The project manager working on a construction site at the moment gave his time for the discussion through a virtual call. The discussion was recorded using a Huawei tablet. The project manager working on a construction site at the moment was asked to comment on each question after it was read by the interviewer to him from the structured questionnaire. These questions are recorded in Appendix A as a semi-structured interview for the validation of the results obtained from data analysis.

The respondent stated that for the effect of *construction constraints* in terms of cost, he listed incorrect planning leading to cost over-run, fluctuation of prices due to economic instability, appointment of an incompetent team resulting in wastage, frequent changes in design as a common factor, unforeseen ground conditions, changes in the scope of project, low speed in design making, cash flow and financial difficulties when there is limited source of funding for the project, poor site management and supervision, and delay in material procurement.

In terms of *time constraints*, the responded explained inadequate client finance, late or delayed payment for completed work, a shortage of materials due to improper funding leading to work stoppage, communication gap between parties, mistakes during the construction stage due to limited timelines which must be prevented, inadequate and inappropriate equipment availability on site, poor work planning leading to low labour productivity on site, late supervision and slowness in making decisions poses a limitation on time duration of project, and changes in building regulations or government policies.

The respondent identified *quality constraints* as failure to document changes and practices which is unethical, unnecessary and inconsistency of design documents on site, use of damaged materials or sub-standard materials and non-conformance to codes and standards, non-adherence to specification leading to poor delivery and doctored results leading to poor performance. He stated that the influence of stakeholders in providing sustainable housing for low-income earners as major parties to construction must ensure that the project is not jeopardised, in terms of funding, monitoring, execution, quality delivery and management, ensuring successful completion.

The respondent listed the *major stakeholders* in construction such as *clients* influencing the project through investment, ensuring suitable management arrangements for the project, financing of the project and also the eventual owner of the project, ensuring that the relevant permissions are secured (permits, etc.) in partnership with the professionals appointed for the project. *The resource manager* influences project execution by selecting the appropriate equipment for the project, selecting and appointing a competent and resourced principal contractor, assigning people to the project based on skills by recruiting skilled staff for the project, availability, previous experience, and project budget, and supporting project managers in on-going resource management efforts for a successful project completion.

The respondent stated that *project manager* influences include planning all crucial project development and implementation details, determining the material and equipment requirements and planning procurement, predicting possible changes and developing risk mitigation strategies, working closely with the construction team to meet client goals, managing disputes that occur on construction sites, meeting any legal and regulatory issues, establishing effective communication among all project participants, and ensuring that relevant permissions are secured (planning, etc.) in partnership with the professionals appointed for the project by obeying building regulations. The project manager explained further the influences of a contractor and subcontractor include ensuring that the project complies with the required legal and regulatory framework according to building standards, responsible for actual physical construction of the project or erection of building, coordinating health and safety-related matters while construction works are being undertaken as protection from building hazards, reducing overall cost of a project and mitigating project risk.

The respondent stated that *external stakeholders such as government* influence providing building regulations and codes, approving building permits, providing funding and subsidy schemes for eligible low-income households, providing sustainable affordable housing for low-income households, facilitating the process of acquiring sustainable affordable housing assist in the provision of infrastructure project (e.g., water supply, power generation, transmission and telecommunication), suppliers as providers of construction materials to customers and PPE not available in the local market, ensuring timely delivery of construction materials to prevent inflation of prices, supplying good quality products to ensure good workmanship, and outsourcing green materials and products that are not available locally. *Non-governmental association* influences are creating opportunities to access basic services such as land and tenure rights, promoting affordable housing while promoting access to finance, providing social welfare for house occupants, alerting the government on housing problems, building spaces where people can become healthier, and increasing economic mobility.

The respondent added that the challenges of implementing planning process towards the achievement of sustainable affordable housing delivery can be a result of *market challenges:* higher cost of construction materials, scarcity of local green building materials and products, lack of tax waiver for importers on building materials, non-acceptance of local building materials to the disadvantage of low-income earners, and limited experience with the use of non-traditional procurement methods. In respect to *professional challenges,* these include lack of commitment of stakeholders, insufficient knowledge and awareness among stakeholders, poor communication amongst stakeholders which can lead to communication gap, lack of coordination and monitoring between local authorities, and low financial capability of developers.

The project manager explained *societal challenges* as a lack of government incentives and tax waiver for low-income earners, inaccessibility to low and cheap housing financing scheme or loans that occur as a result of inaccessibility to low-cost housing due to high prices of buildings and lands, ineffective mortgage system or high mortgages, poor remuneration and low minimum wage of citizens resulting in low purchasing power, and lack of political commitment by the government which is an economic issue.

The respondent further stressed *technological challenges* as including lack of adequate local green technology in impeding the planning sustainable affordable housing, unavailability of soft technology (e.g., BIM), misunderstanding of sustainable technological operation such as low exposure, uncertainty in sustainability technology performance as it is not sustained by the government as a major stakeholder, changes and knowledge advancements in green technology, unavailability of materials, the need to import building materials, high professional fees which are unaffordable for low-income earners, and low technological know-how which means little exposure education and insufficient skills for construction.

The project manager further explained that the *modalities* of achieving sustainable and affordable housing delivery require engaging a good project manager and professional team that will practice management techniques in terms of time for successful project execution, ensuring the completion of project in time to avoid delay, within specified budget, cost, quality, risk, communication, human resources such as staff, integrate and maintain good leadership skills and maintain the scope of work to ensure successful project completion.

**Interview with respondent B**

On 10 May 2021, an interview was conducted with an experienced quantity surveyor around 3.00 pm lasting for 25 minutes during the lockdown period. The project manager working on a construction site at the moment gave his time for the discussion. The discussion was recorded using a Huawei tablet. The quantity surveyor, working on a construction at that time decided, to participate in the discussion and was asked to comment on each question after it was read out by the interviewer. These questions are recorded in Appendix A as a semi-structured interview for validation of results.

The quantity surveyor explained the effects of *construction constraints* on the implementation of planning towards achieving sustainable affordable housing delivery in terms of cost, time and quality. In reference to cost constraints, he identified incorrect planning leading to over budgeted cost, fluctuation of prices due to economic issues, appointment of an incompetent team resulting in wastage, frequent changes in design increasing construction cost, unforeseen ground conditions due to absence of soil test, changes in the scope of work resulting in cost overrun, low speed in design making among the professional team, cash flow and financial difficulties with limited sources of funding for the project, poor site management and supervision by the contractor, delays in material procurement on site, and the appointment of an incompetent project manager resulting in project failure.

The respondent explained *time constraints* such as inadequate client finance when the client can no longer fund the project, late payment for completed work and shortage of materials which can lead to temporary work stoppage, poor work planning leading to low labour productivity on site and poor execution of work, unskilled staff resulting in poor work execution, inadequate equipment on site, communication gaps between parties resulting in conflicts, mistakes during the construction stage due to poor timelines as a result of hastiness, late supervision and slowness in making decisions, delay in project delivery due to unforeseen circumstances, and delay in issuance of certificates affecting time frame of the project.

In regard to quality, the respondent added that *quality control constraints* include failure to document changes and practices, unnecessary and inconsistency of design document complicating the time frame to execute a project, non-conformance to code and standards that are not following construction processes impeding quality services, contractors not adhering to specifications when there is

need for project review on material, changes in prices that affect project quality delivery, and the use of damaged and low quality materials.

The respondent added that stakeholders in providing sustainable affordable housing during planning processes for low-income earners include *major stakeholders* in construction ranging from clients to consultants, contractors and nominated sub-contractors, to clerks of work and several others. Each has a different influence. *Clients,* for example, influence the investing in projects, releasing funds valued and certified, and are involved in the recruitment of the team of consultants and competent resource persons for advice in the execution of projects. *Resource managers* influence project execution by selecting the appropriate equipment for the project, selecting and appointing a competent and resourced principal contractor, assigning people to the project based on skills by recruiting skilled staff for the project, availability, previous experience, and project budget, supporting project managers in on-going resource management efforts for a successful project completion. These are the duties expected to be carried out on a project.

The respondent stated that the *project manager* influences the planning of all crucial project development and implementation details, determining the material and equipment requirements and planning procurement, predicting possible changes and developing risk mitigation strategies, working closely with the construction team to meet client goals, managing disputes that occur on construction sites, meeting any legal and regulatory issues , establishing effective communication among all project participants, and ensuring that the relevant permissions are secured (planning, etc.) in partnership with the professionals appointed for the project by obeying building regulations.

The project manager listed the influences of a *contractor and subcontractor* as including ensuring that the project complies with the required legal and regulatory framework according to building standards, responsible for actual physical construction of the project or erection of building, coordinating health and safety-related matters while construction works are undertaken as a protection from building hazards, reducing overall cost of project and mitigating project risk. These are duties expected to influence planning sustainable affordable housing.

The respondent stated that *external stakeholders such as government* have the role of providing building regulations and codes, approving building permits, providing funding and subsidy schemes for eligible low-income households, providing sustainable affordable housing for low-income households, facilitating the process of acquiring sustainable affordable housing to assist in the provision of infrastructure project (e.g., water supply, power generation, transmission and telecommunication). With these duties, he explained, they have maximum control of project activities in general, enact suitable policies that will reduce prices for local and imported materials, and ensure material subsidisation in order to execute projects.

*Suppliers*, as providers of construction materials to customers and PPE not available in the local market, can influence the following: ensuring timely delivery of construction materials to prevent inflation of prices, supplying good quality products to ensure good workmanship, outsourcing green materials and products that are not available locally at a lesser cost, and nominating subcontractors to show diligence with the work subcontracted to them. Suppliers are expected to procure materials timely and deliver to site; contractors are expected to carry out quality tests properly, make timely decisions at all levels, and have a suitable payment plan for end users to achieve sustainable affordable housing.

*Non-governmental association* influences a project by creating opportunities to access basic services such as land and tenure rights, promoting affordable housing while promoting access to finance, providing social welfare for house occupants, alerting the government on housing problems, building spaces where people can become healthier, and increasing economic mobility.

The quantity surveyor added that the challenges of implementing planning processes towards achieving sustainable affordable housing delivery include *market challenges* such as high cost of construction materials due to inflation arising, issues elongating duration of construction project, the pandemic having impact on importation, lack of tax waiver for importers on building materials, scarcity of local green building which the government needs to prevent and make provision for, non-acceptance of local building materials to the disadvantage of low-income earners due to importation of building materials, and low production of local building materials (while high-income earners can purchase high prices building materials, this can affect the chances of low-income earners in achieving sustainable affordable homes), limited experience with the use of non-traditional procurement methods as construction stakeholders need more training and skills in the construction work environment.

The respondent expressed several *professional challenges:* financial capability of developers that is, low financial capacity and inaccessibility to funds and loans can impede planning housing sustainability and affordability; lack of coordination and monitoring between local authorities can lead to some certain misconducted among stakeholders which should be monitored and controlled; poor communication amongst stakeholders such as a communication gap can result in disputes and misinformation affecting project execution; lack of knowledge and awareness among stakeholders due to weak exposure to advanced learning and technology which means there is need for training and skill acquisition for construction professionals; and lack of commitment of stakeholders when there are preventing work progress on site.

The respondent addressed *societal challenges* as follows: poor remuneration and low minimum wage of citizens resulting in low purchasing power and the need of government to solve the issue by providing accessible loans and funds; inaccessibility to low and cheap housing financing schemes when sustainable housing becomes unaffordable for low-income earners due to the class system where

only high-income earner can afford high priced materials or other circumstances such as fluctuation of prices of building materials; lack of political commitment by the government due to the failure to carry out house planning and provisions; ineffective mortgage systems that are not available to low-income earners; lack of government incentives and tax waivers for low-income earners. All of these make it challenging to achieve sustainable and affordable housing.

The respondent addressed *technological challenges* such as uncertainty in sustainability technologies performance, green technologies keep changing, misunderstanding of sustainable technological operation, lack of adequate local green technology and sustainable alternative technology, lack of a system of project execution for construction stakeholders for relevant aspects of work such as applying appropriate devices or technology to achieve a successful project which is affordable to end users, and unavailability of soft technology due to fluctuations arising.

The respondent further explained *modalities* of achieving sustainable affordable housing as effective planning from pre-construction to post-construction. Management techniques include *cost management* such as effective budget planning at tender stage, providing an accurate estimate to help control the project from execution to close out, providing a cost budget to determine the total cost of funding to execute the building project, avoiding or minimising wastage on construction site, monitoring and controlling cost as project cost increases, and managing cost through effective allocation of budget to each activity. The respondent stressed that these are all professional cost controls and important budget controls that are not to exceed the planned budget and project timeline.

The respondent stated that *time management* is important for achieving sustainable affordable housing, such as regular monitoring of the progress of work to control lapses, timely response by project team on requested information to avoid unnecessary delays, strategic planning to recover time lost, effective communication and administration of contract instruction to avoid disputes, ability to schedule work and measure results in due time, ability to work under pressure to meet tight deadlines and adapt to changes, and prioritising time management as part of the culture of the firm is mandatory as project duration works with project value.

In respect to *quality management* planning techniques, the quantity surveyor identified the following: quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change is part of quality assurance process, quality planning to ensure that the building services or product is fit for the purpose to ensure that the quality of design specification is followed, adopting appropriate construction methods and processes to achieve quality workmanship, documenting the quality requirements and results required to effectively manage project for quality assurance. All of these help to alleviate poorly managed project quality.

*Integration and leadership management* techniques involves delegating work appropriately to the project team, improving team performance by overcoming the project team dysfunctions with early

monitoring and controlling of site activities, developing in the project team willingness and desire to work towards common objectives to achieve project goals, increasing the effect of positive events and decreasing the effect of negative events in the building production processes, documenting various planning assumptions and communicating with the client will all prevent unwanted crises from occurring.

*Communication management* techniques includes the ability to analyse a problem and reach sound conclusions, developing interpersonal skills for a good relationship with the project team, adopting written communication in keeping the project team adequately informed, using oral communications to keep the project team adequately informed. These are all the necessary means of avoiding communication gaps to execute a successful project. Risk management techniques such as estimating the risk that can affect the project schedule. Also, communicating risk register such as a spread sheet or analysis software reports for risk identification and listing, and brainstorming sessions with the team and experts on risk associated with the building project all show good understanding of risks which allows stakeholders to take steps to reduce their negative impact.

The quantity surveyor stated that *scope management* techniques entail preparing detailed scope of work, providing information and assistance in determining and controlling the project scope, applying scope planning such as initiation, planning, definition with various output and input, a written scope statement or future project decisions defining boundaries and deliverables as what a project will accomplish and deliver from start and finish.

*Human resources management* techniques involve preparing organisational charts to assign roles and responsibilities, ensuring the needs of stakeholders, planning future needs of employees of skilled and unskilled labour, recruiting more staff to increase productivity. These techniques are all means of making effective use of people involved with a construction project to improve project teams while regulating a project manager's quality of work.

**Interview with respondent C**

On 10 May 2021, an interview was conducted with an experienced quantity surveyor around 3.50 pm lasting for 20 minutes during the lockdown period. The quantity surveyor working on a construction site at the moment gave his time for discussion. The discussion was recorded using a Huawei Tablet. The quantity surveyor, working on a construction at that time, was asked to comment on each question after it was read by the interviewer to him. These questions are recorded in Appendix A as a semi-structured interview for the validation of results.

The quantity surveyor stated that the effects of *construction constraints* on the implementation of planning in terms of cost include incorrect planning leading to cost overrun exceeding planned budget, fluctuation of prices due to economic issues, frequent changes in design leading to work

complexities, unforeseen ground conditions due to absence of soil test, changes in the scope of work resulting in cost overrun, poorly managed project cost increases, appointment of an incompetent team resulting in wastage, low speed in design making among the professional team, cash flow and financial difficulties, poor site management and supervision by the contractor, delays in material procurement on site, and appointment of an incompetent project manager resulting in project failure.

The respondent explained *time constraints* such as inadequate client finance that extends the work duration and limits work progress, late or delayed payment for completed work, shortage of materials leading to temporary work stoppage, poor work planning leading to low labour productivity on site when the project manager does not ensure proper monitoring and controlling of site activities, unskilled staff resulting in poor work execution, inadequate equipment on site affecting the time, communication gaps between parties resulting in conflicts, mistakes during the construction stage due to limited timelines as a result of hastiness which is impedes work progress, late supervision and slowness in making decisions, and changes in building regulation and policies by the government.

Regarding *quality constraints,* the respondent added that failure to document changes and practices affects the quality work, unnecessary and inconsistency of design document, non-conformance to codes and standards with contractor work, contractors not adhering to specification, lack of cooperation between parties involved in a contract as a result of poor communication, use of damaged and low-quality materials, and limited time can likewise compromise quality.

The respondent added that the *influence of stakeholders* in providing sustainable affordable housing during planning process for low-income earner are the major parties to construction: *clients* investing in projects by issuing funding to the project team and going to resource persons for advice in execution of projects. *Resource managers* influence project execution by selecting the appropriate equipment for the project, selecting and appointing a competent and resourced principal contractor, assigning people to project based on skills by recruiting skilled staff for the project, availability, previous experience, and project budget, supporting project managers in on-going resource management efforts for a successful project completion.

The respondent stated that the *project manager* plans the crucial project development and implementation details, determining the material and equipment requirements and planning procurement, predicting possible changes and developing risk mitigation strategies, working closely with the construction team to meet client goals, managing and resolving disputes that occur on construction sites, meeting any legal and regulatory issues, establishing effective communication among all project participants, ensuring that the relevant permissions are secured (planning, etc.) in partnership with the professionals appointed for the project by obeying building regulations. These are all duties of the project manager to ensure proper planning.

The respondent explained further the influence of a *contractor and subcontractor* includes ensuring that the project complies with the required legal and regulatory framework according to building standards, responsible for actual physical construction of the project or erection of building, coordinating health and safety-related matters while construction work is undertaken as a protection from building hazards, reducing overall cost of project and mitigating project risk.

The respondent stated that *external stakeholders* such as *government* influence by providing building regulations and codes, approving building permits, providing funding and subsidy schemes for eligible low-income households, providing sustainable affordable housing for low-income households, facilitating the process of acquiring sustainable affordable housing to assist in the provision of infrastructure projects (e.g. water supply, power generation, transmission and telecommunication), and providing access to loans and mortgage. Suppliers, providers of construction materials to customers and PPE not available in the local market influence by ensuring timely delivery of construction materials to prevent inflation of prices, supplying good quality products to ensure good workmanship, outsourcing green materials and products that are not available locally as local supplier preference is to supply mostly to high-income earners rather than low-income earners for profitable issue to achieve sustainability affordability. *Non-governmental association*s influence by creating opportunities to access basic services such as land and tenure rights, promoting affordable housing while promoting access to finance, providing social welfare for house occupants, alerting the government of housing problems, and building spaces where people can become healthier and better educated.

The respondent added that the challenges of implementing planning are *market challenges* such as higher cost of construction materials due to inflation, the pandemic impacting importation, lack of tax waivers for importers on building materials, scarcity of local green building which the government needs to prevent by making provision for locally sourced materials, non-acceptance of local building materials to the disadvantage of low-income earners due to importation of building materials and low production of local building materials while high-income earners purchase high priced building materials, limited experience with the use of non-traditional procurement methods as construction stakeholders, so training and skills in the construction work environment are necessary.

The respondent stated that *professional challenges* are financial capability of developers and inaccessibility to funds and loans, lack of coordination and monitoring between local authorities and controlled, poor communication amongst stakeholders such as communication gap which can result in dispute and misinformation affecting project execution, lack of knowledge and awareness among stakeholders due to little exposure to advanced learning and technology, and lack of commitment of stakeholders limiting work progress on site.

The respondent addressed *societal challenges* such as poor remuneration and low minimum wage of citizens resulting in low purchasing power and the need of government to solve this issue by providing accessible loans and funds, inaccessibility to low and cheap housing finance schemes when sustainable housing becomes unaffordable for low-income earners due to the class system where only high-income earner can afford high priced materials or due to the fluctuation of prices of building materials, lack of political commitment by the government due to the failure to carry out house planning and provisions, ineffective mortgage systems that are not available to low-income earners, lack of government incentives and tax waivers for low-income earners. All of these make sustainable and affordable housing a challenge to achieve.

The quantity surveyor addressed *technological challenges* such as uncertainty in sustainability technology performance, the changes in green technologies, misunderstanding of sustainable technological operations, lack of adequate local green technology and that sustainable alternative technology should be a system of project execution for construction stakeholders for effective delivery, lack of application of appropriate devices or technology to achieve a successful project affordable to end users, and unavailability of soft technology due to fluctuations arising. All these issues extend the project's duration of time.

The project manager further explained the modalities of achieving sustainable and affordable housing delivery with the practice of principles of management techniques and a professional team. It is important to manage time for successful project execution to ensure the completion of project in time and to avoid delays, keeping within a specified budget, cost, quality, risk, communication, and human resources, integrating management skills, good leadership skills and maintaining the scope of work in order to ensure successful project completion.

**Interview with respondent D**

On 10 May 2021, an interview was conducted with an experienced quantity surveyor around 4.20 pm lasting for 20 minutes during the lockdown period. The quantity surveyor, working on a construction site at that moment, gave his time for the discussion through a video call. The discussion was recorded using a Huawei tablet. The respondent was asked to comment on each question after it was read out by the interviewer.

The quantity surveyor identified the effects of *construction constraints* on the implementation of planning. In terms of *cost constraints,* these are incorrect planning resulting in work complexities and exceeding planned budget, fluctuation of prices due to economic challenges such as the pandemic, frequent changes in design leading to cost overrun, unforeseen ground conditions due to absence of soil tests, and the appointment of incompetent builders. In regards to *time constraints,* these include inadequate client financing that extends work duration, late or delayed payment for completed work and shortage of materials which can lead to temporary work stoppage, poor work planning leading to

low labour productivity on site and incurring cost above planned budget, and delayed payment of the building team. The respondent also mentioned a shortage of materials to execute site work, lack of funds affecting the clients which impeded time duration of the project execution, inadequate equipment on site affecting time, communication gaps between parties resulting in conflicts slowing work progress, mistakes during the construction stage due to limited timelines as a result of hastiness, late supervision and slowness in making decisions, and changes in building regulation by local authorities are constraints to achieving sustainable affordable housing.

Regarding *quality constraints,* the respondent added that failure to document changes and practices affected productivity, unnecessary and inconsistency of design document, non-conformance to code and standards and requirements by contractor affecting quality of the project, lack of adherence to specification impeding project success, lack of cooperation between parties involved in a contract as a result of poor communication, use of damaged and low quality materials, and limited time. All these factors compromise quality.

The respondent added that the *influence of stakeholders* in providing sustainable affordable housing during planning process for low-income earner are clients, resource managers, project managers, contractors and subcontractors, and non-governmental associations that create project charters and project scope statements, identifying project constraints as development planning, timely project deliver, identifying risks, and managing a project team properly.

The respondent added that the challenges of implementing planning process towards the achievement of sustainable affordable housing delivery include delay in project timeline from Covid-19 affecting the general state of work, acceptance of unrealistic deadlines in the contract, project deadline, underestimated design budget, unavailability of materials. In explaining modalities of achieving sustainable affordable housing delivery during planning process, the respondent discussed the application of management techniques such as time management, cost planning and other areas of management techniques such as quality, communication and risks, scope, leadership and integration, and human resources.

**Table 4.11: Summary of qualitative interview**

| Content | Respondent A | Respondent B | Respondent C | Respondent D |
|---|---|---|---|---|
| **Cost constraints** | Incorrect planning leading to cost overrun<br>Delayed payment | Incorrect planning leading to over budgeted cost Delay in | incorrect planning exceeding the planned budget | Incorrect planning leading to work complexities |

| | | | | |
|---|---|---|---|---|
| **Time constraints** | Inadequate client finance | Inadequate client finance to fund project | Inadequate client finance extending work duration | Inadequate client finance extending work duration |
| **Quality constraints** | Failure to document changes and practices which is unethical | Failure to document changes and practices | Failure to document changes practices affecting quality of work | Failure to document changes and practices affecting productivity |
| **Influences of stakeholders** | Major parties to construction ensuring successful project completion | Major stakeholders in construction | Major parties to construction | Major parties to the project ranging from clients to end users and their roles in |
| **Challenges of implementing planning** | Market Professional Societal Technological | Market Professional Societal Technological | Market Professional Societal Technological | Market Professional Societal Technological |
| **Modalities of achieving sustainable affordable housing** | Engaging good professional team that will apply the management techniques | Application of management techniques | Practising principles of management techniques | Applying management techniques |

### 4.8 Summary

This chapter presents an analysis of data, explaining the process followed during the data gathering exercise, the presentation of subsequent results and the discussion of findings. The data collected were analysed using the Statistical Package for Social Sciences (SPSS) software, version 27. The survey questions were designed using the 5-point Likert scale, with results of analysis ranked using mean score values. The number of respondents was sufficient (300 questionnaires were distributed) to generate a meaningful result as required for computing statistical analysis. Also, the obtained demographic information of respondents – such as gender, qualification and experience – confirmed that respondents had sufficient experience in the construction industry and were knowledgeable in terms of the subject matter to warrant analysis. The reliability of scaled questions was tested with the Cronbach's alpha coefficient. The value of the coefficient was 0.84, indicating that the responses to scaled questions were reliable. Findings from the analysis were discussed and linked to the literature review.

Regarding the effects of construction constraints on the implementation of planning, it was discovered that the respondent agreed that time, cost and quality constraints impede the achievement of sustainable affordable housing planning. Results indicate that these factors are the major constraints to work progress. The Kruskal-Wallis test was conducted to determine if there were significant differences in

the responses of construction professionals and their perceptions on how construction constraints affect the implementation of planning sustainable affordable housing.

In respect to the influence of stakeholders during the planning process providing sustainable affordable housing for low-income earners, it was evident that stakeholders influence the planning process. Respondents indicated a high frequency of influence of stakeholders during the planning process in providing sustainable affordable housing for low-income earners. The Kruskal-Wallis test was conducted to examine whether a significant difference existed in the responses obtained amongst respondents; findings from the test indicated no significant variance amongst the group.

Respondents expressed agreement regarding the challenges of implementing planning techniques towards the achievement of sustainable affordable housing. Findings revealed that respondents indicated a high frequency of challenges as market challenges, professional challenges, societal challenges and technological challenges impeding the implementation of sustainable affordable housing. The Kruskal-Wallis test was applied to examine the significant difference between respondents and their perceptions on the challenges of implementing planning.

In respect of the modalities of achieving sustainable affordable housing delivery during the planning process, findings revealed that respondents indicated that management techniques are undeniably the clearest mode of achieving sustainable affordable housing, with specific factors of time, cost, quality, communication and risks, integration and leadership, and human resources management techniques. The Kruskal-Wallis test was applied to examine the significant difference between respondents and their perceptions on the modalities of achieving sustainable affordable housing. Findings from the Kruskal-Wallis test revealed no significant difference amongst the respondents on their perceptions.

# CHAPTER FIVE

# SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

## 5.1 Preambles

This chapter draws conclusions based on the presentation of findings and testing of hypotheses, highlights the limitations encountered during the study and offers recommendations for future research. A total of four hypotheses were tested against the findings. The conclusions are drawn from the findings of the questionnaire survey and the implications and outcomes of the study are discussed in the recommendation section. The aim of this study was to develop a framework that will ensure an effective implementation of planning techniques towards achievement of sustainable affordable housing. Specific objectives were formulated, and these are outlined below.

## 5.2. Summary of findings

### 5.2.1 Achieving the objectives of the research study

*Objective one* of the study was to identify the effects of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing. In achieving this objective, the data collected were analysed and major findings centred on cost, time and quality constraints.

With regard to cost constraints, the respondents ranked fluctuation in prices of material, cash flow and financial difficulties of contractors, and change in the scope of projects as the major factors resulting in cost constraints. Poor site management and supervision by contractor was ranked as the least cost constraint. It is worth noting that respondents ranked fluctuation in prices of materials as the most notable cost constraint for the implementation of planning techniques.

With respect to time constraints, the top ranked factors were late payment for completed work, poor work planning leading to low labour productivity, and lack of communication between parties involved in the project. The least ranked factor was changes in building regulations. It is worth noting that respondents ranked late payment for completed work as the most notable time constraint on the implementation of planning techniques.

With regard to quality constraints, the respondents ranked use of damaged materials, non-adherence to specifications, and lack of cooperation between parties involved in the contract as the major factors. Failure to document changes and practises was the least ranked factor. It is evident that respondents ranked use of damaged and low-quality materials as the most notable quality constraint on the implementation of planning techniques.

*Objective two* of this study was to establish the influence of stakeholders during the planning process providing sustainable affordable housing for low-income earners. In achieving this objective, the data collected were analysed and major findings centred on internal and external stakeholders. In respect of clients as internal stakeholders, the respondents ranked investing in the building project, ensuring

that the relevant permissions are secured in partnership with the professionals appointed for the project, and ensuring that suitable management arrangements are made for the project as the major factors. The financier of the project and eventual owner was the least ranked factor. With regard to resource managers, the respondents ranked selecting and appointing a competent and resourced principal contractor, assigning people to a project based on skills, availability, previous experience, and project budget, and selecting the appropriate equipment for the project as the major factors. Supporting project managers in on-going resource management efforts was ranked the factor of least influence.

With respect to project managers, the respondents ranked establishing effective communication among all project participants, planning all crucial projects, development, and implementation details, and predicting possible changes and developing risk mitigation strategies as the most influencing factors. Determining the material and equipment requirements and planning the procurement was the least ranked factor. Regarding contractors and subcontractors, ensuring that the project complies with the required legal and regulatory framework, coordinating health and safety-related matters while construction work is undertaken and being responsible for the actual physical construction of the project were the top ranked factors. Reduction in overall cost of project was ranked as the least influential factor.

With reference to external stakeholders, government assisting in the provision of infrastructure projects, approving building permits, and facilitating the process of acquiring sustainable affordable housing were ranked as the major factors by respondents. Providing funding and subsidy schemes for eligible low-income households was the least ranked influencing factor. With respect to suppliers, outsourcing green materials and products that are not available locally, ensuring timely delivery of construction materials to prevent inflation of prices and supplying good quality products to ensure good workmanship were the top ranked factors. With regard to non-governmental associations, building spaces where people can become healthy and better educated and increase economic mobility, providing wellbeing and social welfare for house occupants, and alerting the government on housing problems were the top ranked factors responsible for promoting affordable housing. While promoting access to finance was the least ranked factor, it is notable that the respondents ranked building spaces where people can become healthier better and educated and increase economic mobility as the most influencing factor of non-governmental association during the planning process of achieving sustainable affordable housing.

*Objective three* of this study was to identify the challenges of implementing planning techniques towards the achievement of sustainable affordable housing. In achieving this objective, the data collected were analysed and major findings centred on market challenges, professional challenges,

societal challenges and technological challenges. In respect of market challenges, higher cost of construction materials, lack of tax waivers for importers of building materials and scarcity of local green building materials were ranked as the major factors by respondents. Limited experience with the use of non-traditional procurement methods was the least ranked factor. With respect to professional challenges, financial capability of developers, lack of coordination and monitoring between local authorities, and poor communication amongst stakeholders were the major ranked factors identified by respondents. Lack of commitment of stakeholders was ranked as the least influential factor. With regard to societal challenges, poor remuneration and low minimum wages of citizens resulting in low purchasing power, inaccessibility to low and cheap housing financing schemes, and lack of political commitment by the government were the most ranked factors by the respondents. Lack of government incentives and tax waivers for low-income earners was ranked as the least influential factor. With reference to technological challenges, uncertainty in sustainability technologies performance, green technologies keep changing, misunderstanding of sustainable technological operations, and lack of adequate local green technology were ranked as the major factors by respondents. Unavailability of soft technology was ranked the influential least factor.

*Objective four* of this study was to ascertain the modalities of achieving sustainable affordable housing delivery during the planning process. In achieving this objective, the data collected were analysed and major findings centred on planning techniques. In respect of time management, timely response by a project team on requested information, strategic planning to recover time lost, and effective communication and administration of contract instruction timeously were ranked by the respondents as the major factors. Prioritising time management as part of the culture of the firm was the least ranked influential factor. With respect to quality management planning technique, quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change, quality planning to ensure that the building services or products are fit for the purpose, and quality of design specification were ranked by the respondents as the major factors for achieving sustainable affordable housing. Documenting the quality requirements and results required to effectively manage a project for quality assurance was ranked as the least factor. Regarding integration and leadership management techniques, delegating work appropriately, improving team performance by overcoming project team dysfunction, and developing in the project team willingness and desire to work towards common objectives were the most ranked factors by the respondents. Documenting various planning assumptions and communicating with the clients was the least ranked influential factor. With reference to communication management technique, the ability to analyse a problem and reach sound conclusions, developing interpersonal skills for good relationship with the project team, and adopting written communication in keeping project teams adequately informed were ranked as the major factors to ascertain the modalities of achieving sustainable affordable housing. Using oral communications in keeping project teams adequately informed was ranked as the least important

factor. Regarding risk management technique, estimating the risk that can affect project schedule, communicating risk register such as a spreadsheet or analysis software reports for risk identification and listing, and brainstorming sessions with the team and experts on risk associated with the building project were the major factors ranked by the respondents.

With respect to scope management techniques, preparing a detailed scope of work, providing information and assistance in determining and controlling the project scope, applying scope planning such as initiation, planning, definition with various output and input were the most ranked factors by the respondents. Defining boundaries and deliverables was the least ranked factor. With regard to cost management techniques, effective budget planning at tender stage of work, providing highly accurate estimates to help control the project from execution to close out, providing a cost budget to determine the total cost of funding required to execute a building project were the major ranked factors by the respondents. Managing costs through effective allocation of budgets to each activity was the least ranked factor. With reference to human resources management techniques, preparing organisational charts to assign roles and responsibilities, ensuring the needs of stakeholders and planning future needs of employees, skilled and unskilled labour, were the most ranked factors by the respondents. Recruiting more staff to increase productivity was the least ranked factor.

The proposed framework suggests the achievement of sustainable affordable housing through the effective implementation of planning techniques. It is essential for construction stakeholders to be fully involved in all activities of planning to apply their skills and abilities for maximum benefit by participating actively in the planning techniques and processes; thereby improving sustainability and affordability of house planning. With a broad range of factors that need to be considered when planning sustainability and affordability, particularly for sustainable outcomes desired from housing, a comprehensive framework representing the achievements of sustainable affordable housing is developed below.

### 5.3 Hypotheses testing

**H1**. There is no statistical difference in the perception of construction professionals on the effect of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing in South Africa. The Kruskal-Wallis test was adopted to test this hypothesis. The test established that there was no significant variance in the responses obtained from construction professionals regarding the effect of construction constraints on the implementation of planning techniques towards achieving sustainable affordable housing.

**H2.** There is no statistical variance in the perception of construction professionals on the influence of stakeholders during the planning process for providing sustainable affordable housing for low-income

earners. The results obtained from the hypothesis testing revealed that no statistical difference existed in the responses and respondent perceptions of stakeholders influence during planning processes.

**H3**. There is no statistical variance in in the perception of construction professionals on the challenges of implementing planning techniques towards the achievement of sustainable affordable housing. The results obtained from the hypothesis revealed that no statistical difference existed in the responses and the perception of respondents on the challenges of implementing sustainable affordable housing.

**H4.** There is no statistical difference in the perception of construction professionals on the modalities of achieving sustainable affordable housing delivery during the planning process. The study found no significant variance in the responses drawn from construction professionals from different companies on the perception of the modalities for sustainable affordable housing delivery during the planning process.

### 5.4 Limitations

The scope of the research was limited to the Western Cape, Eastern Cape and Northern Cape provinces of South Africa. The major challenge faced during the study was persuading respondents to participate due to the Covid-19 pandemic. Some respondents declined to complete the distributed questionnaire, while others showed no interest due to low exposure to the issue stated. However, effort was made to ensure distribution of a large number of questionnaires to be completed through visitations and phone call. Given that the study was focusing on planning techniques, the questionnaire survey was designed to address questions based on the planning processes and techniques for achieving sustainable affordable housing.

### 5.5 Recommendations

As the study focused on the implementation of planning techniques, discoveries were made on the constraints, stakeholder influences, challenges, and modalities of achieving sustainable affordable housing. Findings from the study revealed that sustainable affordable housing can be implemented successfully in construction projects with consideration for the factors indicated in the literature and referring to the shortcomings and mode of implementing of planning techniques.

With regards to findings and conclusions from the study, the following recommendations are made.

- Direct participation of top management should be encouraged as good leadership is essential for implementation of planning techniques towards achieving sustainable affordable housing. This could be a good driver of success.
- An effective communication pattern is important. Newsletters and memos are good ways to disseminate information within the project team to keep others informed and involved.

- Training programmes for management and staff should be organised to improve competence promote good communication and understanding planning techniques towards achieving sustainable affordable housing for low-income earners.
- Consistent planning and practice of sustainable affordable housing delivery jn the construction industry for end users at controlled cost, expected time and required quality without compromising the building designs
- Application of project planning techniques to prevent challenges and constraints that might impede planning tasks and successful project execution.

### 5.6 Conclusion

The acceptance of these findings by construction professionals in the South African construction industry during building construction will enable the delivery of sustainable affordable housing for end users that will promote health, wellbeing of occupants and environmental balance – at minimised cost; at the time stipulated time; at a desirable quality. Considering the hypotheses and objectives of this study, factors were discussed and achieved. It was evident from the findings that management of construction projects and planning techniques depends largely on the competence of key project stakeholders in the construction industry for the execution of sustainable affordable housing project for low income earners. Assigning construction project management responsibilities to skilled managers will support to a large extent the identification of client needs prior to and during the execution of construction project. Construction firms should emphasise constant professional development of their existing staff, as well as empowering new recruits with appropriate qualifications to handle challenges within the industry, particularly the ability to forecast and identify the constraints, challenges and modalities of achieving sustainable affordable housing during planning processes.


**Figure 1.3 Proposed framework for achievement of sustainable affordable housing through effective implementation of planning techniques**

### 5.7 Proposed framework for achievement of sustainable affordable housing through effective implementation of planning techniques

The research project's proposed framework presented in Figure 1.3 which captures implementation of planning techniques objectives for achievement of sustainable affordable housing in South Africa with regards to effects of construction constraints on the implementation of planning techniques for achieving sustainable affordable housing in South Africa in terms of time, cost and quality,the influence of stakeholders during the planning process of providing sustainable affordable housing for low-income earners, the challenges of implementing planning techniques for the achievement of sustainable affordable housing to project delivery ,the modalities of achieving sustainable affordable housing delivery during the planning such as ensuring suitable management arrangement, selecting appropriate equipment, supplying good quality products to ensure good workmanship, promoting access to finance, planning future needs of employees, skilled and unskilled, constraints such as fluctuation of prices of materials, cash flow and financial difficulties faced by contractors, inadequate equipment and material availability, low quality damaged materials, lack of adequate local green technology complying with the use of PMBOK and other factors such as initiation process, planning process, execution process, closing out process of sustainable affordable housing delivery.

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## APPENDICES

## APPENDIX A- PERMISSION LETTER

Cape Peninsula

University of Technology

FACULTY OF ENGINEERING

DEPARTMENT OF CONSTRUCTION MANAGEMENT & QUANTITY SURVEYING

Research Data Collection Permission Student: Adekanbi Adeola Olayinka Student Number: 218318235

Topic: Achievement of Sustainable Affordable Housing in South Africa through Effective Implementation of Planning Techniques.

In support of the ethical clearance for the above student, this letter confirms that permission hasbeen requested and granted from this organisation where data will be collected for research.

Personnel Signature:

nted from th

Personnel Capacity:

Date: 2019/06/03

PENINSULA CONSTRUCTION (PTY) LTD. (EDMS.) BPK. REG. No. 1988/004255/07

Name of Organisation/Official Stamp

## APPENDIX B- QUESTIONNAIRE SURVEY

Faculty of Engineering and the Built Environment
Department of Construction
Management and Quantity Surveying
P.O. Box 1906, Bellville 7535, South Africa

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Date: dd/mm/yyyy
Dear Sir / Madam,

**RE: PARTICIPATION IN A SURVEY**

You are invited to participate in a research survey entitled "**Achievement of sustainable affordable housing through effective implementation of planning techniques**". It is a research study undertaken by a master's student towards fulfilling a Master of Construction degree in the Department of Construction Management and Quantity Surveying at the Cape Peninsula University of Technology. The purpose of the research is to identify the effects of construction constraints on the implementation of planning techniques, establishing the influence of stakeholders in providing sustainable affordable housing for low-income earners and identifying the challenges of implementing planning techniques and the modalities of achieving sustainable affordable housing in South Africa. However, the level of understanding on the concept itself is low and the extent of its implementation.

Participants to the survey include construction industry stakeholders such as architects, quantity surveyors, engineers, contractors, and clients. Please answer each question carefully. The survey takes about 20 minutes to complete. All information obtained from the participants will be kept strictly confidential and will be only used for research purposes.

**Declaration by participant:**
By signing below, I (name)……. Agree to take part in this study and I am aware that no compensation will be provided for participating.

Signature……. Date…….

**Please complete the survey and return to:**

Name of the Student: Adeola Olayinka Adekanbi

Email: adekanbi_a@yahoo.com
Mobile: 0847801601

**Thanking you in anticipation for your response**

## QUESTIONNAIRE

### SECTION A: PROFILE OF RESPONDENT

(Please tick options where applicable)

1.1 Please indicate which of the following best describes your profession

a. Architect ☐ b. Consulting Engineer c. Quantity Surveyor ☐ d. Project Manager ☐

e. Real estate ☐ f. Others ☐ if others, please specify……

1.2. Please indicate your gender

☐ Female ☐ Male

1.3. Please indicate your age group

☐ Under 25 years ☐ 41 – 50 years

☐ 25 – 30 years ☐ 51 – 60 years

☐ 31 – 40 years ☐ Over 60 years

1. 4. In what construction sector do you work?

a. public sector ☐ b. Private sector ☐ c. Both ☐

1.5. Please indicate your highest formal qualification

☐ Matric certificate ☐ Postgraduate diploma

☐ Diploma ☐ Master's degree

☐ Bachelor's degree ☐ Doctorate degree

☐ Honour's degree ☐ Other, please specify ……

**SECTION B: EFFECT OF CONSTRUCTION CONSTRAINTS ON THE EFFECTIVE IMPLEMENTATION OF PLANNING TOWARDS SUSTAINABLE AFFORDABLE HOUSING**

2. Please indicate the extent to which you agree with the following statements relating to the effects of construction constraints on the implementation of planning towards achieving sustainable affordable housing delivery in terms of cost, time and quality. Kindly rate as you perceive them on a scale of 1 to 5 where 1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4- Agree, 5 – Strongly Agree.

| S/N | **Construction constraint** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| | **Cost constraint** | | | | | |
| 2.1 | Incorrect planning and scheduling by contractors | 1 | 2 | 3 | 4 | 5 |
| 2.2 | Fluctuation in prices of materials | 1 | 2 | 3 | 4 | 5 |
| 2.3 | Frequent design changes | 1 | 2 | 3 | 4 | 5 |
| 2.4 | Unforeseen ground conditions due to inadequate soil investigation | 1 | 2 | 3 | 4 | 5 |
| 2.5 | Change in the scope of the project | 1 | 2 | 3 | 4 | 5 |
| 2.6 | Low speed of decisions making | 1 | 2 | 3 | 4 | 5 |
| 2.7 | Cash flow and financial difficulties faced by contractors | 1 | 2 | 3 | 4 | 5 |
| 2.8 | Poor site management and supervision by the contractor | 1 | 2 | 3 | 4 | 5 |
| 2.9 | Delay in material procurement | 1 | 2 | 3 | 4 | 5 |
| 2.10 | Appointment of incompetent project team | 1 | 2 | 3 | 4 | 5 |
| | **Time constraint** | | | | | |
| 2.11 | Inadequate client's finance | 1 | 2 | 3 | 4 | 5 |
| 2.12 | Late payments for completed work | 1 | 2 | 3 | 4 | 5 |
| 2.13 | Shortage of material leading to temporary work stoppage | 1 | 2 | 3 | 4 | 5 |
| 2.14 | Poor work planning leading to low labour productivity | 1 | 2 | 3 | 4 | 5 |
| 2.15 | Inadequate equipment availability | 1 | 2 | 3 | 4 | 5 |
| 2.16 | Lack of communication between parties involved in the project | 1 | 2 | 3 | 4 | 5 |
| 2.17 | Mistakes during the construction stage due to limited timelines | 1 | 2 | 3 | 4 | 5 |
| 2.18 | Late supervision and slowness in making decisions | 1 | 2 | 3 | 4 | 5 |
| 2.19 | Changes in building regulations | 1 | 2 | 3 | 4 | 5 |
| | **Quality constraint** | | | | | |
| 2.20 | Failure to document changes and practices | 1 | 2 | 3 | 4 | 5 |
| 2.21 | Unnecessary and inconsistency of design document | 1 | 2 | 3 | 4 | 5 |
| 2.22 | Non-conformance to codes and standards | 1 | 2 | 3 | 4 | 5 |
| 2.23 | Non-adherence to specifications | 1 | 2 | 3 | 4 | 5 |
| 2.24 | Lack of cooperation between parties involved in a contract | 1 | 2 | 3 | 4 | 5 |
| 2.25 | Use of damaged and low-quality materials | 1 | 2 | 3 | 4 | 5 |

**SECTION C: INFLUENCE OF STAKEHOLDERS IN PROVIDING SUSTAINABLE AFFORDABLE HOUSING FOR LOW INCOME EARNERS**

3. Please indicate the influence of the following stakeholders in providing sustainable affordable housing for low-income earners. Kindly rate as you perceive them on scale of 1 to 5 where 1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4- Agree, 5 – Strongly Agree

| S/N | Stakeholders | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| | **Internal stakeholders** | | | | | |
| | **Client** | | | | | |
| 3.1 | Invest in the building project | 1 | 2 | 3 | 4 | 5 |
| 3.2 | Ensure that suitable management arrangements are made for the project | 1 | 2 | 3 | 4 | 5 |
| 3.3 | Financier of the project and eventual owner | 1 | 2 | 3 | 4 | 5 |
| 3.4 | Ensuring that the relevant permissions are secured (permits etc) in partnership with the professionals appointed for the project | 1 | 2 | 3 | 4 | 5 |
| | **Resource manager** | | | | | |
| 3.5 | Selecting the appropriate equipment for the project | 1 | 2 | 3 | 4 | 5 |
| 3.6 | Selecting and appointing a competent and resourced principal contractor | 1 | 2 | 3 | 4 | 5 |
| 3.7 | Assigning people to project based on skills, availability, previous experience, and project budget | 1 | 2 | 3 | 4 | 5 |
| 3.8 | Supporting project managers in on-going resource management effort | 1 | 2 | 3 | 4 | 5 |
| | **Project manager** | | | | | |
| 3.9 | Planning all crucial project development and implementation details | 1 | 2 | 3 | 4 | 5 |
| 3.10 | Determining the material and equipment requirements and planning their procurement | 1 | 2 | 3 | 4 | 5 |
| 3.11 | Predicting possible changes and developing risk mitigation strategies | 1 | 2 | 3 | 4 | 5 |
| 3.12 | Managing dispute that may occur on construction sites | 1 | 2 | 3 | 4 | 5 |
| 3.13 | Meeting any legal and regulatory issues | 1 | 2 | 3 | 4 | 5 |
| 3.14 | Establishing effective communication among all project participants | 1 | 2 | 3 | 4 | 5 |
| | **Contractor & subcontractor** | | | | | |
| 3.15 | Ensure that the project complies with the required legal and regulatory framework | 1 | 2 | 3 | 4 | 5 |
| 3.16 | Responsible for actual physical construction of the project | 1 | 2 | 3 | 4 | 5 |
| 3.17 | Coordinating health and safety-related matters while construction works are being undertaken. | 1 | 2 | 3 | 4 | 5 |
| 3.19 | Reduction in overall cost of project | 1 | 2 | 3 | 4 | 5 |
| 3.20 | Mitigation of project risk | 1 | 2 | 3 | 4 | 5 |
| | **External stakeholders** | | | | | |
| | **Government** | | | | | |
| 3.21 | Providing building regulations and codes | 1 | 2 | 3 | 4 | 5 |
| 3.22 | Approving building permits | 1 | 2 | 3 | 4 | 5 |
| 3.23 | Providing funding and subsidy schemes for eligible low-income household | 1 | 2 | 3 | 4 | 5 |
| 3.24 | Facilitating the process of acquiring sustainable affordable housing | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 3.25 | Assist in the provision of infrastructure project (e.g water supply, power generation and transmission, and telecommunications). | 1 | 2 | 3 | 4 | 5 |
| | **Suppliers** | | | | | |
| 3.26 | Providing construction materials to customers and PPE not available in the local market. | 1 | 2 | 3 | 4 | 5 |
| 3.27 | Ensuring timely delivery of construction materials to prevent inflation of prices | 1 | 2 | 3 | 4 | 5 |
| 3.28 | Supplying good quality products to ensure good workmanship | 1 | 2 | 3 | 4 | 5 |
| 3.29 | Outsourcing green materials and products that are not available locally | 1 | 2 | 3 | 4 | 5 |
| | **Non-governmental association** | | | | | |
| 3.30 | Creating opportunities to access basic services such as land and tenure rights | 1 | 2 | 3 | 4 | 5 |
| 3.31 | Promoting affordable housing while promoting access to finance | 1 | 2 | 3 | 4 | 5 |
| 3.32 | Providing wellbeing and social welfare for house occupants | 1 | 2 | 3 | 4 | 5 |
| 3.33 | Alerting the government on housing problems | 1 | 2 | 3 | 4 | 5 |
| 3.34 | Build spaces where people can become healthier, better educated, and increase economic mobility | 1 | 2 | 3 | 4 | 5 |

## SECTION D: CHALLENGES OF IMPLEMENTING PLANNING TOWARDS THE ACHIEVEMENT OF SUSTAINABLE AFFORDABLE HOUSING DELIVERY

4. Please assess how critical the following challenges are to the implementation of planning towards the achievement of sustainable affordable housing delivery. Kindly rate as you perceive them on scale of 1 to 5 where 1 – not critical, 2 – less critical, 3 – neutral, 4- critical, 5 – Very critical

| | **Challenges of implementing planning** | **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|---|---|
| | **Market challenges** | | | | | |
| 4.1 | Higher cost of construction materials | 1 | 2 | 3 | 4 | 5 |
| 4.2 | Scarcity of local green building materials / products | 1 | 2 | 3 | 4 | 5 |
| 4.3 | Lack of tax waiver for importers on building materials | 1 | 2 | 3 | 4 | 5 |
| 4.4 | Non acceptance of local building materials to the disadvantage of low- income earners | 1 | 2 | 3 | 4 | 5 |
| 4.5 | Limited experience with the use of non-traditional procurement method | 1 | 2 | 3 | 4 | 5 |
| | **Professional challenges** | | | | | |
| 4.6 | Lack of commitment of stakeholders | 1 | 2 | 3 | 4 | 5 |
| 4.7 | Lack of knowledge and awareness among stakeholders | 1 | 2 | 3 | 4 | 5 |
| 4.8 | Poor communication amongst stakeholders | 1 | 2 | 3 | 4 | 5 |
| 4.9 | Lack of coordination and monitoring between local authorities | 1 | 2 | 3 | 4 | 5 |
| 4.10 | Financial capability of developers | 1 | 2 | 3 | 4 | 5 |
| | **Societal challenges** | | | | | |
| 4.11 | Lack of government incentives and tax waiver for low-income earners | 1 | 2 | 3 | 4 | 5 |
| 4.12 | Inaccessibility to low and cheap housing financing scheme | 1 | 2 | 3 | 4 | 5 |
| 4.13 | Ineffective mortgage system | 1 | 2 | 3 | 4 | 5 |
| 4.14 | Poor renumeration and low minimum wage of citizens resulting in low purchasing power | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4.15 | Lack of political commitment by the government | 1 | 2 | 3 | 4 | 5 |
| | **Technological challenges** | | | | | |
| 4.16 | Lack of adequate local green technology | 1 | 2 | 3 | 4 | 5 |
| 4.17 | Unavailability of soft technology (i.e., BIM) | 1 | 2 | 3 | 4 | 5 |
| 4.18 | Misunderstanding of sustainable technological operation | 1 | 2 | 3 | 4 | 5 |
| 4.19 | Uncertainty in sustainability technologies' performance | 1 | 2 | 3 | 4 | 5 |
| 4.20 | Green technologies keep changing | 1 | 2 | 3 | 4 | 5 |

## SECTION E: MODALITIES OF ACHIEVING SUSTAINABLE AFFORDABLE HOUSING DELIVERY DURING THE PLANNING PROCESS

5. Please indicate the importance of the following modalities in achieving sustainable affordable housing delivery during the planning process. Kindly rate as you perceive them on scale of 1 to 5 where 1 – Not important, 2 – Somewhat important, 3 – Important, 4 – Very important, 5 – Extremely important.

| S/N | Planning techniques | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| 5.1 | Prioritizing time management as part of the culture of the firm | 1 | 2 | 3 | 4 | 5 |
| 5.2 | Effective communication and administration of contract instruction timeously | 1 | 2 | 3 | 4 | 5 |
| 5.3 | Ability to plan and schedule work and measure results | 1 | 2 | 3 | 4 | 5 |
| 5.4 | Ability to work under pressure to meet tight deadlines and adapt to changes | 1 | 2 | 3 | 4 | 5 |
| 5.5 | Regular monitoring of the progress of work | 1 | 2 | 3 | 4 | 5 |
| 5.6 | Strategic planning to recover time lost | 1 | 2 | 3 | 4 | 5 |
| 5.7 | Timeously response by project team on requested information | 1 | 2 | 3 | 4 | 5 |
| | **Quality management technique** | | | | | |
| 5.8 | Documenting the quality requirements and results required to effectively manage project for quality assurance ` | 1 | 2 | 3 | 4 | 5 |
| 5.9 | Adopting appropriate construction methods and processes to achieve quality workmanship | 1 | 2 | 3 | 4 | 5 |
| 5.10 | Quality of design specification | 1 | 2 | 3 | 4 | 5 |
| 5.11 | Quality planning to ensure that the building services or product is fit for the purpose | 1 | 2 | 3 | 4 | 5 |
| 5.12 | Quality control through monitoring and recording the results of project delivery to assess performance and recommend necessary change | 1 | 2 | 3 | 4 | 5 |
| | **Integration and leadership management technique** | | | | | |
| 5.13 | Increasing the effect of positive events and decrease the effect of negative events in the building production processes | 1 | 2 | 3 | 4 | 5 |
| 5.14 | Developing in the project team willingness and desire to work towards common objectives | 1 | 2 | 3 | 4 | 5 |
| 5.15 | Improving team performance by overcoming the project team dysfunctions | 1 | 2 | 3 | 4 | 5 |
| 5.16 | Documenting various planning assumptions and communicating with the clients | 1 | 2 | 3 | 4 | 5 |
| 5.17 | Delegating work appropriately | 1 | 2 | 3 | 4 | 5 |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Communication management technique** | | | | | | |
| 5.18 | Using oral communications in keeping project team adequately informed. | 1 | 2 | 3 | 4 | 5 |
| 5.19 | Adopting written communication in keeping project team adequately informed | 1 | 2 | 3 | 4 | 5 |
| 5.20 | Ability to analyse a problem and reaching sound conclusions. | 1 | 2 | 3 | 4 | 5 |
| 5.21 | Developing interpersonal skills for good relationship with the project team. | 1 | 2 | 3 | 4 | 5 |
| **Risk management technique** | | | | | | |
| 5.22 | Estimating the risk that can affect the project schedule | 1 | 2 | 3 | 4 | 5 |
| 5.23 | Communicating risk register such as a spread sheet or analysis software reports for risk identification and listing. | 1 | 2 | 3 | 4 | 5 |
| 5.24 | Brainstorming sessions with the team and experts on risk associated with the building project. | 1 | 2 | 3 | 4 | 5 |
| **Scope management planning technique** | | | | | | |
| 5.25 | Preparing detailed scope of work | 1 | 2 | 3 | 4 | 5 |
| 5.26 | Providing information and assistance in determining and controlling the project scope | 1 | 2 | 3 | 4 | 5 |
| 5.27 | Defining boundaries and deliverables | 1 | 2 | 3 | 4 | 5 |
| 5.28 | Applying the scope planning analysis such as initiation, planning, definition with their various input and output. | 1 | 2 | 3 | 4 | 5 |
| **Cost management planning technique** | | | | | | |
| 5.29 | Effective budget planning at tender stage | 1 | 2 | 3 | 4 | 5 |
| 5.30 | Providing highly accurate estimate to help control the project from execution to close out | 1 | 2 | 3 | 4 | 5 |
| 5.31 | Providing a cost budget to determine the total cost of funding required to execute building project | 1 | 2 | 3 | 4 | 5 |
| 5.32 | Monitoring and controlling cost as project cost increases | 1 | 2 | 3 | 4 | 5 |
| 5.33 | Managing cost through effective allocation of budget to each activity | 1 | 2 | 3 | 4 | 5 |
| 5.34 | Avoiding or minimizing wastage on construction site | 1 | 2 | 3 | 4 | 5 |
| **Human resources management planning technique** | | | | | | |
| 5.35 | Recruiting more staff to increase productivity | 1 | 2 | 3 | 4 | 5 |
| 5.36 | Planning future needs of employees both skilled and unskilled labour | 1 | 2 | 3 | 4 | 5 |
| 5.37 | Preparing organizational charts to assign roles and responsibilities | 1 | 2 | 3 | 4 | 5 |
| 5.38 | Ensuring the needs of stakeholders | 1 | 2 | 3 | 4 | 5 |

**THANK YOU! END… 😊**