

**THE EFFECTIVENESS OF QUALITY ASSURANCE SYSTEMS TOWARDS  
DELIVERING LOW-COST HOUSING IN CAPE TOWN SOUTH AFRICA**

**by**

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## **ABSTRACT**

The study investigates the effectiveness of quality assurance systems in the delivery of low-cost houses in Cape Town South Africa.

As an endeavor to deliver adequate social housing in Cape Town's disadvantaged and underdeveloped communities, the study is aimed at ensuring that National Housing Code as set by Department of Human Settlement concerning the overall resultant quality of houses constructed is adhered to. There are several studies on resultant quality and quality assurance of low-cost houses (LCH) in the entire country, of which skill inadequacy has been highlighted as the major concern. This is because of the sluggish improvement in quality of the low-cost houses constructed. However, skill inadequacy of construction workers has been reported in developed and developing countries, and consequently poorly impacts on the delivery of low-cost house construction projects. The human resource (labour) is the significant tool to adequate use of materials and plant for the achievement of the project objectives.

The study identified six objectives directed towards establishing an instrument that will ensure appropriate application of quality assurance systems in the delivery of low-cost house construction, hence improving the resultant quality of low-cost houses being constructed. The first objective identifies the existence, prevalence and depth of the poor resultant quality in low-cost housing areas; the second objective identifies the quality assurance systems in current use in construction of low-cost housing; the third objective evaluates the extent to which the existing quality assurance systems used assist in current low-cost housing construction; the fourth objective evaluates the effectiveness of quality assurance systems in current use; and fifth objective determines whether the poor resultant quality is the consequence of poor application of the system or the lack of knowledge from the professionals involved. Finally, the last objective is to establish the mechanism to ensure the effective use of quality assurance systems in the construction of low-cost houses.

The research adopted a mixed methodological approach, with a use of quantitative questionnaires completed by beneficiaries and structured qualitative interviews conducted with the building inspectors, contractor and designer. The research questionnaires were designed to understand the perceptions of beneficiaries on the day to day structural performance of their houses. The structured interviews were designed to understand the knowledge of building inspectors, the contractor and the designer about the quality assurance systems and their applications in the delivery of low-cost houses,

In the main study, one hundred (100) questionnaires were administered and hand- delivered to all three areas identified as Delft, Khayelitsha and Langa. Seventy three (73) questionnaires (73%) were duly completed, returned and analysed with Statistical Package for Social Sciences (SPSS) version 22.

The key findings included the use of unskilled workmanship, limited knowledge of quality assurance systems by the building inspector, contractor and designer, and inappropriate procurement systems as well as benchmarking used. This thesis is both theoretical and practical research and is limited to books relevant to quality assurance and quality of low-cost houses and data retrieved from interviews and questionnaire surveys. The selection criteria for inspectors should incorporate skill in quality assurance. The National Home Builders Registration Council (NHBC) criteria for appointment of contractors to carry on works should not be just a saying but also be put into practice. It should also at least refer to three previous completed projects to ensure the profile of the contractor is in accordance with the statutory requirements of NHBC.

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*There is a saying “no man is an Island” so the success of this thesis is a collective effort of several individuals that contributed in different capacities from beginning to completion of the research study.*

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Vuyo Ngquba

November 2017

## DECLARATION

I, Vuyo Ngquba, declare that the contents of this dissertation represent my own work and that no plagiarism took place and that it has not been previously submitted for academic examination towards any qualification. The study was executed with the support provided by my supervisor, Mr. Jonathan Crowe.

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Signed

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Date

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## LIST OF ABBREVIATIONS

<b>AJBM:</b>	African Journal of Business Management
<b>ANC:</b>	African National Congress
<b>APQC:</b>	American Productivity and Quality Center
<b>BNG:</b>	Breaking New Grounds
<b>CIDB:</b>	Construction Industry and Development Board
<b>CONQ:</b>	Cost of non-quality
<b>CPI:</b>	Cumulative Cost Performance Index
<b>DA:</b>	Democratic Alliance
<b>DOE:</b>	Design of Experiments
<b>DOH:</b>	Department of Housing
<b>DOHS:</b>	Department of Human Settlements
<b>EPHP:</b>	Enhanced Peoples Housing Process
<b>EVMS:</b>	Earned Value Management System
<b>FBFI:</b>	Faster Building for Industry
<b>FMEA:</b>	Failure Modes and Effects Analysis
<b>IPCC:</b>	Intergovernmental Panel on Climate Change
<b>ISO:</b>	International Organizations for Standardization
<b>LCH:</b>	Low-Cost Housing
<b>NAHB:</b>	National Association of Home Builders
<b>NEDO:</b>	National Economic Development Office
<b>NHBRC:</b>	National Home Builders Registration Council
<b>NNP:</b>	New National Party
<b>PECG:</b>	Provincial Eastern Cape Government

<b>QA:</b>	Quality Assurance
<b>QAS:</b>	Quality Assurance Systems
<b>QC:</b>	Quality Control
<b>RDP:</b>	Reconstruction and Development Program
<b>SAGI:</b>	South African Government Institute
<b>SPC:</b>	Statistical Process Control
<b>SPI:</b>	Schedule Performance Index
<b>SPSS:</b>	Statistical Package for Social Science
<b>TOPS:</b>	Team Orientated Problem Solving
<b>TQM:</b>	Total Quality Management
<b>UK:</b>	United Kingdom
<b>WHO:</b>	World Health Organization

# **“The effectiveness of Quality Assurance Systems towards delivering Low-Cost Housing in the Western Cape South Africa”**

## **CHAPTER 1**

### **1. INTRODUCTION**

#### **1.1 Background**

##### **1.1.1 Western Cape Housing Background**

The government of South Africa and the department of human settlement have been faced with a huge backlog in delivering adequate houses for the citizens. In fact, the provision of adequate social housing has been an issue before the current regime came into power in 1994 and it continues to be a current contentious issue. This led to the growth of informal settlements evident in and around many South African cities. This tends to diminish the standard of the cities, concurrently threatening low-income earners' dignity, health and security. Cities were and are considered the option for economic development (Dewar, 1992). However, the emergence of the current government of the Republic of South Africa in 1994 envisaged the necessity for proper housing for all citizens and initiated strategies to accommodate the poor.

In 1994 millions of people in our country stayed in informal settlements, overcrowded backyard shacks far from infrastructural amenities incorporating workplaces (Du Plessis, 2002). The housing backlog and the slum living conditions it created was a central concern to the new government. To address this situation, government committed to overcome the legacy of apartheid's divided cities and Bantustans, to tackle the housing backlog in formal and informal settlements, to find ways that the poor could access affordable housing and to build sustainable communities where the building of houses went hand in glove with the construction of community facilities such as schools, hospitals, recreation centres and economic development.

The objectives mentioned in the paragraph above guide government's work in respect to housing in general and influence the land the government chooses for community development and the priority government gives to relocating existing communities to new places closer to facilities and economic activities. However, housing the legitimate citizens has been one of the greatest challenges facing the government of South Africa. The degree of the challenge derives not only from the massive size of the housing backlog and the harassment and irritation of the homelessness, but stems also from the extremely

complicated technical, administrative, financial and institutional framework inherited from the previous regime.

### **1.1.2 Western Cape Housing Situation (1994-2004)**

South Africa is situated in the Southern part of the African continent and has nine provinces. However, the study is focused at the Western Cape particularly Cape Town known for its unique culture. The Western Cape Province is also known for its white dominant culture. The Democratic Alliance (DA) is the provincial government of the Western Cape Province with effect from 2000. The Western Cape consists of six municipalities namely: Cape Metro district municipality, Cape Wine lands district municipality, Central Karoo district municipality, Eden district municipality, Overberg district municipality, and West Coast district municipality. The premier of the province is Ms. Helen Zille. The popular municipality is Cape Metro with its effective Local Government City of Cape Town.

According to the prolonged nature and background of the crisis in South African low-cost housing, this study will be investigating in an effort to find the progress, processes undergone regarding delivery of adequate social housing and systems in place to ensure quality going forward. The study will also look at the correlation between the poor end-product and the insufficient use of quality assurance systems (QAS) in the delivery of low-cost housing (LCH). The study will be done for the period of 20 years (from 1994 to 2004 and 2004 to 2014). In doing so, the aim is to incorporate the current innovations and technologies to the study and establish mechanisms to conform to the satisfactory implementation of quality assurance systems while ensuring quality in low-cost housing. The following are the typical examples of quality assurance systems which will be discussed in details in literature review: Strategic quality management, ISO 9000 and ISO 9001, benchmarking, information management, quality control, customer focus and market intelligence, performance management plans, process management and training.

The new democratic government headed by the African National Congress (ANC) after the official release of Dr. Nelson Mandela in 1990 was followed by the first free elections in 1994. The ANC initiated the reconstruction and development programme (RDP) in an effort to address the backlog in housing, developed the White Paper which together with RPD sets out a clear vision for housing in the future. It was therefore imperative that future housing policy and strategy be developed in accordance with the vision and guidelines as stated in the White Paper (ANC agenda 1994).

The Western Cape Province as other provinces had to adhere to the initiative as it was focusing on uplifting the dignity of the South African citizens living in South Africa. At the time

Western Cape was under the leadership of New National Party (NNP) led by F.W de Klerk. In terms of Section 126 of the Constitution of South Africa Amendment Act No. 2 of 1994, a provincial legislature has to display competence with validation of parliament meaning fit to deliver adequate social housing, for making laws for the province with regard to all matters which fall within the functional areas defined in Schedule 6 of the Act. These include housing, as well as areas relevant to housing, such as consumer protection, public transport, regional planning and development, and urban and rural development. Since then government's goal was to increase housing's share in the total state budget to five percent and to increase housing delivery on a sustainable basis to a peak level of 200 000 units per annum, within a five year period, to reach the target of the government of Republic of South Africa of 1,000,000 houses in five years. However, due to reworks and refusal of community members to relocate to allow for construction to commence this has not yet manifested and it remains a fleeting illusion to be pursued but has never been attained.

The measurement above displays the lack of political stability and confidence or relatively the lack of relevant skill from the key individuals in leadership and the consequences of the little knowledge of the construction dynamics. Hence the above clearly focuses on the quantity of the houses to be constructed within a predetermined period ignoring the very importance of the initiative which is to build adequate social houses. That has a negative impact in the conditions transpiring in low-cost housing currently built in South African communities.

The African National Congress (1994) initiated reconstruction and development programme (RDP) and stated that the provision of adequate, affordable social housing and services was a key component of the RDP. Apart from being seen as a national priority in its own right, future housing strategy has a direct bearing on the success of all five key programmes of the RDP.

These programmes are:

- Meeting basic needs;

The reconstruction and development programme (RDP) planned to provide a service to improve housing conditions of the underprivileged members of society. This aims at building adequate social houses for the poor; hence the house is not just a structure with a roof on top but also performs significant role in the lives of beneficiaries such as privacy, security and most importantly health (Department of Public Works, 1999).

- Developing human resources;

The initiative was basically aimed at providing infrastructures with the construction of low-cost houses in the communities of poor people hoping to provide resources such as clean water, sewerage disposal, recreational centres, shopping centres, transportation and power (electricity). These were/are expected to uplift the standard of living of the low-income earners (McCutcheon & Taylor-Parkins, 2003).

- Building the economy;

As the idea of reconstruction and development programme (RDP) was planned to provide a service to improve housing conditions for the underprivileged members of society through promotion of community-based projects relating to self-help, empowerment, capacity building and skills development and transfer meaning it aims at training and employing people from the developing communities in trying to build the economy of those communities (McCutcheon, 1995).

- Democratizing the State and society;

Through a thorough analysis and outcomes of the stringent and ruthless system created by the previous regime before 1994 whose intentions were totally to exclude the poor from participating or benefiting from government housing through financial constraints created. The reconstruction and development programme mission was to build adequate social houses for the poor to normalize the society.

- Implementing the RDP.

The success of the four programmes mentioned previously depends entirely on the successful implementation of RDP which was directed to the department of housing now known as the department of human settlements.

The implication of a successful housing programme, or of its relative lack of success, are the subject of constant interaction between the department of human settlements and the RDP unit as they aim towards improving the lives of the communities of South Africa by building quality housing for all. Because of its consequential impact on the question of hard and soft services, as well as on local government, the role of housing needed to be correctly located within the overall framework of the RDP.

The City of Cape Town on the other side is working towards the goal of delivering a minimum of a 40m<sup>2</sup> RDP (a subsidized house built between 1994 and pre-September 2004) or Breaking New Grounds (BNG) house (a house built according to the BNG policy in the

post September 2004 period) to waiting list families, the low-income earners between R0 - R 3 500 per month (with the subsidy amount provided by the National Housing Department). Recipients must be on the City's waiting list and meet the requirements prescribed in the national housing code ([www.capetown.gov.za/en/housing/pages/programmes](http://www.capetown.gov.za/en/housing/pages/programmes)).

“Housing” is the thoroughly planned provision of accommodation by the Department of Human Settlements for the legitimate citizens of the Republic of South Africa focusing on uplifting the dignity of low-income earners in trying to protect the image of the fellow citizens and promoting a healthy lifestyle simultaneously. The thought was that the provision of adequate social houses will allow beneficiaries to pay less while living in a sanitized environment with all services needed to make life pleasant. The houses to be constructed are to be according to the national housing standards codes and regulations of the Department of Human Settlements to suite a healthy lifestyle and ensured by NHBC. These include the provision of infrastructures like clean water, sanitation and good drainage systems, power, proximity to transport services, good sound and weatherproofing to houses with enough space to accommodate the family (Johnson, 1987).

“House” is the actual structure, building or unit constructed to accommodate the family; it is expected to perform certain adequate functions such as the privacy and security of the beneficiary. The quality of the houses is expected to be adequate as stipulated by the department of human settlements regulations. The proper house is expected to be in proximity to the infrastructure and services such as schools, churches, shopping centres, public transport, power, clean water and all other basic needs (as mentioned above) to make life easy and be free from diseases and crime (Fernandes, 2007).

A government's low-cost housing makes provision for a subsidy provided by government to qualifying low-income earners for housing purposes. Government does not give beneficiaries cash. The grant is used only for acquiring housing goods and services or the provision of complete houses that comply with the minimum technical and environmental norms and standards (African National Congress, 1994).

The urban population of developing countries is increasing at a distressing rate. As a result a disturbing feature of this trend is the explosion of informal housing development in cities of developing countries. A great deal of importance in recent years has been laid on the informal housing sector considering the safety and security of the beneficiary, as the houses are often constructed defying the norms and standards set out in terms of constructing formal housing by the department of housing and human settlements as well as building codes enforced by the national housing authorities. Formal housing is constructed complying

with the building codes and standards enforced by the national housing authorities, whereas informal housing is built defying minimum standards of housing regulations. Judging from the comparison of the two construction methods, the current situation concerning the quality of low-cost houses determines the lack of practice of the building codes and standards as set out. As a result the owners of low-cost houses cannot distinguish between the formal low-cost house and the informal house.

The Vienna declaration on national regional policy and programmes 2004 on informal settlements states, 'informal housing or informal settlement' is defined as human settlements, which for a variety of reasons do not meet legal construction procedure (and have been built without respecting formal construction procedures of legal ownership, transfer of ownership, as well as urban planning regulations), prevail in their respective countries and hinder economic development. The common characteristics of informal housing are insecurity of tenure and low standard of infrastructure and services (Johnson 1987). Countries experiencing informal settlement growth are facing many problems related to urban poverty, higher unemployment, social hardships and conflicts (Environment and Urbanization, 1997).

As the residents of informal settlements are often poor and disadvantaged, they face many problems like lack of access to adequate roads, clean water, public transport, and reliable power. In this regard in the South African context it falls under the objectives of the RDP five key programmes namely meeting the basic needs, developing human resources, building the economy, democratizing the state and society and implementing the RDP. The areas informal settlement dwellers illegally locate themselves is usually unhealthy and environmentally hazardous because of unplanned garbage and sewer discharge and it is suitable for breeding diseases, and plagues (Tsenkova, 2009). Since there is no tenure security, in most of these cases, these housing areas are constantly under threat of being lost and becoming dead capital, particularly due to environmental hazards like floods, landslides, earthquakes or demolition like most Asian countries and Islands (Sethuraman, 1985).

The urban population in developing countries is increasing rapidly and creating enormous pressure on the urban housing sector. As mentioned above informal sector housing is mostly evolved because of non-availability of adequate housing in the legal housing market. Practically developing countries are not able to provide adequate housing through the formal housing market (Sastrosasmita & Amin, 1990). However, this is not the case in the Republic of South Africa but the quality of the houses constructed for the communities is questionable.

Poor urban governance is another element to cause poor quality in low-cost housing and the mushrooming of informal settlements due to the falling short in encouraging quality practices and/or providing necessary training to inspectorate teams before sending them out to assess any execution of construction processes and the bad selection of land for the construction of these houses (Sivam, 2003). There are two important matters out of the many mentioned in both documents introduced by the representatives of government related to low-cost housing both from 1994 and 2004 (White Paper and Breaking New Grounds) respectively. One is the security and the other is health, so if we select a place where for example there is underground water rising frequently, we ignore both of these and the major reason for the idea is at stake.

### **1.1.3 The situation in housing (2004-2014)**

After a decade (from 1994 to 2004) of implementation of the new strategies, parting ways from the stringent and ruthless strategy of previous regime (as said) that intentionally excluded black people from participating in government's adequate houses, there is not much difference in the quality of living of legitimate citizens. Informal settlements countrywide have increased from 1.049 million dwellings to 1.376 million (Statistics South Africa 2004) and 'slum' housing was projected to continue increasing to some 2.4 million by 2008 (Hemson & O'Donovan, 2005). The problem of adequately housing the residents of informal settlements is likely to be on the development agenda for some time.

After several attempts made trying to tackle the housing backlog and provide citizens with adequate housing, however, there have been concerns in resultant quality of houses constructed.

These concerns include attributes like adaptability, aesthetical, durability, health and hygiene, indoor environmental acoustics, indoor environmental hygrothermal, indoor environmental visual, maintainability and security. Defects in a building which impact the resultant quality negatively are due from different attributes from the differential soil types, designs and workmanship. The non-cohesive soil allows settlement to start earlier and is expected to end with the completion of the structure, while the compact soil settlement takes time to occur (Marshall, Worthing & Heath, 2009). Cape Town has sandy soil and naturally is loose soil and referred to as non-cohesive soil. Defects in the building impact the quality of the building; this is witnessed from the different structural performances due to variations occurring in different soil types (Marshall, Worthing & Heath, 2009).

There are other factors that contribute to the poor structural performance as a result of poor resultant quality. These are procurement system selected, quality of material used and

effectiveness of quality assurance system implemented during the delivery of low-cost housing.

The attributes result in concerns such as defective foundations, damp floors and chipping paint because of humid walls when wet. The walls have vertical cracks which are not regarded as fine cracks and the plumbing system is faulty. Perhaps the aggregate mix proportion if proven incorrect will be another attribute to poor resultant quality.

The former minister of housing in 2004 highlighted the lack of infrastructure and effective governance as two key areas that were identified as being in need of improvement (Sisulu, 2004). There are still deficiencies mostly in water, sanitation, electricity and ventilation. Such conditions are associated with a range of health risks including diarrheal and respiratory diseases (WHO, 1987). Another manifestation of stress as a result of poor access to services and infrastructure is social unrest. In response to the gravity of this situation the South African housing programme aimed to improve the lives of 2.2 million households by 2014. The focus of this programme is not only on informal settlements but also on medium-density housing, rental and rural housing programmes.

Currently, after ten years (1994-2004) since the release of the White Paper which was believed to set out a new national housing vision, policy and strategy seemingly it did not live up to expectations. Hence in 2004 the Department of Housing/Human Settlements adopted the release of the new document entitled "Breaking New Ground" (BNG) which is said to be a comprehensive plan for the development of sustainable human settlement (DOH, 2004). BNG aims, among other things, to eradicate informal settlements in South Africa in the shortest possible time (SAGI, 2012).

However, the quality of low-cost houses remains uncertain in the entire South Africa. The documents released (White Paper and Breaking New Ground) are more concerned about the quantity of houses to be constructed within a predetermined period, than built quality needs.

Both documents are silent about the quality of houses and the strategy to achieve high quality, as a healthy lifestyle is mentioned on both documents. The steady increase of urbanization and the housing backlog, stringent financial support inherited from the previous government imposed the current government to work under unusual circumstances likely appeared as insufficient budget, time restriction and pressure aggravated from the commitments made in fighting the housing backlog by building adequate social housing in the Western Cape. These directly affect designers as they are expected to produce accurate designs within budget.

These subsequently affected negatively the resultant quality of the product by the contractors due to poor designs and time restrictions inherited. The Department of Human Settlements/or Housing consequently suggested a new strategy “enhanced people’s housing process” (EHPH) which seeks to involve communities for the sustainable housing and all infrastructural services.

It is here that government is required to take responsibility for delivery processes of low-cost housing together with procurement and quality management systems to be in practice. The thought of a healthy lifestyle is not feasible if the quality of low-cost houses is neglected. The quality of any product depends entirely upon the quality of management and there are management systems to guide management towards being quality management.

Management is the process of planning, organizing, leading and controlling the resources and the work of the members of the organization in order to reach a common goal (Smit, Cronje, Brevis & Vrba, 2007). Quality management on the other hand is a management strategy for ensuring that all the activities which are necessary to design, develop and implement a product or service are effective and efficient with respect to the system and its performance.

The degree of visibility and support that municipal representatives/inspectors and contractors can take in implementing a total quality environment when undertaking construction of low-cost houses is critical to the success of projects. The lack of commitment from these entities will result in poor quality. However, working towards ensuring quality systems and implementing total quality management in construction projects will assist in the allocation of budgets, planning for change right at the beginning of implementation and providing methods of monitoring progress of construction works and be cost effective while providing adequate houses for citizens.

Quality is a series of attributes selected on the basis of accuracy and precision of measurement (Duncan, Thorpe & Sunmer, 1990:15). The neglect of quality as said led the researcher to the following problem statement and objectives.

## **1.2 Problem statement**

The problem to be investigated may be stated as:

The lack of implementation of appropriate quality assurance systems during construction of Low-Cost Housing is deemed to be undermining the norms and standards as set out by National Home Builders Registration Council (NHBRC) to promote beneficiaries’ healthy and secure lifestyle.

### **1.3 Aim:**

To identify and establish quality assurance systems that will conform to National Housing Standards and National Home Builders Registration Council (NHBRC) norms ensuring acceptable resultant quality.

### **1.4 The main research question**

The research questions to be asked are as follows:

- ❖ Are the poor resultant quality problems still persistent in low-cost housing construction?

#### **1.4.1 The research sub questions**

- Which types of quality assurance systems are in practice in the delivery of low-cost housing?
- Are the quality assurance systems assisting in the delivery of low-cost houses?
- How can the quality assurance systems be implemented to achieve the objective of NHBRC of good quality standards?
- What are the factors hindering the successful implementation of quality assurance systems in low-cost housing?
- What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost house construction?

### **1.5 Objectives**

The objectives of this research will be to:

- ❖ To identify the existence, prevalence and depth of the poor resultant quality in low cost housing areas.
- To identify the quality assurance systems in current use in construction of low-cost housing.
- To evaluate the extent to which the existing quality assurance systems used assist in current low-cost housing construction.
- To evaluate the effectiveness of quality assurance systems in current use.
- To determine whether the poor resultant quality is the consequence of poor application of the system or the lack of knowledge from the professionals involved.
- To establish the mechanism to ensure the effective use of quality assurance systems in the construction of low-cost houses.

Table 1.1 below will show the relationship between research questions, research objective.

<b>RESEARCH OBJECTIVES</b>	<b>RESEARCH QUESTION</b>	<b>RESEARCH METHOD</b>
To identify the existence, prevalence and depth of the poor resultant quality in low-cost housing areas.	Are the poor resultant quality problems still persistent in low-cost housing construction?	Review of relevant literature, questionnaire administration and structured interviews.
To identify the quality assurance systems in current use in construction of low-cost housing.	Which types of assurance systems are in practice in the delivery of low-cost housing?	Review of relevant literature, questionnaire administration and structured interviews.
To evaluate the extent to which the existing quality assurance systems used assist in current low-cost housing construction	Are the quality assurance systems assisting in the delivery of low-cost houses?	Review of relevant literature, questionnaire administration and structured interviews.
To evaluate the effectiveness of quality assurance systems in current use.	How can the quality assurance systems be implemented to achieve the objective of NHBRC of good quality standards?	Review of relevant literature, questionnaire administration and structured interviews.
To determine whether the poor resultant quality is the consequence of poor application of the system or the lack of knowledge from the professionals involved.	What are the factors hindering the successful implementation of quality assurance systems in low-cost housing?	Review of relevant literature, questionnaire administration and structured interviews.
To establish the mechanism to ensure the effective use of quality assurance systems in the construction of low-cost houses.	What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost houses?	Analysis of retrieved structured questionnaires and structured interview conducted.

**Table 1.1: Represent the relationship between research objectives, research question and research method.**

### **1.6 Significance of the dissertation**

The investigation will seek to examine the root cause of the poor quality that has transpired in low-cost housing (RDP) construction in the Republic of South Africa specifically in the Western Cape as a Metro-City and to where people move to look for job causing urban sprawl. Hence there is always a need of new development of infrastructures, schools, public health centres, and affordable residential areas. However, the current conditions in quality of houses constructed contradict the clear concept emphasizing human rights and opposing change seeking to incorporating poor citizens in terms of providing adequate accommodation that was put forward in South Africa by the civic movement in the 1980s and early 1990s (Huchzermeyer, 1999a).

The state and society were to be democratized, where everybody will live exactly the same life, with little class difference and people will be living in good quality houses. If the quality assurance systems will be effectively applied when constructing low-cost housing, the standard and norms as set out by NHBRC will be achieved. If the quality of the houses constructed in the areas of black communities can be improved, the rapid increase of informal settlements will decrease and people will not want to sell their RDP houses because with quality improvement there will be a great distinction between low-cost houses and the shacks citizens/beneficiaries used to stay in.

The high statistic of diseases in related communities will decrease because there will be planned sewer, drainage, uncontaminated water, electricity and all other infrastructures; the crime rate will be lower and may eventually be minimized because everyone will be living well. Class differences will be less important in the sub-consciousness of the people.

### **1.7 Methodology**

The methodology employed in this research comprises of:

- A background to the investigation will be undertaken and a literature review related to the area of research will be conducted.
- The research design based on a clear and sure functional sampling selection process in terms of a representative sample of participants in the construction process will be chosen.

- The selected research methodology will be employed to approve or disprove the hypotheses/or research questions and reach objectives after collecting relevant data.
- Combined data will be used both qualitative and quantitative methods.
- Conclusions will be reached; recommendations made and lessons learnt expanded upon.

### **1.8 Research population**

The population of this research comprises of professionals like Building inspectors, Designers and Contractors. The population also includes beneficiaries as they experience the day-to-day performance of the houses they live in.

### **1.9 Scope**

The study is restricted to Cape Town in the Western Cape Province due to its urban sprawl and continuous community development.

### **1.10 Key assumptions**

The research assumptions were as follows:

- Construction professionals involved will allow time for consultation for interviews.
- Construction professionals interviewed will have background on the subject of structured interviews and will provide their knowledge of the subject.
- House beneficiaries' will provide their knowledge of the structural performance of the houses.
- The research population will provide relevant and reliable information that will respond to the research questions and study objectives.

The research process from inception to completion is presented in figure 1.1. below.

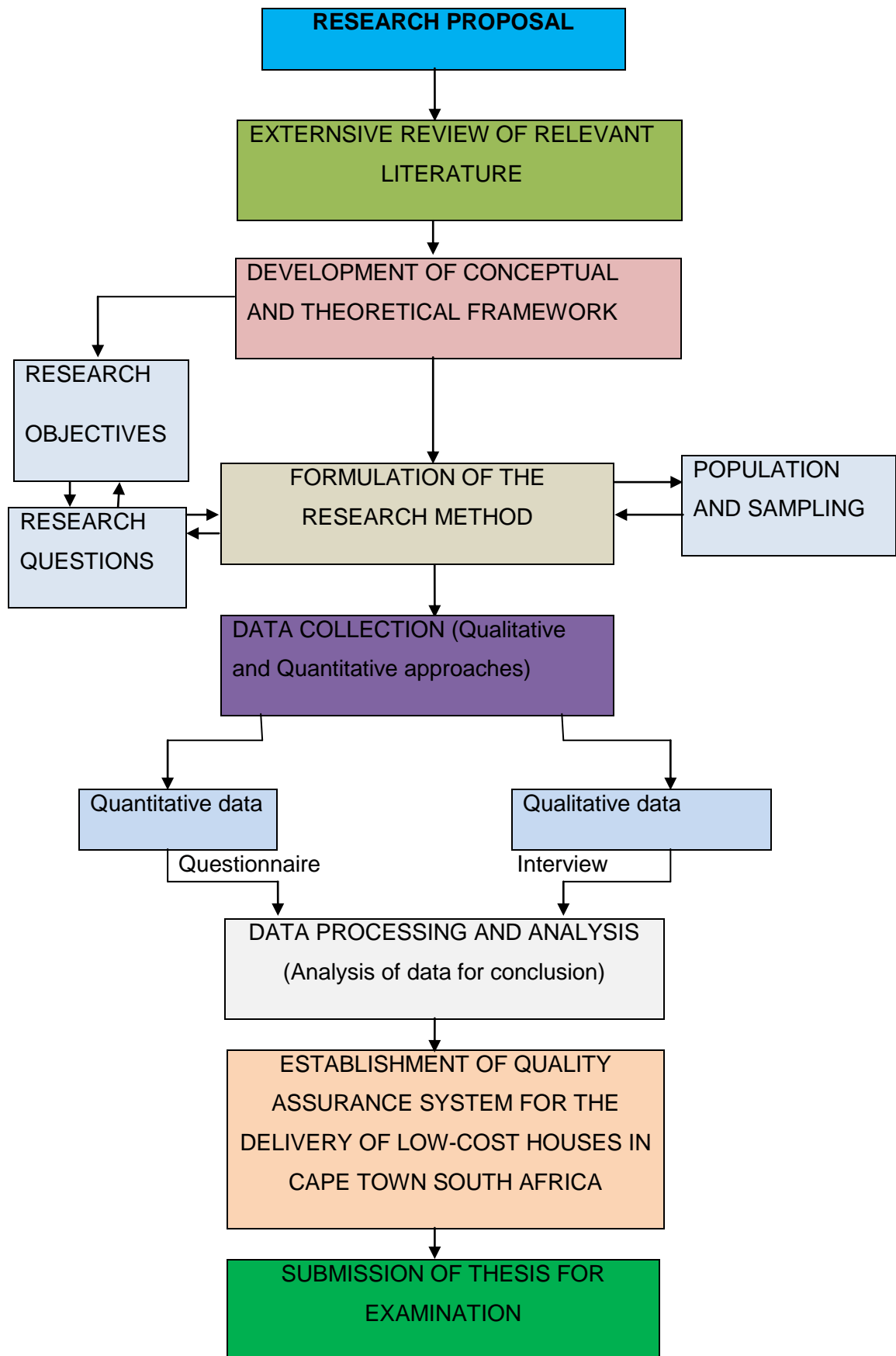


Figure 1.1: Represent the process of research.

### **1.11 Structure of the thesis**

The chapters of this thesis are presented as follows:

Acknowledgement, table of contents

**Chapter 1.** Introduction: The background to the research area, the research problem, the research hypothesis/question, the research objectives, significance, limitation as well as the thesis structure, conclusion and references are presented in this chapter.

**Chapter 2.** Literature review/Theoretical frame of reference: The literature review is presented in this chapter. Important aspects addressed in this chapter are: quality management systems, total quality management, top management commitment and employees empowerment, Impact of poor quality of low-cost houses on beneficiaries.

**Chapter 3.** Methodology: In this chapter research methodologies are interrogated with a view to finding the method best suited to the subject under investigation. Also a description of the aspects related to our research approach given is presented.

**Chapter 4.** Analysis: This chapter shows a critical analysis of the methodology. Aspects such as quality assurance systems, total quality management, and top management leadership and employee empowerment are critically analyzed in this chapter, based on the information obtained through data collection.

**Chapter 5.** Discussion: A discussion in relation to our research question is made. Aspects on the Literature review, methodology and analysis are critically discussed in order to answer our research question

**Chapter 6.** Conclusion and Recommendations: This chapter made conclusions on the findings discovered in the study and also made recommendations based on the findings.

### **1.12 Limitations of the research**

The research is confined within South Africa, specifically to the limitations of the investigation in the Western Cape. The time period is 18 months from the current year till next year (2012-2017). The research should be undertaken in a construction management area specifically focusing on the quality of low-cost houses and the quality assurance systems in place in the construction of low-income housing communities.

### 1.13 Ethical considerations

The individuals from the organizations and beneficiaries were assured 100% anonymity. This is in line with compliance with international accepted ethical standards and that there will be no compensation paid to any respondent for contributing to the study. Quality will be assured with respect to the following:

- Correctness and completeness of questionnaires
- Accuracy in calculations
- General conduct and competence of interviewers and
- Quality of data

### 1.14 Program chart

ACTIVITY	PROCESS	COMPLETION TIME
Topic and proposal. Presentation of the topic	Introduction of the topic for discussion. Proposal introduction and background, problem and objectives also explanation on how to carry on with the study.	February 2013
Proposal	Draft submission for evaluation by supervisor	April 2013
Final proposal	Submission of the final proposal	June 2013
Literature review	Literature review submission	November 2014
Research Methodology	Submission	April 2015
Compile of questionnaires and interviews process	done	July 2015
Analysis of data and preparation of findings	Submission	October 2015
Recommendations, lesson learnt and conclusion	Recommendations, conclusion and final work submission	May 2016
Examiners review of the final	Submission of the final thesis	September 2017

thesis.	for review.	
Examiners corrections and submission of final thesis	Submission of the final thesis for final marks.	November 2017

**Table: 1.2: Represent the program chart presented.**

### **1.15 Conclusion**

The introduction to the study has been presented and the extent of the need of quality assurance systems in the construction of low-cost housing has been highlighted. The background presented clarified how the quality assurance systems evolved. However, as the research continues literature review will briefly expound on quality assurance systems. The study is more focused in the quality of houses built in the communities of Western Cape South Africa. The study is of political and social concern so the intervention of government representatives deemed more crucial, hence there is a need to investigate their knowledge of quality assurance systems. The policies on housing delivery have been viewed. The two exceptionally important features of the housing policy environment in current South Africa are the results of election of April 1994, and the scale of need apparent in comparing the typical housing conditions of different racial groups. The low-cost houses currently constructed in South Africa is not promoting the healthy lifestyle of low-income earners as set out by NHBRC and as in the White Paper and Breaking New Grounds state the importance of adequate houses with provision of infrastructural services proximity to communities.

Even the then minister of housing Ms Lindiwe Sisulu in her address made mention of the need for the speedy intervention in improving the current state of informal settlements. She further emphasized the speeding up of the processes for delivering low-cost housing to the beneficiaries. However, she is repeating the existing predicament of focusing on quantity rather than building quality houses for the citizens.

The problem statement has been presented, which is in line with research questions, objectives, significant and research methodology of the study. Limitations were looked at and seen as meeting the research period as the institution policy on research stated.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

In chapter one objectives were presented to identify possible problems relating to occurrence of poor quality in low-cost houses, to conclude on reasons for poor quality on construction process, finding the natural history and degree of the impact of poor quality on beneficiaries' economic world and physical health and establishing the mechanisms to ensure that quality is attained in the construction of low-cost houses. Finally, the quality assurance systems currently operational are carefully assessed and the impact towards improving the quality issues presently facing the Department of Human Settlements (DOHS) on low-cost houses. The importance of quality assurance in the construction of low-cost houses has been extensively documented in journals and other reference materials. Several diverse opinions from researchers were expressed. To give an overview of these perspectives, on this chapter, relevant literature will be reviewed, in particular on existing quality assurance systems and total quality management and how these impact the low-cost housing sector, design process, workmanship, procurement, and benchmarking and quality assurance and the introduction of Enhanced Peoples Housing Process Program as the strategy to build sustainable communities.

Construction is one of the most accident-prone industries due to its unique nature. Minor accidents may obstruct production, and a serious accident can produce a variety of problems, having its implications for delivery, schedule, quality, cost, and even social responsibility.

## **2.2 Quality defined**

Quality has been defined as the extent of conformance to the norms and standards of use (McLaughlin, 1995:32). Quality is defined as a series of attributes selected on the basis of accuracy and precision of measurement. These attributes are in turn used to evaluate the effect of a breeding line or transgenic product, chemical or quarantine treatment, handling technique or system, set of storage conditions or other pre-construction variables on the construction of houses. Taylor & Hosker (1992:1) referred to British Standards 4778, defined quality as the totality of aspects and characteristics of a product or service that bear on its ability to satisfy specified or implied needs. Ledbetter & Lemer (1991:7) defined quality as “the totality of features, attributes, and characteristics that bear on ability to satisfy a given need: fitness for purpose and meeting the requirements”. Product-oriented quality is readily defined and clearly understood. Quality changes can be plotted as a function of time and directly related to physiological changes, such as disorientation of materials during handling and storage.

### **2.2.1 Barriers to Quality**

Griffith (1990) said that the failures to buildings are thought to occur from faults originating in the quality of design and construction process. Barriers can be the latent defects resulting in protracted litigations. These problems pervade due to:

- (i) Poor communication of design requirement.
- (ii) Design is difficult to build or not practical.
- (iii) Inadequate skill of labour and supervision.
- (iv) Unrealistic timeframes and cost assessments.

Griffith (1990) further said the specific problem surrounding the achievement of quality can be broadly categorized into two areas, problems attributed to: design and construction.

#### **2.2.1.1 Barriers to quality continued.**

##### **(a) Design**

- Detailing – inaccurate or inadequate detail of design concept.
- Specification – incorrectly specified or misused materials and components.
- Supervision – inadequate supervision of construction by client, building inspector and designer.

- Buildability – lack of design empathy for construction.

### **(b) Construction**

- Project priorities – speed and cost factors outweigh the requirements for workmanship and quality.
- Organization – inadequate definition of site duties to the workforces.
- Control – few quality control procedures used at site level.
- Supervision – inadequate site management and foremanship.
- Workmanship – inadequate standards of work at the work place.

### **2.2.2 Causes of Poor Quality in Construction of Low Cost Housing**

Many people in the country have directed the blame on designers and contractors workmanship, while overlooking the client's role concerning the clear details of the project. The client should provide the designer with a clear desire, time-frame and exact budget. Griffith (1990) also said that most of the blame for poor building performance and low quality work is directed to the designer. The inadequate skill of workmanship is one of major problem facing the industry hence there is need for greater attention to aspects of leading and motivating the workforce in order to achieve better workmanship (Griffith, 1990). Cape Town and South Africa is faced with issues such as housing backlog, design faults, inadequate skill and client manipulation, and these factors influence low-cost housing.

The other factor as Danny, (2010) postulated is the incorrect practice of the National Building Regulations by the municipal representatives or the negligence aggravated by ignorance of National Building Regulations and National Housing Standards as set out by the Department of Human Settlements and other relevant bodies regarding the quality of low-cost houses. The lack of knowledge of quality assurance systems in the departments responsible for deliverance of low-cost housing is another great attribute to the poor resultant quality. This is substantiated by the responses obtained from the building inspectors, two from the effective local Government City of Cape Town and one from Human Settlement showed that there is no quality assurance system in place during the construction process.

Furthermore, other barriers to quality arises through the process of procuring contractors are investigated, namely that of matching a contractor's capabilities to the requirements of the project, as well as political interference, cronyism, fraud and corruption. Specifically, it is noted that the Construction Industry Development Board (CIDB) Register of Contractors and

the National Home Builders Registration Council (NHBRC) Register of Homebuilders do not provide a reliable indicators of a contractor's ability to provide quality and specifically for the lower grade contractors. International practice suggests that an assessment of competencies, construction management systems, and previous project performance should be the requirements to prequalify contractors and/or to assess their potential to provide quality on which the CIDB's Best Practice Contractor Credit System has been based (CIDB newsletter 2011).

However, the thesis focused on the quality of the end-product which will from what has been discussed in paragraph 1, 2 & 3 of 2.2.1 above through its relevance to causation will look at contractor's capabilities to the requirements of the project along with design process, workmanship, procurement, benchmarking, and effectiveness of quality assurance systems in place at government level.

### **2.2.5 Impact of Poor Quality**

The South African government's policy on "Housing for The Poor" (1994) was originally based on maximizing the volume of delivery; this is basically "Quantity over Quality". Many communities have raised concerns regarding the resultant quality of units that have been delivered (Department of Housing, undated (a):1, and Sisulu, 2005a:5).

This study also highlights some of critical negative impacts that poor quality in low-cost houses may have on structural performance and lifespan of the building as Tiho lego Ecovillage (2008) cited by Wentzel, (2010) suggested, that the construction of low-cost housing in South Africa currently is somehow poor in quality, predominantly environmental, hygrothermal and aesthetic characteristics. This raises concerns in communal contribution at the design stage of low-cost housing units. The idea of community participation or involvement is recently been introduced by the Department of Human Settlements as Enhanced Peoples Housing Process (EPHP). The attributes to poor quality concerns in the construction of houses were identified as:

- (1). Insufficient concrete mix
- (2). Poor foundations
- (3). Insufficient cement sand mix
- (4). Poor plastering
- (5) Poor brick bonding
- (6). Structural defects

## (7). Sagging and leaky roofs

The above will be accompanied by the pictures appearing as appendices as the proof of defects or hazards that transpire on low-cost houses.

These concerns are the consequences of poor workmanship depending on the quality of designs and perhaps are the results of poor building material which automatically unsubscribe to the idea of adequate social housing to the communities (Department of Housing, 2005e). The study focus is on the structural performance of the building; however, it also discusses individuals housed in the communities and some of the social and financial costs of a failure to ensure required standard housing conditions. There are negative impacts that affect the individuals' health and well-being, possibility of criminality and educational attainment. These were identified as the results of overcrowded and temporary accommodation.

The entire Cape Flats is an example of a deprived area fraught with difficulty around proving causation: for example, it is whether quality concerns in low-cost housing conditions causes certain people to fail in achieving their educational potential, or whether the two are 'associated' that those who are likely to fail at school tend to be concentrated in poorer housing conditions. This applies to all three fields covered: that improving the quality, size and quantity of houses. Improving the quality of houses in the areas where low-income households live will have a positive effect in reducing criminality and ill-health and improving educational attainment.

In United Kingdom's context and perspectives in this argument is already won, in that the majority of relevant central government strategies or sponsored reviews, such as the Marmot Review of Health Inequalities (2010), Every Child Matters (2004), the Sustainable Communities Plan (2003) and the National Strategy for Neighborhood Renewal (2000) have taken a holistic approach, linking up the mutually-beneficial outcomes in tackling the four issues (Poor housing and delinquency, Poor housing conditions and education, poor housing and health, and cost of health) in an integrated manner. In particular the National Strategy for Neighborhood Renewal focused on the most deprived areas, and incorporated linked targets for tackling unemployment, crime, health, skills housing and the physical environment. It represented 'the first time that a UK government had set out how policy interventions by different departments and at different geographical levels would work together to impact on the poorest neighborhoods'.

However, the impact of quality concerns on low-cost housing will be the same in all parts of the world from Europe to Asia and here in Africa.

## **2.2.6 The similarities of poor resultant quality in Low-Cost Houses (Cape Town)**

There is a great distinction when it comes to the comparison of the resultant product. This may possibly be motivated by the number of aspects ranging from geographical phenomenon, geomorphology and climatic conditions transpiring in various part of the Western Cape area. These can have both negative and positive influences to the houses constructed in the province. Apparently it is sandy in the Cape Metro which is different from the Central Karoo and both are in the Western Cape. However, skill competence is anticipated in the same capacity. The different municipalities are another divergence affecting the quality of houses in the Western Cape areas. The above mentioned are without the accuracy of in the designs process, capacity of workmanship, procurement, benchmarking and quality assurance systems used.

### **2.2.4.1 Design Processes**

In building projects customer requirements, constructive aspects and quality standards are defined during the design phase. However, this important phase is usually carried out with little interaction between the construction and design teams causing many problems during construction such as: incomplete designs, change orders, rework, and construction delays. However, there are several aspects that can contribute to poor design processes and which can lead to design failure. These are: the selection of inappropriate materials, innovative designs, approving a defective product, client selected products and quality of design staff (Sawczuk, 1996).

#### **2.2.4.1 (i) Unsuitable Materials**

In construction everything is made of some material, but poor performance or failure of structures cannot be determined by material properties only. It is through the irrational use of procedures, linked with indecisive material choice, design process, poor workmanship, poor implementation and choice of quality assurance system and poor choice of procurement system which determines the structural failures (Rossmannith, 1996).

Problems can be aggravated by various aspects of features such as: selecting low grade products or a good product, but which is not suitable to its specific application. This problem also arises because of the workload or inexperience of the designers, which leads to improper evaluation of the product specified. Smaller design consultancies cannot afford to keep a full technical and product library and those that can, will often have an outdated library (Sawczuk, 1996).

#### **2.2.4.2 Workmanship**

The most significant aspect of a quality project is the workmanship; unfortunately, poor quality workmanship can destroy projects already put in place.

Poor workmanship is attributed to either one or a combination of the following factors: inappropriate use of a component or materials, use of a material adjacent to or in combination with another that poorly affects it, and lack of knowledge by the designer regarding the potential deterioration of a material and poor design (Carillon, 2001). Ahmad (2002) said factors that contribute to the poor quality of construction workmanship are improper monitoring of projects, poor quality of materials used, and improper site supervision due to inconsistent supervision. In my opinion, the improper monitoring of quality performance and quality standards will affect the workmanship produced.

Abdul-Aziz and Al-Atiq (1999) performed evaluations on ISO 9000 standards in Saudi Arabia using 15 construction contractors. The findings discovered that the majority of contractors believe ISO 9000 standards are appropriate to the construction industry, constructive to their companies, and bring about improvement in their operations. Furthermore, Pheng (1993) worked on workmanship and the relevance of quality assurance as a management process for achieving quality standards in the construction industry. Pheng & Chuan (2006) emphasized that skills alone are inadequate to produce the workmanship desired if there has been an insufficient exercise of skills.

Therefore, workmanship is a function of both skills and sufficient care; to a large extent, insufficient care results in shoddy workmanship.

#### **2.2.4.3 Procurement**

There are several forms of procurement systems in practice in the construction industry. Fotwe & McCaffer (2007) said they are separated and co-operative arrangements, management-orientated procurement systems, integrated arrangements and discretionary systems. To mention few of procurement systems is traditional, design and build, management procurement, design and manage procurement. The procurement systems have advantages and disadvantages. Turner (2000:16) suggests that the National Economic Development Office (NEDO) guide identified six steps to a successful building procurement as follows:

### **(i) Selecting an internal executive**

As anticipated research has confirmed that companies that build frequently have people with developed project management skills, these are people employed inside the company. In this context, at the inception of the probable project, requires the project management skills of experience of the total process of planning, designing and constructing building inclusive of experience of authority within client's organization (Turner, 2000:17). Furthermore, the skills needed exceed those of managing a construction project on site and start before any decision has been taken and actual construction has been undergone. For a project of any size and/or complexity the internal project management should:

- Be available fulltime.
- Be the single point of contact for the company.
- Understand and organize the internal decision-making process required for the project.
- Have the power to speak and act for the company.

### **(ii) Appointment of Principal Agent**

Turner (2000:17) said the capital investment in a building will not usually be decided without board approval and all the skills of reporting, communicating and obtaining timely decisions will be imperative for the successful procurement. In addition Turner (2000:18) said building procurement can be very complicated and stressful for an inexperienced client and even for the experienced client will still find the procurement process very complex.

To deal with this complication and stress the company in the building industry appoints a principal agent-consultants like Architects, Quantity surveyors, Engineers, Project managers or Contracting companies with design and construction skills in addition to a construction record (Turner, 2000:18).

### **(iii) Care in deciding the client's requirement**

The client must know what he wants first; this is the most important stage of the project as it assists designers to proceed with their work knowing exactly what is expected of them to design (Turner, 2000:19). This will eventually assist in deciding the procurement system to be used in the project and in measuring time-frames of the project, project cost, materials needed, type of plants needed and workmanship required.

#### **(iv) Timing the project realistically**

Turner (2000:20) said the entire attitude to time and to the programme required for the design and construction of buildings has significantly changed in the past two decades. In simple terms, this has been responding to a general speeding up in economic activity, to the effects of international competition on commercial and industry, to the instability and change of markets that require a facility to come on stream quickly. Turner (2000:20) further said producing an excellent facility for a product, with everything in the facility that could probably be needed, but a year or so after the product can be sold is obviously bad procurement.

#### **(v) Selecting the procurement path**

The research that was carried out for NEDO concluding in the Faster Building for Industry (FBFI) report, led to conclusions on how to use the construction industry, which procurement path was applicable and under which circumstances (Turner, 2000:20). In addition, Turner (2000:20) highlighted the key to procurement by identifying priorities in the objectives of the client and plans a path, a procurement route that will be the most appropriate. It is important and emphasized that priorities must be put into order of precedence, each in order before others, because by definition there can be only one priority. Here, the principal agent's role is of importance to select the appropriate procurement path.

#### **(vi) Choosing the company(ies) to work for the client**

The fundamental reason for employing a company to assist the client construct a building is due to the fact that it is less expensive to provide a service than the client can provide (Turner, 2000:20). The client is responsible for monitoring and controlling any risk that may possibly decrease workload or productivity. Selecting companies to work for the client is critical to successful procurement and is difficult, in outlining how to select the company, to avoid what may appear to be trite statement. The following are critical:

- Recognition of the lack of skill is fundamental - obtaining it is the key.
- Recognition of vested interests - people and company's naturally wish to sell their services.
- Responsibility for any action stays with the person who has it until he specifically delegates it - if it important, delegation should be in writing.
- Mutual trust is essential – speed of operation can then be flow, quality and value can be achieved.

- Construction contracts seem to become longer in their written conditions, on more and more occasions. Harshness, penalties and litigation have increased and certainly this will eventually increase the involvement of lawyers.
- Price competition is important and is here to stay as the backcloth for both contractors and consultants – but is not necessarily the main selection criteria.
- The most crucial appointment is the principal agent – obtain him by:
  - Comparing several firms.
  - Seeing the person responsible for day-to-day activities.
  - Checking references and track record.
  - Accepting his qualities and the relationship of trust with the client must be right. The principal agent must rapidly become an extension of client's organization.
  - There should be a correlation between the price of services and the quality of work produced.
  - Judging the impartiality and integrity the principal agent has.

#### **2.2.4.3.1 Traditional procurement**

In a traditional procurement, quality assurance relies upon the individual contribution to implementation from each designer, contractor, supplier and sub-contractor (Griffith, 1990). The traditional procurement seems to have a correlation with one of quality assurance systems ISO 9000 and 9001 for the involvement of every stakeholder in the complete introduction of the system and making sure of its success. The traditional procurement has been in practice for centuries with the function of design being provided direct to the client, linked quite often with a role for the designer that may have appeared to be one of management of the construction process (Turner, 2000:48). Practically, the management of construction by the designer is not the designer's role under traditional procurement. Turner (2000:48) said the client appoints the consultants for design and for cost control; therefore, once the design is complete the contractor is appointed to carry out the construction work. The traditional procurement has the following components (Turner, 2000:48-50):

- Establishment of the need to build.
- Establishment of client's requirements.
- Appointment of the design team.
- Developing the design and cost control.
- Acceptance of design for the scheme by the client.
- Preparation of tender documentation.
- Selecting and inviting tenderers to bid.
- Appraisal and acceptance of a tender which then becomes a contract.
- Commencement of construction works.

#### **2.2.4.3.1 (i) Advantages of traditional procurement**

Some of the advantages of traditional procurement approach are:

- Contractors and consultants are familiar with traditional procurement and the roles and responsibilities are well understood.
- The client retains responsibility for and control of design team.
- The design team report directly to the client to ensure that quality control is maintained.
- The client appoints an independent professional in the role of contract administrator monitoring the project.
- There is price certainty.
- The basis for variations to be priced at tender rates is provided by a priced Bills of Quantities.
- All prices are based on the same information

#### **2.2.4.3.1 (ii) Disadvantages of traditional procurement**

- To be effective, it requires the scheme to be more or less fully designed before tenders are sought - this often results in an extended pre-tender period.
- The fragmented design and construction procedures and responsibility can lead to disputes.
- There is potential for overdesign.
- Since the contractor is not involved in the design process so is not required to 'buy in' to the design.

- The client retains responsibility for the design team performance.
- A fixed lump sum is rarely actually achievable.
- The use of provisional sums and the power of the architect or engineer is to issue instructions for additional or varied works can lead to price escalation.

#### **2.2.4.3.2 Design and Build procurement**

Design and build may appear as new to people today. However, is not new in the industry. Previously before Architecture and design separated from the building process the architect and contractor used to supply buildings for the client together (Turner, 2000:45). In a design and build procurement the client approaches the contractor directly without the architect. This is unlike in the traditional procurement where the contractor is excluded from the design stage (Ashworth & Hogg, 2002). Furthermore, Turner (2000:45) added that in design and procurement one organization is responsible to the client for both design and construction. Organizations currently supplying the procurement option of buying a finished building are most generally building contractors. Turner (2000:45) identified the following as the components of design and build procurement:

- Establishment of a need to build.
- Establishment of the client's requirements.
- Selecting and inviting tenderers to bid.
- The contractor(s) preparing proposals for design, time and cost.
- Appraisal and acceptance of a tender which then becomes a contract.
- Commencement of construction works.

#### **2.2.4.3.2 (i) Advantages of design and build procurement**

- In design and build the speed of delivery from conception to completion is faster than in the traditional procurement. Usually, the design and build procurement approach allows programmes and budgets to be more easily met and the speed of construction is also often quicker.
- The contractor is taking responsibility of the design and construction. Thus, the client has the single point of responsibility.

- Since the contractor is responsible for the design and the construction of the building, the contractor and the contractor's supply chain are involved in the production of design to be used, and hence buy in to that design.
- There is usually the facility for the client's own designers to be notated to the contractor.

#### **2.2.4.3.2 (ii) Disadvantages of design and build procurement**

- The initial price may be higher as the contractor may build into his price a risk premium.
- Post-contract variations can be more expensive, and it is often more difficult to monitor the additional charges raised.
- The client has less control and over design matters.
- Since it is often perceived that the contractor is driven by price rather than by design standards. It is often considered that the design and build procurement approach is not the appropriate approach to use where a high quality design is required, unless a robust specification is included within the client's requirements.

#### **2.2.4.3.3 Management procurement**

The management procurement has been in practice dating back in 1970's. However, the majority of clients, consultants and contractors either have no or little experience of the procurement (Turner, 2000:52). It is very important that the elements of management should have become separated as design and construction were already separated. Turner (2000:52) suggests that the separation likely came about because the general perception of the construction process, and general reports on the building industry were that the industry is managed badly. In management procurement a client usually seeks the advice and expertise of the contractor concerning the procurement, hence appointing contractor at a very early stages of the project (Sawczuk, 1996). The project undertaken with the use of management procurement is generally completed in a shorter time than traditional procurement projects (Turner, 2000:53) and further identified the following as components of management procurement:

- Establishment of the need to build.
- Establishment of the client's requirements.
- Appointment of design team possible in advance, simultaneously or after a construction company is appointed.
- Selection and appointment of Management Company.
- Development of programme and design requirements simultaneously.
- The actual construction is carried out by contractors in competition, the management contractor or construction manager does not usually do the actual construction, however, can provide services like, safety and welfare facilities and site management personnel.
- Tendering, evaluation and appointment of maybe sixty to hundred work contractors.
- Commencement of construction works.

#### **2.2.4.3.3 (i) Advantages of management procurement**

- Management procurement is particularly beneficial for fast-track complex projects where minimal design information is available at the start of the project.
- Management procurement allows for early 'build-ability' and programming input from the management contractor acting as a consultant.
- There is a single point contractually and payment arrangement for the client with the management contractor.
- The preliminaries and management fee can be fixed, therefore allowing for a degree of certainty on price.
- The quality can be controlled by the design team.
- There is great scope for client changes.

#### **2.2.4.3.3 (ii) Disadvantages of management procurement**

- Management procurement is a low risk strategy for the management contractor as the contractor has little responsibility for package contractor defaults and bankruptcy.

- Although guaranteed maximum price can be achieved, the process is still fundamentally prime cost in its nature, which is an approach that contractors naturally prefer.
- Cost increase can be substantial, and there is often a tendency for the initial cost plan to be adjusted upwards.

#### **2.2.4.3.4 Design and Manage procurement**

As the name suggests, the design and manage procurement is a combination of some characteristics design and build procurement and management procurement. In design and manage procurement a single firm is appointed, after a selection process that perhaps includes some degree of completion on price. However, price should not be the main selection criteria (Turner, 2000:57). The design and manage procurement have the following components:

- Establishment of the need to build.
- Establishment of the client's requirements.
- Selection and invitation of tenderers to bid.
- The contractors preparing their proposals for management, design, time and cost.
- Evaluation and acceptance of a tender which becomes a contract.
- Management, design and commencement of construction works.

#### **2.2.4.3.4 (i) Advantages of design and manage procurement**

- The contractor normally owns the project until it is complete, and thus it has the financial motivation to complete the project as quick and efficiently as possible.
- There is enough time for the client to seek financing and investors before the contractor is required to pay for a completed project.
- An inexperienced client does not need to make difficult construction decisions, as those decisions are left entirely in the hands of the contractor.

#### **2.2.4.3.4 (ii) Disadvantages of design and manage procurement**

- The lack of control the client maintains over design and construction decisions, which may mean that the project is not perfectly suited to their needs once it is complete.
- In the case where a developer or a contractor has some financial long-term interest in the project, this may encourage the contractor to make construction decisions based on the long-term needs of the project, rather than just the short-term decisions needed to get the project completed.

#### **2.2.4.4 Benchmarking**

Evaluating performance of a company to that of a known company's excellence or quality framework can bring a range of benefits for companies. It is essential for a company to know one's own standard and compare it to others in today's complex and competitive business environment (Matthews, & Lave, 2003). Benchmarking has been identified as a tool to improve organizations performance and competitiveness (Kyro, 2003). Kyro (2003) added that benchmarking has been defined as the process of evaluating and applying best practices that provide possibilities to improve quality of work. While, Alarcon & Serpell (1996) suggested that to this day there is no available information describing the potential that benchmarking is offering to construction. More narrowly defined, "benchmarking is a systematic and continuous process involving the comparison of characteristics of the best products, services and processes in order to improve business performance" (Harrington, 1995; Dahlgard et al. 1998). According to Prasnikar et al. (2005) "Benchmarking is a process of creating business knowledge by comparing and analyzing business information about other companies with the goal of improving the quality of decision- making."

APQC (1993) agreed that benchmarking is a method for evaluating a company's performance against the performance of other companies. It is used to discover the best practice and to take essential actions to improve the company's own performance so that it meets or exceeds that of its competitors. It is usually a process of reengineering or quality improvement initiative, and focuses on the ongoing quality management efforts of strategic business units (APQC, 1993).

Benchmarking is a comparative method where a company finds the best practices in an area and then attempts to bring its own performance in that area in line with the best practice (Chadha, 2007). It is a reference point for the purpose of assessing and when applied to work processes produce superior results.

A company could attempt benchmarking at several levels using all the different types of benchmarking. The main purpose of applying benchmarking should be to find out the best practices so that one could conform to it. However, before one does this, benchmarking is enough to show where a company surpasses or lags behind. This is helpful in evaluating the advantages and disadvantages of an organization and determining its capability. The following are the various types of benchmarking:

**(i) Performance benchmarking**

This is done through comparison of one's own performance with that of some other competitors or the purpose of determining how good one's own organization is. It allows the initiator company to evaluate their competitive position by comparing products and services with those of competitors (Chadha, 2007).

**(ii) Process benchmarking**

The process benchmarking is comparing the approaches and practices for performing processes. It is used in the strategic management, in which the initiating company focuses observation and investigation of business processes with a goal of identifying and observing the best practices from one or more benchmark firms (John, Pearce, Richard, 2005). Activity analysis will be required where the objective is to benchmark cost and efficiency; increasingly applied to back-office processes where sub-contracting may be a consideration.

**(iii) Strategic benchmarking**

Strategic benchmarking is to compare the long-term, important decisions and activities undertaken by other organizations to achieve their goals (John, Pearce, Richard, 2005).

**(iv) Internal benchmarking**

Internal benchmarking is done within the organization by comparing the departments or units (Chadha, 2007).

**(v) Competitive benchmarking**

This is a direct comparison of one's own performance against the best competitors and confines the search for best practices to competitors (Chadha, 2007).

**(vi) Functional benchmarking**

This seeks to determine best practices irrespective of industry. It is a comparison of functions against non-competitive organizations within the same sector or technological

area (Khalil, 2000). Complex functions such as human resources, finance and accounting and information and communication technology are unlikely to be directly comparable in cost and efficiency terms and may need to be disaggregated into processes to make valid comparison.

**(vii) Financial benchmarking**

Financial benchmarking performs a financial analysis and compares the results in an effort to evaluate your overall competitiveness.

**(viii) Generic benchmarking**

This is a comparison of one's own processes against the best practices anywhere in any type of organization.

**(ix) Product benchmarking**

Product benchmarking as suggested by the name is the process of designing new products or upgrades to current ones. This process can sometimes involve reverse engineering which is taking apart competitors' products to find advantages and disadvantages.

**2.2.4.4.1 Benchmarking as a management tool**

Benchmarking is an effective management tool to identify changed ideas and brings changes to achieve continuous improvements in the way an existing activity, function, or process is performed (Sekhar, 2010). It is basic to strategic business process improvement and reengineering. In employing this technique, a company compares performance with that of strong and more successful competitors in the industry. Benchmarking helps a company not only to assess the current performance relative to other companies, but also learn from others and generate new ideas, approaches and practices to improve own functioning. Therefore, productivity and cost reduction can be improved and new performance targets which are practical and achievable can be set to give a company a competitive advantage (Wheelen, et al. 2006; Pearce & Robinson, 2005).

**2.2.4.4.2 Advantages of benchmarking**

(Sekhar, et al. 2010) listed the following advantages:

- Benchmarking helps to minimize the costs and saves time to adapt the best practices of other companies rather than re-inventing them internally.

- Helps in implementation of upcoming changes and sophisticated technological improvements, arising out of change across industries.
- Bridges the competitive gaps in one's own concern from other competing firms.
- Initiates the formulation of strategic objectives based on the external models for improving activities and procedures in the organization.
- Stimulates an organization to overcome its inertia and think differently in the context of the brand-new approaches/models implemented elsewhere.
- Facilitates organizational learning and,
- Drags improvement in critical areas within the organization by adapting best practices and processes.

#### **2.2.4.5 Quality Assurance Systems**

Quality has been defined as the extent of conformance to the norms and standards of use (McLaughlin, 1995:32). Quality is defined as a series of attributes selected on the basis of accuracy and precision of measurement. Therefore, quality assurance systems will be the set of systems in place to ensure quality is attained. These are as follows:

- Strategic Quality Management.
- ISO 9000 and ISO 9001.
- Benchmarking.
- Information Management.
- Quality Control.
- Customer Focus and Market Intelligence.
- Performance Management Plans.
- Process Management.
- Training.

#### **2.2.4.6 Implementation of quality assurance system**

Every organization will implement quality assurance practices in a way which suits its own individual, even unique operational structure and characteristics. There are however, a number of principles which influences any organization when developing its quality assurance policy and procedures, these include:

- (i) Quality involves all organizational processes from initial design, through products or serves to the satisfaction of the client.
- (ii) Quality assurance is the shared commitment and responsibility of all levels of management and workforce.
- (iii) Leadership, motivation and impetus must come up from the top management and be made to flow inherently through the organization.
- (iv) Each employee must understand the need for quality and accept their part in its overall achievement.
- (v) Overall responsibility to be vested in one individual to co-ordinate the successful achievement of quality. This individual is usually the Quality Assurance Manager.

### **2.3 Quality Assurance**

Quality assurance may not be old enough, but its credentials are now firmly established as an important feature in manufacturing and design industry (Taylor & Hosker, 1992). However, there are still business activities which have not been familiar with its principles. Quality assurance parameters have not been finally defined up to now, but certainly, the value of a well-conceived quality system is been recognized widely (Taylor & Hosker, 1992). Quality assurance is considered to be a broader, more nearly all-encompassing term for the application of standards and procedures to ensure that a product meets the desired performance criteria (Barrie & Paulson, 1984). Ledbetter & Lemer (1991:9) defined quality assurance as what the client of construction does to determine that contractor's quality control system is effective adequately and that the product therefore will meet the client's needs. In order for quality assurance to be entirely successful, the components of many services and construction activities which contribute to the complete building should have quality systems which comply with a common standard (Taylor & Hosker, 1992).

Quality Assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation or development process. Reviews, preferably by independent third parties, should be performed upon a finalized inventory following the implementation of quality control (QC) procedures. Reviews verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of production and float given the current state of scientific knowledge and data available, and support the effectiveness of the quality control programme (IPCC 1997).

### **2.3.1 Quality Assurance Procedures**

Good practice for quality assurance procedures requires an objective review to assess the quality of the inventory, and also to identify areas where improvements could be made. The inventory may be reviewed as a whole or in parts. The objective in quality assurance implementation is to involve reviewers that can conduct an unbiased review of the inventory. It is good practice to use quality assurance reviewers that have not been involved in preparing the inventory (ISO1994). Preferably these reviewers would be independent experts from other agencies or a national or international expert or group not closely connected with national inventory compilation. Where third party reviewers outside the inventory agency are not available, staff from another part of the inventory agency not involved in the portion of the inventory being reviewed can also fulfill QA roles.

It is good practice for records group to conduct a basic expert peer review prior to inventory submission in order to identify potential defects and make rework where possible. It is also good practice to apply this review to all source categories in the inventory. However, this is not always practical due to timing and resource constraints hence poor quality features appear in houses a few months after beneficiaries have been accommodated.

### **2.3.2 Quality Audits**

To verify that quality procedures are being followed, for the purpose of good practice in record preparation, audits may be used to evaluate how effectively the record agency complies with the minimum quality control specifications outlined in the quality control plan (Wentzel. L. 2010). It is important that the auditor be independent of the record agency as much as possible so as to be able to provide an objective assessment of the processes and data evaluated. Audits may be conducted during the preparation of a record, following record preparation, or on a previous record. Wentzel, (2010) postulate that audits are especially useful when new production estimation methods are adopted, or when there are substantial changes to existing methods. It is desirable for the record agency to develop a schedule of audits at strategic points in the record development. For example, audits related to initial

data collection, measurement work, transcription, calculation and documentation may be conducted.

### **2.3.3 Non-Conformance**

To monitor and track quality issues and that those defects are kept from the customer.

### **2.3.4 Specifications**

To ensure that every work undertaken corresponds to the specification given and eliminating unintended flaws in doing so ensuring a good resultant quality concurrently.

## **2.4 National Building Regulations**

No building, infrastructure, public space or place can be considered genuinely well designed or sustainable if it does not contribute to the triple bottom line of environmental, social and economic sustainability. A good design process requires real engagement with key stakeholders but offers the prospects of more sustainable management and maintenance of assets, and more competitive running costs.

## **2.5 NHBRC and Role of Structural Integrity**

The Council is a statutory body established in terms of the Housing Consumer Protection Measures Act 1995, (Act 95 of 1995), to protect the interest of housing consumers and to regulate the home building industry (Department of Housing, 2005e). Its Home Building Manual provides guidelines from practical experience in implementing the National Building Regulations, and is applicable to low income urban developments. The manual deals with general requirements, design, and construction standards which have been incorporated into the Department of Housing's Procurement Documents (Department of Housing, 2002(b):1.1).

The National Home Builder's Registration Council (NHBRC) is a statutory body that aspires to achieve quality to protect home owners (Department of Housing, 2005e). It has identified the following quality concerns in house construction in general, supported with photographic evidence, but the extent in the context of low income housing is not provided:

(1) Poor quality bricks.

(2) Insufficient cement in mortar mix.

- (3) Poor plaster applications to exterior walls.
- (4) Poor storm-water management.
- (5) Structural failure due to poor founding conditions.
- (6) Incorrect use of brick reinforcement.
- (7) Incorrect or no brick bonding.
- (8) Vertical cracks in plaster – poor quality sand and mix.
- (9) Not built to plan.
- (10) Poor workmanship.
- (11) Structural defects.
- (12) Use of substandard building material.
- (13) Lack of general maintenance.
- (14) Storm-water management control non-existent.
- (15) No on-site quality control and supervision.
- (16) Sagging and leaking roofs.

The NHBRC on its website (NHBRC, 2002a) identifies the shortage of project management skills, construction and financial management skills and construction execution skills as major challenges. It has been identified that the building of high quality houses in the government subsidized houses as a major challenge that needs to be assessed (Department of Housing, 2005e).

The Provincial Eastern Cape Government (PECG) has responded to this challenge by developing “A Basic Guide to Quality Housing Development Norms and Standards”, aimed at residential structures delivered through government subsidized low income houses, built by the people themselves. The document reflects standards, materials, quantities, sample plans and graphic representation of mixing methods, and general construction requirements to deliver a completed 40m<sup>2</sup> units. It also incorporates a checklist for inspections, from site preparation, through to completion and handover to the occupant (Province of the Eastern Cape, 2005:3). The response by the PECG is also suggesting the involvement of community as is by Enhanced Peoples Housing Process which seeks to involve community from all

stages of the project in an attempt to achieve high standard of infrastructural services through skill transfer.

### **2.5.1 Inspectorate- where does this fit in**

The NHBRC incorporated a checklist for inspection from site preparation through to completion and handover to the occupants. Inspectors are representatives of municipalities when there are new strategies and advanced systems invented by the Department of Housing which contractors are not fully aware of such innovations. Then the inspectorate has the significant role in the construction of low-cost housing from the inception stage to completion to guide the work as it progresses and pressurize contractors' efficiency to deliver the acceptable product.

### **2.5.2 Earned Value**

Earned Value analysis is a method of performance measurement in construction industry. Earned Value is a programme management technique that uses work in progress to indicate what will happen to work in the future (Fleming, and Koppelman, 2002). Earned Value is an enhancement over traditional accounting progress measures. Traditional methods focus on planned accomplishment expenditure and actual costs (Christensen, 1998). Earned Value goes one step further and examines actual accomplishment. This gives managers greater insight into potential risk areas. With a clearer picture, managers can create risk mitigation plans based on actual cost, schedule and technical progress of the work. It is an early warning programme or project management tool that enables managers to identify and control problems before they become insurmountable (Nagrecha, 2002). It allows projects to be managed better on time, and on budget. The Earned Value Management System (EVMS) is not a specific system or tool set, but rather, a set of guidelines that guide a company's management control system. It allows projects to be managed better on time, on budget (Christensen, 1998).

### **2.5.3 Benefits of EVMS**

The following are some of the benefits of EVMS, described by Fleming and Koppelman as the legacy of using the criteria on government contracts for three decades (1996, p.22). Note that they do not separate benefits of earned value data from the benefits of the criteria, perhaps because the reliability of data depends on the disciplined application of the management practices described by the criteria.

1. It is a single management control system that provides reliable data.

2. It integrates work, schedule and cost using a work breakdown structure (WBS).
3. The associated database of completed projects is useful for comparative analysis.
4. The cumulative cost performance index (CPI) provides an early warning signal.
5. The schedule performance index (SPI) provides an early warning signal.
6. The CPI is a predictor for the final cost of the project.
7. It uses an index-based method to forecast the final cost of the project.
8. The “to-complete” performance index allows evaluation of the forecasted final cost.
9. The periodic (e.g. weekly or monthly) CPI is a benchmark.
10. The management by exception principle can reduce information overload.

## **2.7 Tools for Better Quality (Quality Assurance Systems)**

### **2.6.1 Strategic Quality Management**

The Department of Human Settlements needs to take the lead in the drive for quality, through its vision, policies and strategies (Evans & Lindsay, 2002:120 & 130). It needs to work together with all stakeholders to form quality partnerships (Evans & Lindsay, 2002:182). This should be part of its strategic plans, which should include all staff so that they can take ownership and responsibility, and provide inputs to quality improvement initiatives in construction of low-cost houses (Kanji & Asher, 1996:2). This should be applicable to all activities as such an approach would enhance service delivery perceptions both internally and externally.

### **2.6.2 ISO 9000 and ISO 9001**

Whereas ISO 9000 is an internationally recognized quality management system, its application would benefit all role players (Evans & Lindsay, 2002:137). Developers are likely to benefit the most as it can provide them with a competitive advantage in the market. It could also inform departmental and municipal procurement processes as ISO certification could provide quality assurance in procurement processes. Whereas it appears that the department does not have a formalized quality management system, the ISO 9000 standards should be used to guide the development of such a system.

### **2.6.3 Benchmarking**

This should include accepted defect rates in low-income housing projects and/or standards. Targets need to be set to improve the number of defects. A Pareto analysis indicates how a significant impact can be made by prioritizing those aspects that cause 80% of the problems (Kanji & Asher, 1996:56). The prioritization of areas needing improvement, in accordance with the findings of the Pareto analysis, will greatly reduce the defect rate. This will require a detailed quality improvement plan including actions, task allocation, resource requirements and timeframes. Many challenges are being experienced in determining defect rates. It is suggested that sample projects be identified in which defects are recorded on a standardized document to assist in setting a benchmark.

### **2.6.4 Information Management**

Inadequate information systems impair quality management (Beckford, 1998:26). Both the department and the municipality need to urgently address their information management systems to include these activities to enhance quality management in terms of supplier management, project management, delivery and defect rates, and variations to contract. The system needs to include organizational goals; key performance indicators; actions plan for improvement; progress measurement; evaluation and feedback mechanisms; customer requirements and satisfaction data; product design, specification and standards; and material, equipment and supplier test results; delivery cycle timeframe projections, actual delivery timeframe and timeframe variation; and other variation data and problem-solving process management data (Gryna, 2001: 656). These factors are significant in necessitating effective project management.

### **2.6.5 Quality Control**

All role players should adopt a suitable audit and quality assurance system. ISO 9000 standards could be used to guide the development of an efficient system (NAHB, 2005a).

Inspection procedures and checklists need to be standardized. Clear guidelines need to be developed by the Department of Human Settlements, in consultation with all stakeholders regarding inspection criteria, and quality expectations, including a description of what customers can expect in terms of level of quality. The tolerances, conditions, frequency of inspections and sample size criteria also need to be defined. Documents drafted by the Eastern Cape Provincial Government, the National Association of Home Builders (NAHB),

and the Construction Industry Development Board (CIDB), as listed in the references attached to this document, could facilitate this process.

### **2.6.6 Customer Focus And Market Intelligence**

Leadership needs to create a customer focused vision with clear quality goals which should be incorporated in strategies (Evans & Lindsay, 2002:223). The lack of shared views on customer needs awareness may point to a need to ensure a common understanding of quality in terms of the customer. This should be incorporated in strategic reviews and involve all staff, as quality is defined by both internal and external customers (Gitlow, et al, 1999:3). Market surveys and customer satisfaction surveys would contribute towards a sustained competitive advantage for developers, whilst improving perceptions of service delivery by organs of state (Evans & Lindsay, 2002:184, read with Beckford, 1998:10).

### **2.6.7 Performance Management Plans**

Performance management systems within all institutions should include measures on quality performance initiatives, as defined by the organization, and including all staff. Measures to monitor adherence to ethical standards should be explored, and this may also be an area for further research in previous projects for better future projects.

### **2.6.8 Process Management**

Delivery rates (at each stage of the inspection) also need to be programmed and monitored, and communicated to all stakeholders to enhance supply chain management activities, including “just in time” principles (Evans & Lindsay, 2002:367). This should also apply to the Department of Human Settlements.

Joint planning and cross functional teams optimize the knowledge base for quality improvement systems and facilitate the incorporation of quality into all processes (Evans & Lindsay, 2002:365). The Department of Human Settlements should develop and communicate the expected timeframes for its internal processes to assist stakeholders in their planning activities and ensure that such stakeholders are involved in the process, e.g. standard operating procedure manuals. The nature of housing projects involve different professional services, thus there is a source for the development of cross-functional teams.

### **2.6.9 Training**

Employee and team appraisal need to be pursued to facilitate a conducive environment for quality improvement. Quality circles tend to focus on problems related to personal wellbeing

of staff and their frustrations (Gryna, 2001:202), thus this tool may assist in communicating concerns based on punitive approaches to management, where these are perceived to exist. Likewise, quality teams could assist in identifying quality-related problems in project implementation and find solutions to address these.

## **2.7 Improving Quality**

The quality which was designed into the product needs to be accessed during the implementation and evaluation phase and it is known that quality is not the responsibility of one person. All stakeholders are involved directly or indirectly in the production of the low-cost houses and their performance service.

It is necessary to establish an informal group of people that consists of operators, supervisors, and managers, who should soon get together to improve ways to make the product or deliver the service (Mitra, 1998:11-12). The concept behind this idea is that in most cases the persons who are proximity to an operation are in a better position to contribute ideas that will lead to an improvement in it. Thus, improvement-seeking ideas do not come only from managers, but also from all other personnel who are involved in the particular activity.

This group has to try to overcome barriers that exist within the prevailing organizational structure so as to foster an open exchange of ideas (Mitra, 1998:11). This group is responsible for identifying critical problems and determining remedial measures through brainstorming sessions which are conducted by the group leader. Whatever suggestions they come up with will be examined by management for feasibility. This informal group is called a quality circle.

Mitra (1998) further mentions that the quality improvement team is another means of identifying feasible solutions to quality problems. This team involves people from various disciplines, for example, personnel from policy and planning, engineering, project management, and customer care services. The key advantage of such a team is that it promotes cross-disciplinary flow of information in real time to solve the problem. The formation and implementation of quality improvement teams are influenced by several factors. Their knowledge and experience must be relevant to the problem being addressed. Team objectives should be clearly defined at the beginning of any quality improvement team project in order to make the team focus on the right problem. The objectives of the team should be to come up with a set of action plans and the team's recommendations will be

based on careful analysis and not on intuition. One of the team leader's responsibilities is to remove barriers to idea generation and to encourage differing points of view and ideas.

## **2.8 Definition of Total Quality Management**

There has not been an accepted definition of total quality management (TQM) as compared to a more complete definition of quality assurance and other related matters in the British Standards (Taylor, & Hosker, 1992:174). Total quality management is defined as a way of managing to improve the efficiency, flexibility and competitiveness of the business as a whole (Taylor, & Hosker, 1992:174). Total quality management is a philosophy that seeks to integrate all organizational functions (marketing, finance, design, and engineering, production, customer services) to focus on meeting customer needs, satisfaction and organizational objectives (Ledbetter, & Lemer, 1991:28). Total quality management is a continuous improvement of a company performance achieved through integrated effort by all members of the company (Ledbetter, & Lemer, 1991:28). Total quality management views an organization as a collection of processes. In order to maintain that organization it must strive to continuously improve these procedures by incorporating the knowledge and experiences of workers. The simple objective of total quality management is "do the right things, right the first time, every time". Total quality management (TQM) is infinitely variable and adaptable. Although originally applied to manufacturing operations, and for a number of years only used in that area, TQM is now becoming recognized as generic management tool, just as applicable in service and public sector organizations. TQM is the foundation for activities, which includes:

- Commitment by senior management and all employees.
- Meeting customer requirements.
- Reducing development cycle times.
- Just in time/ demand flow manufacturing.
- Improvement teams.
- Reducing services and product costs.
- Systems to facilitate improvement.
- Line management ownership.

- Employee involvement and empowerment.
- Recognition and celebration.
- Challenging quantified goals and benchmarking.
- Focus on procedures/ improvement plans.
- Specific incorporation in strategic planning.

This shows that TQM must be practiced in all activities, by all personnel, in manufacturing, marketing, engineering, sales, purchasing and human resources.

### **2.8.1 Implementing Total Quality Management**

In developing a total quality culture in construction, one important step is to develop a construction team of a main contractor and subcontractors who would commit to the quality process and develop a true quality attitude (Low & Peh, 1996). Thus, the main contractor should only select subcontractors who have demonstrated quality attitude and work performance on previous jobs. Low & Peh (1996) outlined the following basic steps to implementing total quality management (TQM) in construction projects:

- Obtain the commitment of the client to quality;
- Generate awareness, educate, and change the attitudes of staff;
- Develop a process approach toward TQM;
- Prepare project quality plans for all levels of work;
- Institute continuous improvement;
- Promote staff participation and contribution using quality control circles and motivation programs;
- And review quality plans and measure performance.

Total quality management (TQM) may be implemented in an organization in the following three phases: The exploration and commitment phase, the planning and preparation phase, and the implementation phase (Burati & Oswald, 1993). Chileshe (1996) showed that most organizations in the construction industry were reluctant to implement total quality management (TQM) because they felt that the ISO 9000 series was enough and that they

did not want to subject their employees to anymore cultural shock. Organizations also felt that there were other pressing issues to consider, such as survival. In addition, Love et al. (2000) noted that organizations in the construction industry have abstained from implementing TQM practices because they feel that the short-term benefits are relatively minimal.

Due to the complex nature and ever-changing environment of construction projects, Biggar (1990) suggested that the management system must be flexible, sensitive to effective communication, and continually improving. Clients should move away from the usual practice of awarding tenders to the lowest price and advocate rewarding the best designers and suppliers who could provide the best service. Mohrman, et al. (1995) established a correlation between various market conditions and the application of TQM practices. This suggests that competitive pressures will lead to the adoption of TQM. Organizations should create supplier partnerships by choosing suppliers based on quality rather than price.

### **2.8.2 Principle of Total Quality Management**

The following key principles of TQM are as follows:

- **Management commitment**

1. Plan (drive, direct).
2. Do (deploy, support, and participate).
3. Check (review).
4. Act (recognize, communicate, revise).

- **Employee empowerment**

1. Training.
2. Suggestion scheme.
3. Measurement and recognition.
4. Excellence teams.

- **Fact Based Decision Making**

1. SPC (statistical process control).
2. DOE (design of experiments), FMEA (failure modes and effects analysis).

3. The seven statistical tools.
4. TOPS (FORD 8D- Team Oriented Problem Solving).

- **Continuous Improvement**

1. Systematic measurement and focus on Cost of non-quality (CONQ).
2. Excellence teams.
3. Cross-functional process management.
4. Attain, maintain, and improve standards.

- **Customer Focus**

1. Supplier partnership.
2. Service relationship with internal customers.
3. Never compromise quality.
4. Customer driven standards.

### **2.8.3 The concept of continuous improvement**

Total quality management (TQM) is mainly concerned with continuous improvement in all work, from high level strategic planning and decision making, to detailed execution of work elements on site. It stems from the belief that mistakes can be avoided and defects can be prevented. It leads to continuously improving results, in all aspects of work, as a result of continuously improving capabilities, people, processes, and technology and machine capabilities.

Continuous improvement must deal not only with improving results, but more importantly with improving capabilities to produce better results in the future. The five major areas of focus for improving capability are demand generation, supply generation, technology, operations and people capability.

A central principle of TQM is that mistakes may be made by labour, but most defects are caused or at least permitted by faulty systems and procedures. This means that the root cause of such mistakes can be identified and eliminated, and repetition can be prevented by changing the process.

There are three major mechanism of prevention:

- Preventing defects from occurring.
- Where defects cannot be absolutely prevented, detecting them early to prevent them being passed down the value added chain.
- Where defects recur, stopping production until the process can be corrected, to prevent the production of more defects.

## 2.9 Effects of Improved/Better Quality occurrence

Effective quality assurance will result/or lead to advantages, both for design process and construction phase. The implementation of formal quality assurance procedures can bring:

- i. Better design.
- ii. More effective planning.
- iii. Improved site management.
- iv. Increased project performance.
- v. Improved resultant quality.

The only emphasis in construction industry today, is therefore the formulation, development and implementation of quality assurance systems.

## 2.10 Chapter Summary

In this chapter various literatures relevant to quality assurance, barriers to quality assurance, workmanship qualities, procurement and quality assurance systems (QAS). The literature review unpacked briefly on the deferent types of procurement characteristics and their advantages and disadvantages, deferent types of quality assurance system characteristics. However, the details were expanded on international organization for standardization (ISO) and benchmarking as well total quality management (TQM).

When looking at these quality assurance systems, it is evident that they are structured allowing for various aspects in the design processes as well as construction processes to be thoroughly tested and checked for any flaws. These aspects are presented as follows:

**Design:** preliminary design, semi-final design, public informative meeting, final design, specification and estimates, construction schedules.

**Construction:** site preparation, footing and slab, brick-work, rough-ins, internal linings, frames and roof trusses, roof tiling, waterproofing and tiling, timber mould-out, lock up, prime cost, practical completion and hand over. The quality assurance involves total quality management hence also involves the process of continuous improvement. The effects of improved quality were also discussed in details at the end of chapter two.

The next chapter (research methodology) will present the various types of research methodologies, approaches and techniques, then decide on the appropriate type for the study.

For the future, the crucial factor will be the extent to which the African National Congress government institutions can deliver the improved living conditions as promised in the Reconstruction and Development Programme (RDP), especially to the poorest citizens.

## **CHAPTER 3**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

The previous chapter (literature review) presented literature that has been reviewed relating to the quality assurance systems, quality of low-cost housing and the problems associated with the failure to adhere to the quality systems presented or the reasons for the ineffectiveness of the systems adopted. The most essential tool some of the research is the data collection. It is communication with relevant people that ensures appropriate and essential information is gathered.

Research methodology describes the different research methodologies available and that are in use. Information obtained by such research depends on the pattern and techniques of searching. The research is defined as the process of acquiring knowledge or information and understanding the data acquired. (Fellows & Liu, 2008) suggested that frequently research is conducted where a need has been identified by the sponsors or perhaps in a context of researches interest, experience and expertise in the matter.

There are two categories of research according to Teitelbaum (1994), namely “library and experimental”. When explaining, the library is by the use of written materials like books, journals and all other relevant literature available. The experimental incorporate the use of questionnaires and case studies.

This chapter will propose a research design best suited to address the ineffectiveness of the quality assurance system like benchmarking and ISO 9001 in the construction industry, specifically in the construction of low-cost housing by describing the best development of the effective use of benchmarking and ISO/or any quality assurance system identified as best for the delivery. The available research methods will be briefly discussed and from the discussion, linking to the problem and objectives the suitable/appropriate research method will be chosen.

#### **3.2 Research philosophies**

##### **3.2.1 Interpretivism**

The interpretivist pattern of research is concerned with an unstructured qualitative approach that may include participant observation studies and in-depth interviews (*Henn, et al.*

2006:14). Interpretivist allows respondents (beneficiaries and professionals) to present information in their own words (Henn, et al. 2006:14). According to the interpretivist paradigm the study of phenomena in the natural environment is paramount, and scientists cannot avoid affecting the phenomenon being studied. Interpretivism deals with a subjective interpretation and involvement in reality which allows the reality to be completely understood. According to Goldkuhi (2012:5) the fundamental idea of the interpretivist research pattern is to work with subjective meaning already in the social world by acknowledging its existence, reconstructing the meaning, avoiding distortion, understanding the meaning and incorporating these as building blocks for theorizing.

### **3.2.2 Positivism**

A significant research philosophy in social science research involves generation and testing of hypothesis by proving or disproving (Neuman, 2000:516). Positivism is described as a research pattern or framework that involves a deductive approach with an accurate measurement of quantitative data that allows for discovery and confirmation of causal laws to permit the prediction of human behavior (Neuman, 2000:516). The approach is based on knowledge acquired through the scientific method or experimental testing. Positivist research paradigm mostly involves quantitative approaches, rather than qualitative (Kumar, 2011:140). However, Struwig & Stead, (2007) maintain that every feature of quantitative research should not be attributed to positivism. Therefore Henn, Weinstein and Foard (2006:13) state the logic of the positivist research philosophy as follows:

- Seeking to recognize processes of causes and effect of phenomena, and to test theories.
- Knowledge should be based on what can be tested by observation of tangible evidence.
- Researchers should use the scientific method, which emphasizes control, objectivity and standardization.

This research study combines the interpretivist and positivist approaches as reflected in the research method section of the study.

### **3.3 Research methodology**

Leedy (2016) postulated that the choice of research method is used as a starting point of the research and the tool for solving the problem and eventually aiming at reaching the

objectives. While Best's (1981) argued that the purpose should be to further one's awareness of relationships, events and procedures.

Fellows & Lui (2008) concurred with Best's saying that research methodology provides understanding of the area being researched on in terms of relationships, events and processes. O'Leary (2010:88) defines research methodology as all-encompassing macro frameworks that offer principles of reasoning associated with paradigmatic assumptions that validate various schools of research. Research methodology offers both strategies and grounding for conducting research study. Hall & Hall (1996:29) suggested that the philosophy and the general principles for conducting a research are termed "research methodology". The general principles of research methodology though not exhaustible is described in this section while the specific method adopted for this research is presented in the research method section of the study.

### **3.3.1 Quantitative Research Methodology**

Quantitative research is the process whereby researchers convert their data into numerical indices and statistical analysis techniques to generalize the findings from a sample of respondents to a population. This type of research involves making careful descriptions of observed phenomena and exploring the possible relationship between different phenomena. Leedy (2016) postulated that the descriptive research method is described as the most basic of quantitative research methods. The advantage of quantitative research is that it produces greater uniformity and hence greater reliability. This is achieved because respondents are being driven to answer in a certain manner. This kind of search is easily coded, and used as numerical value for statistical computerized analysis. The disadvantage is that it is often superficial. Respondents are often irritated when none of the alternatives given appear to match their views. Fellows & Liu (2008) postulated that the results of irritation mentioned may result in the possibilities of inappropriate, inaccurate and maybe misleading responses. According to Dahlberg & McCaig (2010:159) said that the development process of the quantitative research method presents respondents with clear questions which provide answers in line with research objectives. Flick (2011) noted the fundamental concerns when formulating questions in a quantitative research as follows:

- Researcher should understand how to formulate the questions;
- Which kind of question to be posed; and
- The purpose of asking the questions.

Dehlberg & McCaig (2010:160) state the essential points to be noted by a quantitative researcher as follows:

- What do you ask?
- Why do you ask?
- Who do you ask?
- How do you ask?
- What is the answer?

Flick (2011:12) and Kumar (2011:104) identified the advantages and disadvantages of quantitative research as follows.

#### **3.3.1.1 Advantages of quantitative research method**

- The quantitative approach allows the study of a large number of cases for certain aspects in a relatively short time.
- The results have a high degree of generalization.
- The design of quantitative research is specific, well-structured and can be clearly defined and recognized.
- The quantitative approach possesses clarity and distinction between design and method of data collection.

#### **3.3.1.2 Disadvantages of quantitative research method**

- The quantitative research approach shows a lesser in-depth understanding of phenomena.
- The features of research studied are not necessarily the relevant features of the participants.
- The distance between the researcher and the study population is comparatively wide.
- Respondents may interpret questions differently from each other.

#### **3.3.2 Qualitative Research Method**

Qualitative research is a broad term that encompasses a variety of approaches to interpretive research. Qualitative research is in some scenarios historical, sociological,

political and educational. Although qualitative studies in education and other social science disciplines have multiplied in recent years, it is incorrect to think of qualitative research as modern or new. Today, when insufficient information exist on a topic, when variables are unknown, when a relevant theory base is inadequate, incomplete or missing, a qualitative study assist in defining what is important and what should be studied (Fellows & Liu, 2008). Likewise, O'Leary (2010:114) postulates that the intention of undertaking qualitative research is to obtain a close understanding of people, environment, subject and culture through rigorous involvement in the reality of the study. The research methodology involves a critical examination of the perspective of the individual or group that is of interest to qualitative researchers. *Henn, et al. (2006)* suggests that qualitative research method effectively examines population attitudes, ideas, intentions and motives. Flick (2011:12) and Kumar (2011:104) identified the advantages and disadvantages of qualitative research as follows.

#### **3.3.2.1 Advantages of qualitative research method**

- The main advantage of qualitative research is the ability to study phenomena with much in-depth.
- It allows for thorough and accurate analysis of a few cases in which participants have much more freedom to determine issues that are relevant in the context.

#### **3.3.2.2 Disadvantages of qualitative research method**

- The design of qualitative research study are less specific and do not have a consistent structural depth.
- The analysis usually requires much time and results are not broadly generalizable.

### **3.4 Interviews**

Interview is an act of verbal communication for the purpose of obtaining information. This act of communication is usually between two people who are interviewer or researcher and the respondent. Interviews are closely allied to questionnaires. Questions and answers are the most fundamental currency of interviews as they are in much of everyday conversation and communication. The interview contains much more unstructured questions than questionnaires. An interview, as a data collection technique, is not just asking any kind of questions in any way but it is investigating a wide variety of research problems and projects. Cohen & Manion (1996) said that interviews are ideal to obtain information from persons with

a low level of literacy. However, Creswell, (2013) supersedes this with a more profound perspective that interviews are typically conducted with a group of individuals who have first-hand knowledge of an event, situation or experience.

Moreover, interviews may encompass a wide range of variables. The interview may be structured and formal. Alternatively interviews may be unstructured, allowing interaction between the interviewer or researcher and the respondents. In a structured interview the interviewer ask the questions with very little chance to deviate from the topic. In an unstructured interview, the respondent is introduced to a topic and the responses are recorded. Fellows & Liu (2008) said that the respondent is given the opportunity to say whatever comes to mind.

Additionally, interviews are regarded as an essential tool for any kind of research which attempts to go beyond simple measurement of the occurrence or existence of social phenomena. Research interviews tend to emphasize the importance of the interview process as a means of genuinely understanding and coming to terms with the social dimension in any research.

The advantage of interviews is that it is more personal than other methods and responses can be candid since the respondents do not have to commit themselves in writing. Interviews are more flexible and less restrictive. The questions are able to be in a variety of ways instead of being printed on a questionnaire. People find it easier to talk rather than to write, hence respondents prefer being interviewed. Other forms of data such as documents, observations and art may also be used. Creswell, (2013) suggested that the data is then read and reread and culled for likes phrases and themes that are then grouped to form a cluster of meaning. The process above assists the researcher to construct the universal meaning of the events, situation or experience and arrive at a more profound understanding of the phenomenon (Creswell, 2013). With roots in philosophy, psychology and education, phenomenology attempts to extract the most pure, untainted data and in some interpretations of the approach, bracketing is used by the researcher to document personal experiences with the subject to help remove him or her from the process. One method of bracketing is memoing (Maxwell, 2013).

### **3.4.1 Strengths and Weaknesses of Interviews**

According to Thomas (2003) the strengths and weaknesses are:

#### **(i) Strengths of interviews**

- Meeting the informants face to face;

- Large amounts of expansive and contextual data quickly obtained;
- Facilitates cooperation from research subject;
- Interviews helps ascertaining complex interconnections in social relationships, and
- Data is collected in a natural setting.

#### **(ii) Weaknesses of interviews**

- Interviews required a lot of time;
- Information gathered through interviews is not trustworthy.

### **3.5 Case Studies**

Case studies are a type of qualitative research, in which the researcher explores a single entity or phenomena by time and activity, collecting detailed information by using a variety of data collecting procedures during a sustained period of time. Almost any phenomena can be examined by the means of case study method. It is important that the case studies be carefully prepared, but it must have relevance to the topic being researched (Allison, 1996).

Normally questionnaires are done to get an understanding of the general topic being researched or studied. Case studies narrow the results down given by questionnaires. Each case being researched is an answer on its own. That is the reason why it important to research a large number of cases for statistical analysis and importance (Fellows & Liu, 1997).

Case studies normally do not have an impact on the time limit of the respondent. Furthermore, case studies do not require the same amount of respondents like other methods and purely deals with similar cases and is not an opinion of any respondent that might not be true. The disadvantage of case studies is that it has to be checked thoroughly for relevance to a topic. The coding involved in case studies might be difficult sometimes. There is always a possibility of divergence. That is why cross checking of information can be difficult (Fellows & Liu, 1997).

### **3.6 Questionnaires**

Questionnaires are defined as the forms of securing answers to questions. Here respondents are required to fill in a questionnaire form themselves. There are two primary forms of questions, open and closed-ended type. Open questions are designed to enable the respondent to answer in full and reply in whatever form, with whatever content and to

extent the respondent wishes to respond. Open ended questions are somehow easy to ask but are difficult to answer. The answers depending on situation and question may never be complete and often very difficult to analyze. It is important that the answers to open questions be recorded in full (Fellows & Liu, 1997).

Close ended questions have a set number of responses. Such rigidity of available responses may constrain the responses artificially. Care must be taken that the responses to open-ended questions are not biased by the response alternative provided related and preceding closed ended questions. It is preferable though to place open ended question before close ended questions. It is possible to ask more closed than open-questions, as responses to closed questions are usually given more easily and quickly (Fellows & Liu, 1997).

The questionnaire however, does not consist simply of an assortment of questions. The questionnaire must be assembled in some practical manner once the questions themselves have been perfected. It is accepted that a shorter questionnaire is better because of the willingness of the respondents to complete it. The data that the questionnaire contains is of a higher quality when the researcher limits questionnaire to a reasonable size. Black (1976) suggested that the use of questionnaire method allows for information to be obtained from people living in any area in the country. Hence, the researcher will be able to combine the responses in order to test the hypothesis or answer the research question.

Questionnaires are less personal than interviews and if properly designed result in good quality data. Better standardization of wording can be obtained by using the printed instead of the spoken word. The use of questionnaires saves cost and time moreover the advantage of convenience to the respondent. The fact that questionnaires requires as little time and effort from the respondent, return postage and an addressed envelope should be provided to the respondent (Allison, 1996).

Unfortunately there are also disadvantages to using questionnaires. Replies to questions are normally very vague. Few people have the patience or motivation to write as fully as they could speak. The above is the reasons why questionnaires generate such allow response from the public (Allison, 1996).

According to Melville and Goddard (1996) a good questionnaire:

- Is comprehensive: gets all the data needed;
- Is short: is not time-consuming and cannot obstruct concentration;
- Asks relevant questions;

- Gives clear instructions;
- Has precise, unambiguous and understandable questions;
- Has objective questions: does not suggest answers;
- Starts with general questions;
- Has appropriate questions: if sensitive questions need to be asked, put these at the end;
- Uses mostly closed-ended questions.

### **3.6.1 Types of Questionnaires**

#### **3.6.1.1 Mailed Questionnaires**

Mailed questionnaire is one which is sent off by mail in the hope that the respondent will complete and return it (De Vos, 1998). A response rate consideration of 50% as adequate, 60% as good and 70% as excellent. De Vos (1998) suggested that mailed questionnaires are in fact the survey technique used regularly.

#### **3.6.1.2 Telephonic Questionnaires**

This form is critical because it is unlikely to notice when respondent is giving the incorrect or biased response. When attempting this kind of questionnaire the researcher and the respondent are physically removed from each other, but are able to communicate with each other about the contents of the questionnaire. As this questionnaire is executed the communication is handicapped in that no non-verbal communication is possible (De Vos, 1998).

#### **3.6.1.3 Personal Questionnaires**

This form of questionnaire is handed over to the respondent who completes on his/her own, with researcher available for clarity. The researcher should allow the respondent to complete the personal questionnaire on his/her own and not contribute except for clarity where needed (De Vos, 1998)

#### **3.6.1.4 Questionnaires delivered by hand.**

This questionnaire is self-explanatory, whereby the questionnaire is delivered by hand to the respondents, which can be completed by the respondents in their own time or immediately in front of the researcher (De Vos, 1998). Furthermore De Vos (1998) added that, should the

respondent request for time a date for collection of this data is to be agreed upon by the researcher and the respondents. The time period between delivery and the collection of this questionnaire should preferably not be more than 48 hours (De Vos, 1998).

### **3.6.1.5 Group-administered questionnaires**

De Vos (1998) suggested that in this form of questionnaire, respondents who are present in a group complete the questionnaire or questionnaires on their own. Preferably each respondent should receive the same stimulus and complete his/her own questionnaire without discussing with the other members of the group (De Vos, 1998).

### **3.6.2 Advantages and Disadvantages of a questionnaire**

According to Kumar (1999) the advantages and disadvantages are:

#### **3.6.2.1 Advantages of questionnaires**

- It is less expensive
- It offers greater anonymity

#### **3.6.2.2 Disadvantages of questionnaires**

- Limited application
- A low response rate
- Self-selected bias
- Lack of opportunity to clarify issues
- Spontaneous responses are not allowed for mailed questionnaires
- The response to the questions may be influenced by the response to other questions.

### **3.7 Triangulation**

Triangulation is the use of two or more research methods to investigate the same aspects of a study. Triangulation studies employ more than two research techniques such as interviews and case studies. Qualitative and quantitative techniques may be employed to reduce disadvantages of each individual technique whilst gaining the advantages of each and of the combination of a multi-dimensional view of the subject is gained through synergy. Quantitative and qualitative techniques may both adopt common research styles but, it is the

nature of the data collected which determine whether the study may be classified as qualitative or quantitative. Triangulation studies may be undertaken when given the opportunity in most cases for the comparison of data (Fellows and Liu, 1997).

Triangulation may be classified as theoretically involving the use of term of reference when analyzing a set of data. Information gathered with a triangulation using different sampling strategies to ensure that the theory is tested in various ways. Investigation with triangulation involves the use of observers, interviews and analysts in a particular study. Methodological triangulation is the use of two or more methods of collecting information in a study. The advantage of triangulation is that methods used will ensure that source of error and possible bias that occurred is identified and be eliminated immediately. The disadvantage is that triangulation method is extremely time consuming.

### **3.8 Research approach**

#### **3.8.1 Deductive approach**

The deductive research approach is principally used in a quantitative research (Bryman, 2004:20). The deductive research approach involves the use of theory at the inception of the study, generating hypothesis from the theory and testing the hypothesis (Dahlberg & McCaig, 2010:20). The information or factual contents in the conclusion of a deductive approach is important to the theory (Mounon, 1996:77). Dahlberg & McCaig (2010:20) described deductive approach as a “top-down” research approach.

#### **3.8.2 Inductive approach**

The inductive research approach begins with the collection of flexible empirical data. Dahlberg & McCaig (2010:20) suggests that the inductive research approach allows for the change of questions in order to introduce new questions at any point in the study. This research approach is a “bottom-up” research approach, which contributes to understanding of reality first and eventually produces a theory. Mounon (1996:77) said that the genuine evidence supporting the theory leads to a conclusion which is likely i.e. supporting statements gradually support the conclusion as the explored reality becomes clearer. While, Bryman (2004:20) argues that the inductive research approach does not test, rather generates a theory and is mainly used in a qualitative research. Researcher can begin the process with an inductive exploratory stage and afterwards generate a theory that can be tested in a deductive explanatory stage (Henn, et al. 2009).

### **3.9 Action research**

Action research is described as a form of enquiry that enables practitioners in every job and work of life to investigate and evaluate their work (Mcniff & Whitehead, 2011:8). Kumar (2011:131) suggests that this is the kind of research directed by the desire to take an action either to improve a practice, resolve a problem or issue as the name suggests “action and research”. Furthermore, this system of research can be a powerful redeeming form of professional review, because practitioners within a profession may investigate practices within the profession and develop ways of improving the existing practice. Dahlberg & McCaig (2010:102) mentioned the fundamental purpose of action research as enabling changes and learning from the experience. However, the harsh reality of changes by practitioners of a profession is significantly depending on the ability of practitioners to interpret a problem, on their motivation to undertake research and their tendency to investigate into their own practice. The most action research is directed towards improving quality of service by identifying areas of interest, developing, testing and experiment alternatives with a new approach (Kumar, 2010:131).

### **3.10 Choice of Research Instrument**

Research is not a vehicle to express one’s own feelings, beliefs, views and opinions. Collecting and analyzing of data enables the researcher to arrive at conclusions and recommendations based on the evidence collected during research which is made valid by the aid of references (Allison, 1996). Most research studies undertaken to improve the effectiveness of construction labour consider the professional perspective on factors affecting construction labour performance. However, Dai, et al. (2007 & 2009) recognizes the necessity of exploring the views and perceptions of construction labour in an effort to improve the performance of workers on construction projects. The input of skilled construction workers on construction production has not been considered significantly by researchers and construction site management teams (Dai, et al. (2009). The above perspectives from different scholars if not understood by those responsible for the actual construction and quality assurance of low-cost houses will result to poor resultant quality.

After reviewing all possible research methods of collecting information, together with the pros and cons, the use of questionnaires and interviews is the most suitable for the study, considering the degree and the extent of topic as the study is close to heart of the communities of Cape Town Metropole. The questionnaires and interviews technique will provide the researcher enough time to interact with the community members, government

representatives who are inspectors and other professionals like designers and all workforce of the construction company which will be identified, especially site supervisors on factors affecting the efficiency of construction labour.

This will be achieved through structured interviews designed and administered to construction professionals (Building inspector, Designer and Contractor) while beneficiaries opinions on the structural performance of the houses were obtained through structured questionnaire in order to validate quantitative data obtained. The triangulation technique will also allow respondents to find comfort when answering in some technique within triangulation and in return enables the researcher to plan and think about responses. In triangulation the researcher will get much more responses than single technique and the use of triangulation will be helpful as the area of research attract many respondents. Opinions of others may be useful when respondents need to answer difficult questions. Respondents prefer to be guided by simple answers, for example yes or no. Henn, et al. (2006:3) identifies three necessary qualities of research design as:

- The research design should be adequately structured.
- The method should be sufficiently reliable.
- The research design should aim to generate large scale, statistically-based studies.

However, Kumar (2011) maintains that competent research design provides adequate answers to the following questions:

- Who will constitute the study population?
- How will the study population be identified?
- Will a sample or the whole population be selected?
- If a sample is selected, how will it be contacted?
- How will consent be sought?
- What method of data collection will be used and why?
- In the case of questionnaires, where will the responses be returned?
- How should respondents contact the researcher in case of queries?
- In the case of interviews, where will they be conducted?

- How will ethical issues be taken care of?

### 3.10.1 Research aim and objective

The aim of this study is to identify quality assurance systems that will confirm to National Housing Standards and National Home Builders Registration Council (NHBR) regulations by ensuring acceptable resultant quality. The study objectives are outlined to achieve the aim of the research. Table 3.1 below indicates the medium through which the research objectives were achieved.

<b>Objectives</b>	<b>Purpose</b>	<b>Achieving objectives</b>
To identify the existence, prevalence and depth of the poor resultant quality in low-cost housing areas.	The objective aims at finding the results of poor quality in low-cost house construction.	The objective is achieved through literature review and structured questionnaire.
To identify the quality assurance systems in current use in construction of low-cost housing.	The objective aims at investigating quality assurance systems used in the construction of low-cost houses.	The objective is achieved through literature review and structured questionnaire.
To evaluate the extent to which the existing quality assurance systems used, assist in current low-cost housing construction.	The objective examines the necessity and input of quality assurance systems in the construction of low-cost houses.	The objective is achieved through literature review and structured questionnaire.
To evaluate the effectiveness of quality assurance systems in current use.	The objective examines the resultant quality as the results of proper or improper implementation of quality assurance system	The objective is achieved through literature review and structured questionnaire.
To determine whether the poor resultant quality is the	The aims at establishing the root cause of poor resultant	The objective is achieved through

consequence of poor application of the system or the lack of knowledge from the professionals involved.	quality in the delivery of low-cost houses.	literature review and structured questionnaire.
To establish the mechanism to ensure the effective use of quality assurance systems in the construction of low-cost houses.	The mechanism is established to ensure the effective use of quality assurance systems in the construction of low-cost houses.	The objective is achieved through analysis of qualitative and quantitative data obtained.

**Table 3.1: Represent the achieving of research objectives.**

### **3.10.2 Data analysis**

Statistical Package for Social Science (SPSS) software 21 was used to analyze quantitative data gathered during investigation of the study. Afterwards, the investigation enhanced modification of questionnaires for the main study, as earlier stated. The quantitative and qualitative data retrieved for the study is presented in the following chapters. Quantitative data retrieved from the structured questionnaire design was analyzed with a descriptive statistics, while qualitative data retrieved from interviewees was analyzed with qualitative content analysis. The fundamental purpose is to validate quantitative data and ensure reliability of research findings. From the analyzed quantitative data tales, bar charts and pie charts were drawn and presented accordingly.

#### **3.10.2.1 Descriptive statistics**

Quartaroli (2009:75) said that the descriptive statistics involves the act of a brief description of quantitative data retrieved in a study in a meaningful manner (Quartaroli, 2009). Russell & Purcell (2009:282) suggests that one of the most significant initial analyses is to describe the participant of a study, and the finding must present the characteristics of the sample. While, O'Leary (2010:237) postulates that descriptive statistics are used for describing the basic features of a data set and are the key for summarizing variables. The basic summary of each variable is presented by showing a proportionate breakdown of categories for each variable (Henn, et al. 2006). The purpose of this statistical instrument is to provide an overall and direct picture of a large amount of data (Stead & Struwig, 2007). The three methods of central propensity have been identified as: mean, median and mode (Henn, et al. 2006). The

study variables are broadly described with mean values and respective percentages of respondents. Therefore, the study adopts research designed to provoke the most significant cause of poor resultant quality transpired in low-cost houses by ranking the identified cause with the aid of mean, percentage and standards deviation. Therefore, the study adopts descriptive statistics for quantitative data retrieved with the purpose of responding to the research questions.

### **3.10.2.2 Content analysis**

The content analysis is basically a system of coding that includes transforming of raw data into a consistent form. Babbie (2007:325) added that the procedure includes coding of communication (oral or written) or classification in line with some theoretical framework. Bryman (2000:182) said that this is an approach to data analysis that is rooted deeply in the qualitative research strategy, with the purpose of producing the quantitative accounts of the raw material in terms of the category specified. The approach includes the summary of content, while the information is paraphrased to skip less relevant passages (Flick, 2011:137). The fundamental idea in content analysis is that many words in the text are classified into considerably fewer content categories (Stead & Struwig, 2007:14). Content analysis is a suitable method for responding to multitudes of research questions, although when compared with analysis of quantitative questionnaire of the same quantity of data consumes more time than questionnaire analysis (Thomas, 2003:60). Content analysis is an inductive process where similarities and differences in text are explored to support or disconfirm a theory. Within the context of this study, significant content attained from the interviewee is reported in the simplest form to validate the quantitative data attained, while less significant information was discarded in the reporting process.

### **3.10.3 Reliability and validity**

Testing for validity and reliability of research mechanism(s) is very imperative to credibility of a research project. Validity refers to the ability of the research tool to prove that the tool fulfills the desired purpose of design, while reliability ensures consistency in findings when continually used (Stead & Struwig, 2007:158), resulting in discarding the need to consider reliability and validity of a study might distort the validity of a research study.

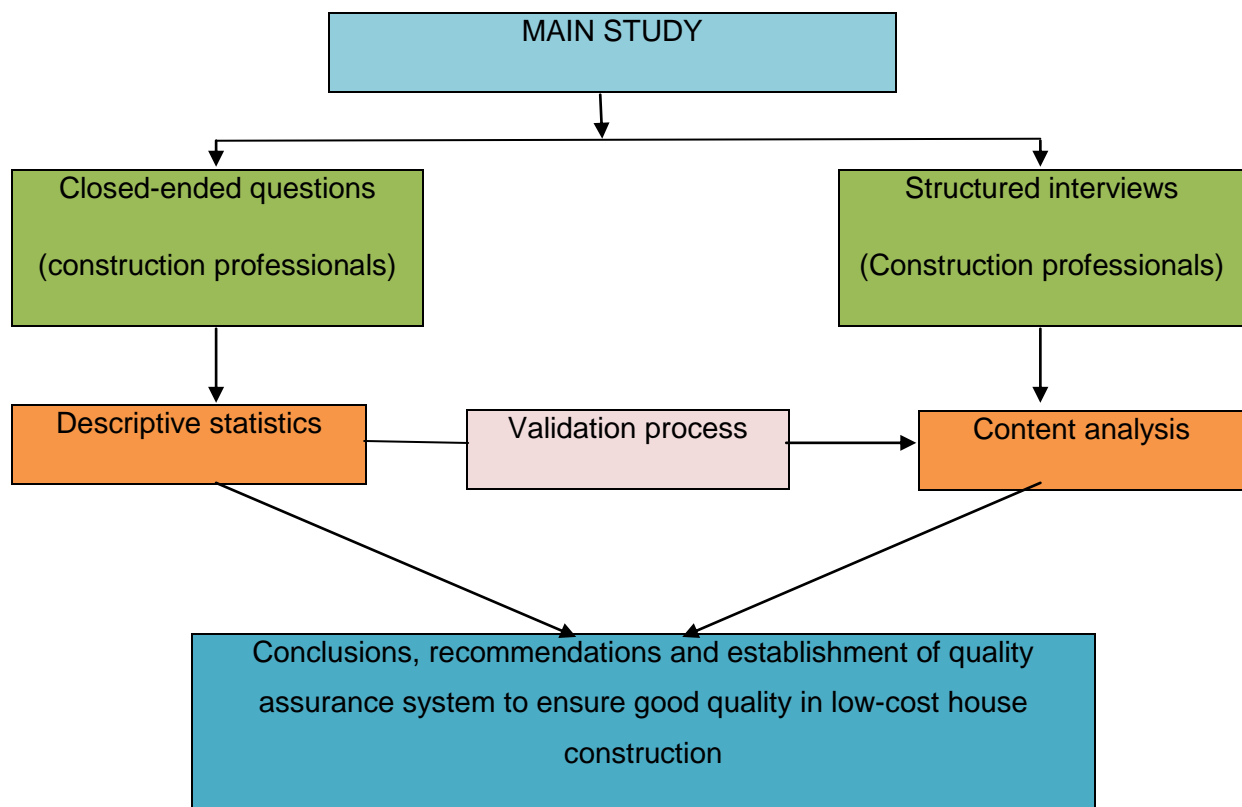
#### **3.10.3.1 Reliability**

Research reliability refers to future researchers to undertake the same research project and come up with the same results, interpretations and claims. Furthermore, Silverman (2006:282) said the reliability in quantitative research approach suggests the extent to which

an experiment, test or measurement provide the same result or regular measurement on continual trials. Kumar (2011:179) suggest that the greater the degree of consistency and stability of an instrument, the greater the reliability of the instrument. The necessity of determining the reliability scores before examining the validity (Stead & Struwig, 2007:158).

### 3.10.3.2 Validity

Validity refers to trustworthiness of research findings (Stead & Struwig, 2007:159). The logic that underpins the formulation of research instruments and the statistical evidence gathered through the use of research instruments combine to form the basis of establishing validity of research instruments (Kumar, 2011:179). Validity is further described as the quality of research to reflect the true report of a phenomenon that is being researched and ultimately confirms the accuracy of the results attained (Plowright, 2011:135). For the purpose of this study, the validity of the result was achieved through validation of quantitative data attained from construction professionals, with quantitative interviews conducted with construction site supervisors.



**Fig. 3.1: Represent the research method.**

### 3.11 Conclusion

In this chapter two types of philosophies (interpretivism and positivism) has been discussed where it was discovered that interpretivist pattern of research is concerned with an unstructured qualitative approach that may include participant observation studies and in-depth interviews. Positivism is described as a research pattern or framework that involves a deductive approach with an accurate measurement of quantitative data that allows for discovery and confirmation of causal laws to permit the prediction of human behavior. Research methodologies were discussed; both qualitative and quantitative research methods were selected. Qualitative is more of structured interviews and the quantitative are the component of questionnaires. However, it will depend on triangulation (questionnaires and interviews) used to find out where the problem lies.

The method chosen appears to be a suitable tool to addressing the research questions and proving or disproving hypotheses. Also it should provide enough evidence to analyze for reaching a satisfactory answer to the problem stated. All different types of questionnaires were discussed their aim and how they reach respondents. Direct communication with people where there is problem and people of the cause is an important tool to be exercised.

Two research approaches were identified as deductive and inductive research approaches. Deductive approach is more quantitative and inductive approach is more of qualitative. This chapter also redirected the study back to research objectives the purpose and how to achieve the objectives.

Data analysis was also discussed where descriptive statistics analysis and content analysis were identified as two types of data analysis. It is fundamental to ensure reliability and validity of the study as discussed at the end of the last chapter. Fortunately, with the aid of the technique chosen the problem will be determined and will find a mechanism to establish quality assurance system to ensure good resultant quality in low-cost houses in Cape Town South Africa.

## **CHAPTER 4**

### **RESEARCH METHODS EMPLOYED**

#### **4.1 Introduction**

In chapter three (research methodology) various research methods concerning the facts attempting to answer the research question and to answer objectives set were discussed. However, the complexity of the research questions as set in chapter one (research proposal) displays the huge need for information and as a result the decision was to use questionnaires and structured interviews.

The analyses of the formulation of questions set and the comparison of the results derived from the literature review will be made in this chapter. Consequently, the research outcomes, developments and factors affecting the validity of data will be highlighted and undertaken. Through that, from the response technique used, an evaluation will be made informing how quality assurance systems could be implemented and improved while ensuring quality to promote highly structural performance right from the beginning of the project and meet low-income earners' needs and satisfaction levels.

Basically, the purpose of this chapter is to acquire the required facts through the use of questionnaires and interviews as chosen to be the solution in collecting data.

## **4.2 Questionnaire Survey**

The questionnaires for quantitative data were formulated and directed to the occupants of three specific low-cost housing areas situated in Cape Town in the Western Cape Province. Adler & Clark (2008:216) postulates that the questionnaire is a data collection mechanism comprising of questions and statements designed to ask information from the research study respondents. However, poorly designed questionnaires leads into obtaining inadequate or useless information that cannot be properly interpreted (Dahlberg & McCaig, 2010:179). Burns (2000:574) on a contrary said a well-planned, structured and carefully designed questionnaire will have increased response rates and greatly enhances summarizing and analysis of data retrieved. Wording of questions in questionnaires if not properly structured may give the wrong answers and eventually compromise the reliability of the study (Babbie, 2004:256).

These residential areas were selected according to the following criteria; oldest residential, above five years old and a recent residential area. The selection was made to compare the quality concerns of the previous low-cost housing with the current ones so as to understand the progress in quality assurance and strategies developed in ensuring successful implementation of quality assurance systems during the construction process.

The development of the relevant questionnaires to the research title and problem statement was undertaken. The questionnaires were reviewed, justified and corrected by various professionals for relevance before being distributed to occupants. These questionnaires were corrected and also correlated to the research title and problem statement set in chapter one. Questions with a limited set of possible choices were identified and a corresponding set of answers were developed.

### **4.2.1 Open-Ended-Questions**

The open-ended-questions do not give a precise guidance to possible responses. In the open-ended-questions, respondents are given freedom to write their perception on a particular question in their own words (Kumar, 2011:151). Neuman (2000:260) said the open-ended-questions are suitable for a research study that aims at exploring the how respondents think, and ascertain what is important to respondents with the use of questions with various possible answers. The majority of people residing in low-cost housing is illiterate or has a poor or limited educational background and hence is being referred to as low-income earners. Open-ended questions were included into the questionnaire survey to allow for community members to openly and fully express their views as they desired. The

questions were also used to obtain the understanding and deep thorough explanation to develop tangible responses for the research findings.

#### 4.2.2 Close-Ended-Questions

Closed-ended-questions have been described as the questions that define possible responses in questionnaire design (Kumar, 2011:151). Here, respondents are provided with option that matches the question asked. Closed-ended-questions have an advantage of attaining consistency of measurement and reliability in making the respondents answer in a manner appropriate to the responses category (Burns, 2000:151). These types of questions require **yes** or **no** answers. Usually, these questions are used to elicit effective answers on issues more sensitive to the topic. The respondents were assured of 100% anonymity hence they were not required to state their names in the questionnaire form.

#### 4.2.3 Sample size

Bryman (2004:87) said population is the world of components from which a sample is to be selected. Population is basically depends on the nature of the researcher's study, and does not only refer to people being sampled for questionnaires. Population is the total membership of a defined class, objects or events (O'Leary, 2010:161). In the case of this study, the lack of implementation of appropriate quality assurance systems during construction of low-cost housing is the identified issue that the research aims at addressing. Consequently, the population for this study consists of building inspectors as they constantly monitors quality and progress in government projects and also represents client, Contractors as appointed by client to construct the houses, Designers as they are responsible for the designs of the houses appointed by client and the beneficiary's as people experiencing the day-to-day structural performance of the houses.

The sample size of a study is suggested by Flick (2011:71) to be minimized representation of the population in terms of heterogeneity of the elements and representativeness of the variables. However, in addition O'Leary (2010:164) said that the larger the sample in a quantitative research study, the better it is represented thus the more generalizable the conclusions remain. Hence, the sample frame for the study is adequate representation of community members (beneficiaries) of Cape Town. The major survey participants are building inspectors, contractors, designers and beneficiaries. The questionnaires were distributed to community members who are currently occupying or own affordable housing in Delft, Khayelitsha and Langa, all in Cape Town. Residents of these three residential areas were the most suitable candidates due to the fact that the areas were frequently undergoing development of low-cost housing. The fact that occupants are witnesses and knowledgeable

of day-to-day and seasonal structural performance of the houses made occupants to be suitable candidates to respond on the structural performance of the houses.

The questionnaires were hand-delivered to randomly selected occupants in these three residential areas. Where questions needed some clarity, assistance was provided hence there was no need for pilot questionnaires for criticism on the type and style of questions. From the 100 questionnaires which were handed out to the community members (beneficiary's) 73 were retrieved for scrutiny. In Khayelitsha 20 questionnaires were distributed of which 12 was retrieved, in Delft 40 questionnaires were distributed and 27 was retrieved and from the 40 questionnaires distributed in Langa 34 was retrieved. The total percentage of responses for these different communities is 73%.

### **4.3 Interviews Survey**

Structured interviews for qualitative data were formulated for municipal representative such as building inspectors. The structured interviews were also formulated for contractors and designers to ascertain correlation and scrutiny aligned to research questions asked and hypothesis set in chapter one and were modified to ascertain different factual responses from the experts mentioned. This was an attempt to acquire their views and perhaps inputs on the quality assurance within low-cost housing in the Western Cape particularly Cape Town. This was also anticipated to acquire their knowledge of quality assurance systems that will respond to the predicament in the resultant quality of low-cost housing. Further, as these are experts in their fields, it was expected that they will assist in the best way of implementing whichever quality assurance system best suited to respond to problem.

The development of the relevant interview questions to the research question, hypothesis and objectives was undertaken. The questions were reviewed, justified and corrected by various professionals for relevance before the actual interviews with building inspectors, contractors and designers. These questions were corrected and also correlated to the research question, and objectives set in chapter one, making sure research questions, and objectives are all covered. Questions with a limited set of possible choices were identified and a corresponding set of answers were developed.

There interviews were undertaken with two inspectors from the City of Cape Town, one based in Khayelitsha and the other in Cape Town. To substantiate the responses of the two from the City of Cape Town the third inspector from the Department of Human Settlement was interviewed.

#### **4.4 Chapter summary**

The research methods implemented to conduct the study have been explained in detail in this chapter. Therefore, all facts attained from occupants, local authorities or/and government representatives either by means of questionnaire survey or structured interviews will be presented in the next chapter so as to make recommendations and conclusions for the research study.

## Chapter 5

### Data Presentation and Analysis

#### 5.1 Introduction

The methods employed in this research study were discussed in chapter four. In this chapter the data retrieved from the questionnaires sent to occupants concerning the structural performance of their houses and satisfaction thereafter. Interviews were conducted with contractors, designers and inspectors concerning their knowledge of quality assurance systems and how effective these systems are in low-cost house construction. A discussion of findings was delivered in order to draw various conclusions to the problem statement, hypothesis/research question and the objectives.

#### 5.2 Data Presentation

##### 5.2.1 The locations visited.

This is the validation of the locations or communities from which the questionnaires were distributed to randomly selected occupants. The table shows the percentages from those communities.

NO	Location	Frequency	Per cent	Valid Per cent	Cumulative Per cent
1	Delft	27	37.0	37.0	37.0
2	Langa Joe Slovo	19	26.0	26.0	83.6
3	Langa Zone 26	15	20.5	20.5	57.5
4	Khayelitsha	12	16.4	16.4	100.0
	<b>Total</b>	73	100.0	100.0	

Table 5.1: Represent locations/communities visited.

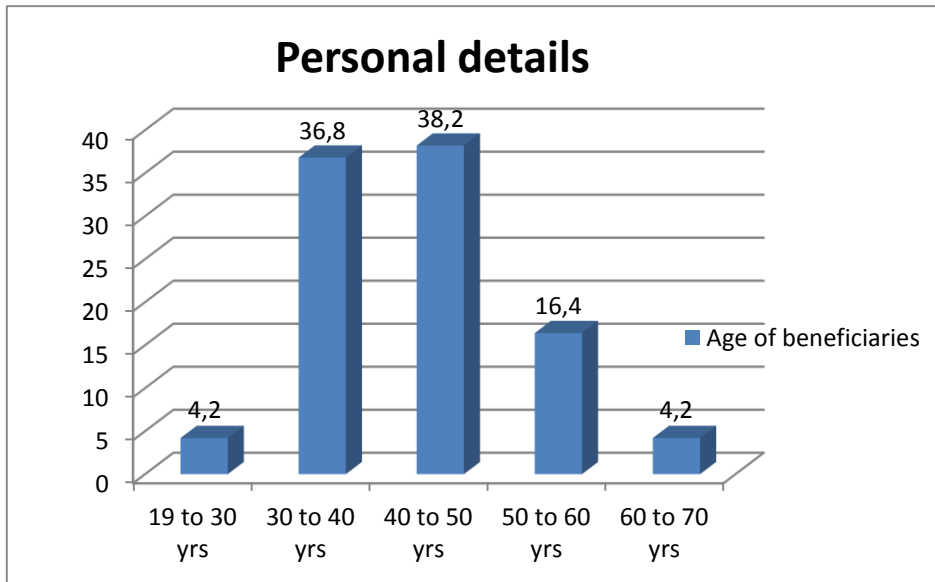
## **5.2.2 SECTION A QUESTIONNAIRE SURVEY: Personal Details of Occupants**

As the history taught us about segregation against owning proper houses in cities, residents were forced to live on the peripheries of the cities with little infrastructures provided. The new government drew statutes qualifying the previous disadvantaged citizens to own adequate houses in proximity to the cities. The statutory requirements validating the qualification of occupants included:

- Age: Focussing on the even spread of the houses across the different age groups.
- Gender: Focussing on the even spread of houses across the age and gender.
- Race: Focussing on rectifying the stringent access and inequalities inherited from the previous government.
- Address: Focussing on addressing race issues on owning houses in the Cities and in areas previously referred to as white only owned.
- Employment: Focussing on the statutory requirements of the low-cost houses set by government on the white paper.
- Monthly income: Focussing on the abilities of the occupants towards maintaining their homes through monetary strength.
- Number of occupants: Focussing on the capacity of the house to accommodate people.
- Durability of occupancy: Focussing on the measuring the age of the house and the capacity of the house to accommodate people during this period.
- The age of the house: Focussing on measuring the durability of the house and structural strength of the house.
- The importance of owning the house: Focussing on reducing the premature sale of the houses.

### 5.2.2.1 Age of the beneficiary

The personal details are based on the statutory requirements for low-cost housing in Cape Town South Africa. Previously, old mature people used to have first preference in owning houses through the stringent rules created by the then government. This is focussing on the even spread of houses across the different age groups.



**Fig. 5.1: Represent the statistics on the different age group of beneficiaries owning the houses**

When it comes to the age of beneficiaries figure 5.1 above shows that 4% of responses from three locations confirmed age group between 19 to 30 years and 60 to 70 years to own the houses, while 37% of responses confirmed age group between 30 to 40 years to own the houses, 38% highlighted that age group between 40 to 50 years own houses and 16% of responses highlighted age group between 50 to 60 years own houses. Here it is clear that youth and middle age groups are leading in owning houses.

### 5.2.2.2 Gender of the beneficiary

Unlike the previously conditions, now women seem to take a lead in owing houses. In fig. 5.1 above it shows an imbalance in terms of gender equality. However, that is not the case; it depends entirely on the employment status and the capacity to maintain the house. The government is trying to balance the employment between the two genders, of course attempting to rectify previous inequalities. The figure 5.2 below shows females takes the lead with 55% superseding males who set at 45%. Government seems to achieve its goal of balancing the spread of houses across all genders.

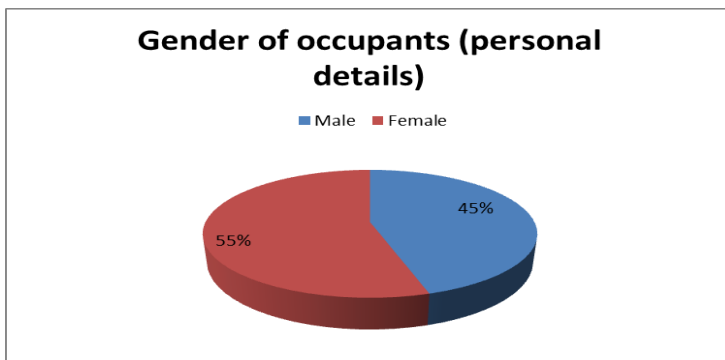


Fig. 5.2: Represent the statistics of the gender of occupants owning the houses.

### 5.2.2.3 Race of the beneficiary

The majority of occupants in low-cost houses are considered to be blacks and coloureds in three areas. As anticipated these two were the most victimised by the previous government and the figure 5.3 below show clear that coloureds are lagging behind with 10% from blacks dominated the ownerships of the houses with 90%. This shows that the previous stringent access to adequate houses does not exist in the current regiment.

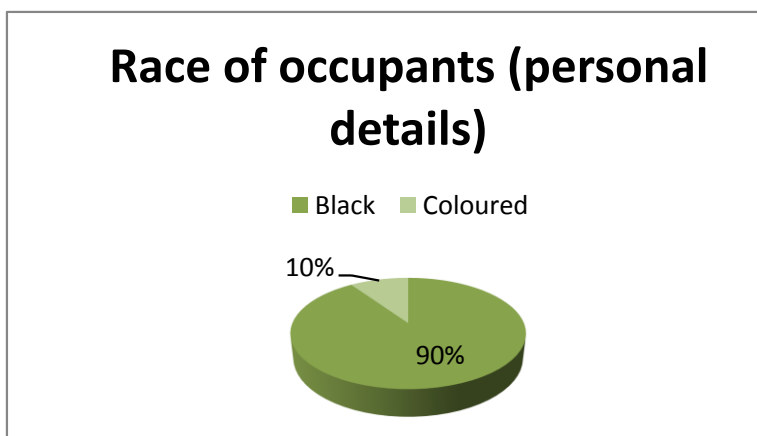


Fig. 5.3: Represent the statistics of the race of occupant owning the house.

### 5.2.2.4 Number of occupants

This is focussing on the capacity of the house to accommodate people.

In contrast to the design of the houses and the number of occupants staying in these houses there is a great distinction and this is hazardous. In all three locations it is evident that the houses accommodate more people than expected and this threatens their health and safety. As shown in figure 5.4 below the majority of houses accommodated the maximum number of people between 3 to 5 occupants with 58% followed by 5 to 10 occupants with 21%, two occupants with 20% and one occupant at 1%.

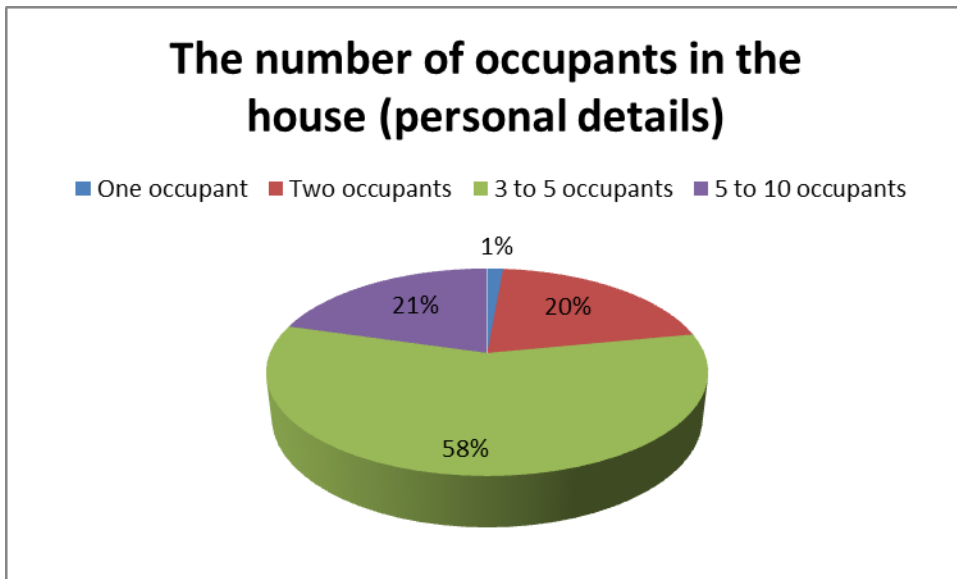


Fig. 5.4: Represent the statistics of the number of occupants in the house.

#### 5.2.2.5 Employment status of the beneficiary

Focussing on the statutory requirements of the low-cost houses set by government on the white paper as one of the statutory requirements for ownership of low-cost housing is R3500.00 per household. However, in the three residential areas employment is low resulting in poor educational attainment. The majority of beneficiaries work as labours in their working environments. The figure 5.5 below shows that 63% of beneficiaries are working and 37% of beneficiaries are not working, either they depend on grant or government pension for basic needs.

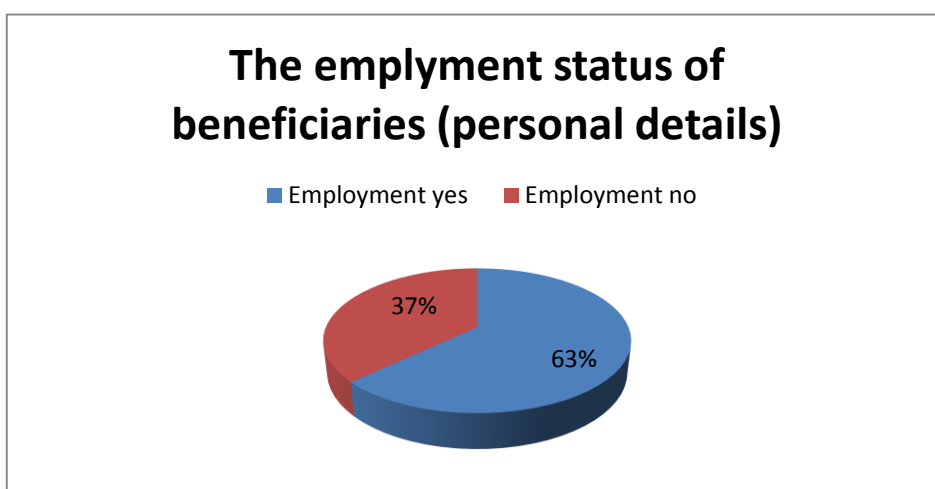


Fig. 5.5: Represent the statistics of the employment status of the beneficiary.

### 5.2.2.6 Monthly income of the beneficiary

This is focussing on the abilities of the occupants towards maintaining their homes through monetary strength. The majority of occupants indicated R1000.00 to R3000.00 as their monthly income. This shows that they are depending on a social grant which is either a pension for older people or child grant. Others they work as labours and they earn little at their work places. This alone is another problem when it comes to maintaining the houses, as this is below the required monthly household income requirement. The figure 5.6 below shows the beneficiaries earning between R1000.00 to R3000.00 with 73%, and between R3000.00 to R7000.00 with 19% and earning R1000.00 with 8%.

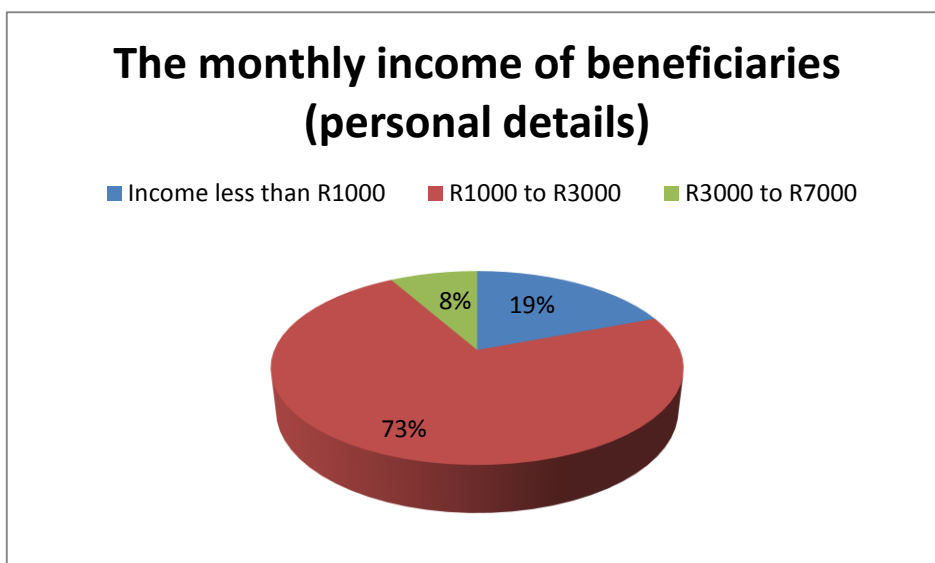


Fig. 5.6: Represent the statistics of the monthly income of the beneficiary.

### 5.2.2.7 Duration of occupancy

This is focussing on measuring the age of the house and the capacity of the house to accommodate people during this period. The occupants in all three areas have been staying in their houses since they were handed over to them. However, the percentages will differ as some houses were built ten years earlier to others, some five years earlier and others recently through continuous development. This is shown in figure 5.7 below as the duration of occupancy between 4 to 5 years take the lead with 46.6% followed by the duration of occupancy between 1 to 3 years with 32.8% and lastly duration of occupancy between 5 to 10 years with 20.5%.

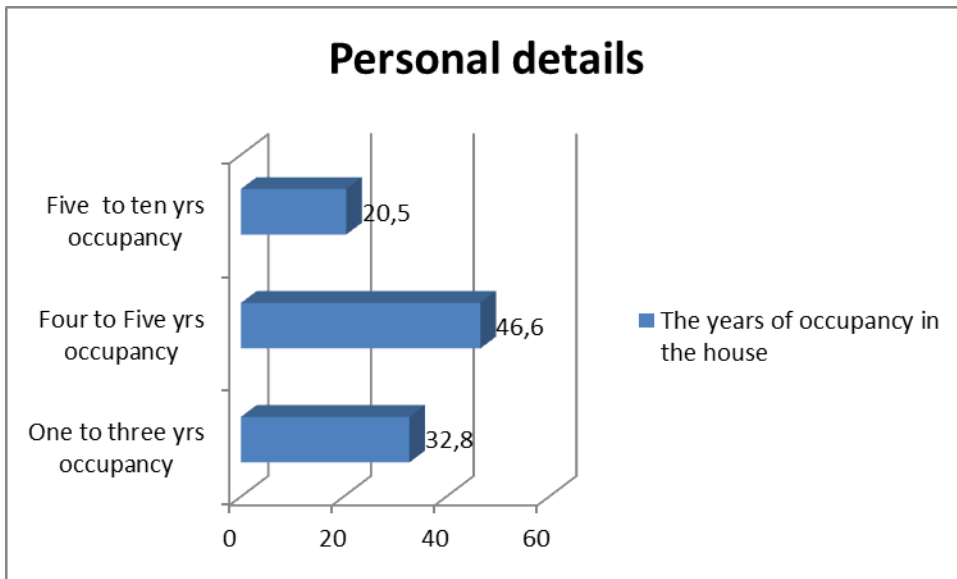


Fig. 5.7: Represent the statistics of the years of occupancy in the house.

#### 5.2.2.8 House age

This is focussing on measuring the durability of the house and structural strength of the house. The houses are ten years all less than three years. According to national home builders registration council (NHBRC) regulations the contractor is responsible for any defects arises within a period of 5 years of contract being handed over to the client and beneficiaries. The beneficiaries with the assistance of local authority can challenge that the municipality (client) recall the contractor to rectify the defects in the houses for as long as it is within five year guarantee period. The majority of houses as shown on figure 5.8 above are greater than five years but less than 10 years old. The figure 5.8 shows that 74% are the houses greater five years old but less than 10 years old and 26% are the houses less than five years old.

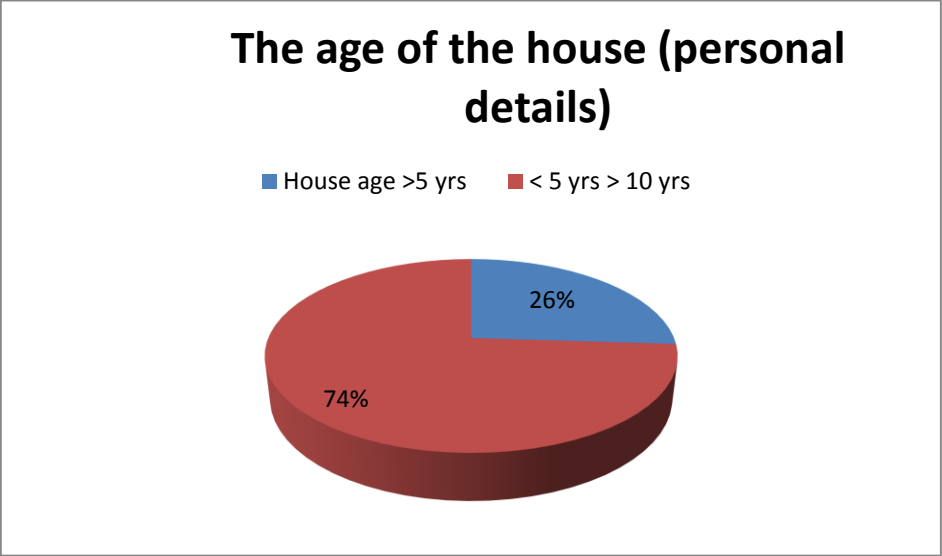


Fig. 5.8: Represent the statistics of the age of the house.

**5.2.2.9** The importance of owing the house

This is focusing on reducing the premature sale of the houses as the beneficiaries sell their houses due to poor resultant quality in their houses and the fact that the houses are far from infrastructural services such as public transport, hospitals and shopping centers. However, in this research study it was discovered that 86% of beneficiaries felt that it is very important to own the house with 14% of beneficiaries felt is fairly important to own the house as shown in figure 5.9 below. This was assumed that beneficiaries will not sell their houses.

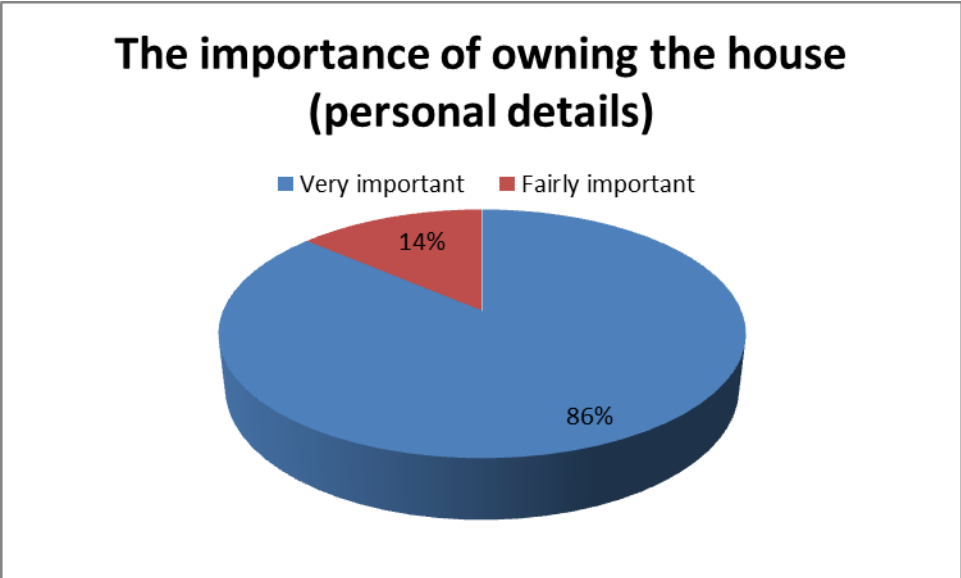


Fig. 5.9: Represent the statistics on the importance of owning the house by beneficiary.

### 5.2.3 SECTION B: Details of the house

In 2013 Human Settlement Research Committee revealed the huge backlog in housing and anticipated a rise by the year 2020 in Cape Town. The pressure inherited from the backlog puts government departments under pressure to work under abnormal conditions to deliver to communities while the budget remains tight. Furthermore, this pressure is directly transferred to designers and contractors as government is the client and contractor and designer depending to government financially. Consequently the pressure to tackle the backlog forced government to use the repetitive design model not far from the design used by the previous government, which is somehow the reason for the on-going quality concerns in the resultant product constructed.

#### 5.2.3.1 The location of the houses

The location where the houses have been built is another factor causing beneficiaries to sell their houses. The government of the Republic of South Africa in 1994 developed a strategy to address homelessness, by building the RDP for the poor, the houses were initially planned to be sustainable communities where the building of houses went hand in glove with the construction of community facilities such as schools, hospitals, recreation centres and economic development.

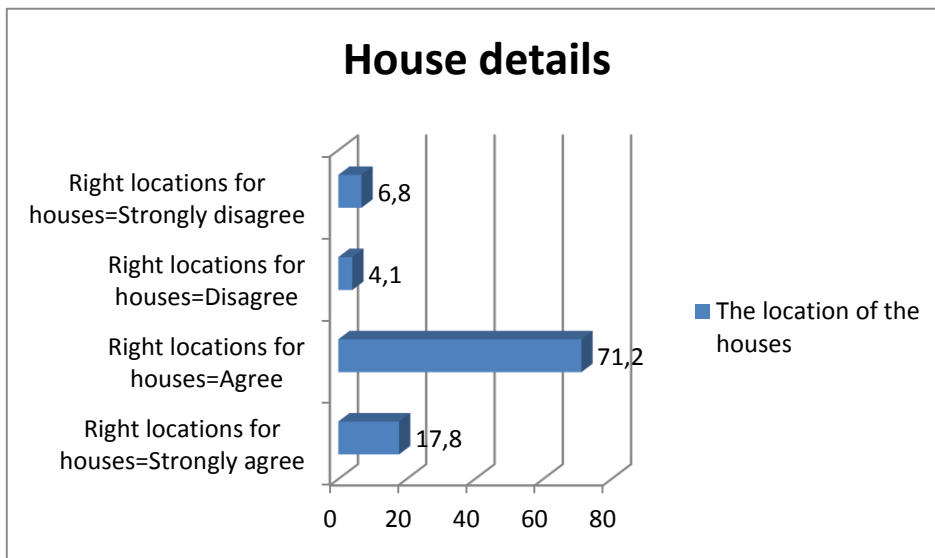


Fig. 5.10: Represent the statistics on the view of beneficiaries on the location of the houses

Apparently 71% of responses shown in figure 5.10 analysed from 73% responses retrieved from the randomly selected occupants for questionnaires agreed the location government selected to allocate people is right, 18% strongly agreed, 7% strongly disagree and 4%

disagree with the location. This was also the promise that beneficiaries will not sell the houses.

### 5.2.3.2 The number of rooms in the house

The number of rooms in government houses is usually two bedrooms, open plan kitchen and bathroom so these are regarded as three rooms by beneficiaries. This is also determined by the size of the house which is 40m<sup>2</sup>. With the number of rooms' majority of responses showed in figure 5.11 below with 49% highlighted three rooms, which is: two bedrooms and the open plan kitchen did not include the bathroom. 26% of responses highlighted four rooms, which is: two bedrooms, open plan kitchen and bathroom and 25% of responses highlighted two rooms, which is: one bedroom and open plan kitchen but are bathrooms which they did not include. This is assumed to have had influence on wellness of the occupants as in fig. 5.11 highlights how overcrowded these houses are in terms of the number of occupants residing in these houses.

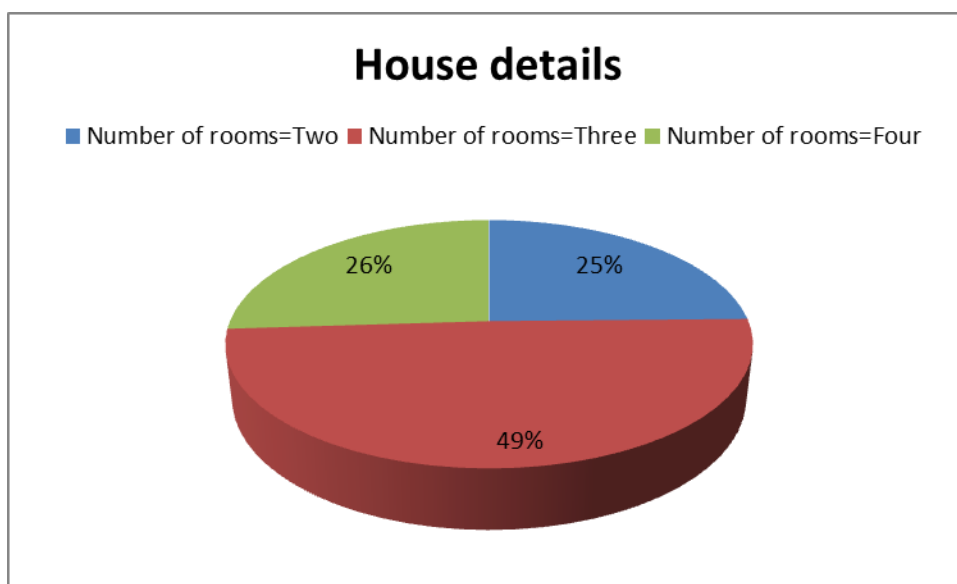


Fig. 5.11: Represent the statistics of the number of rooms in the house

### 5.2.3.3 The number of doors of the house (internal and external)

The houses depending on the type of the soil they been constructed on and the underground arising water they become humid and the humidity causes the paint to chip and plaster to crack. This can result in respiratory problems. For exchange of gases in around the houses, figure 5.12 below shows 40% of responses stated four doors; 30% responses stated three doors; 18% stated five doors and 12% stated that their houses have two doors. The houses have one external door; two for bedrooms and one for the bathroom. This is a concern not only for the exchange of gases but for emergency exit in-case of fire burst.

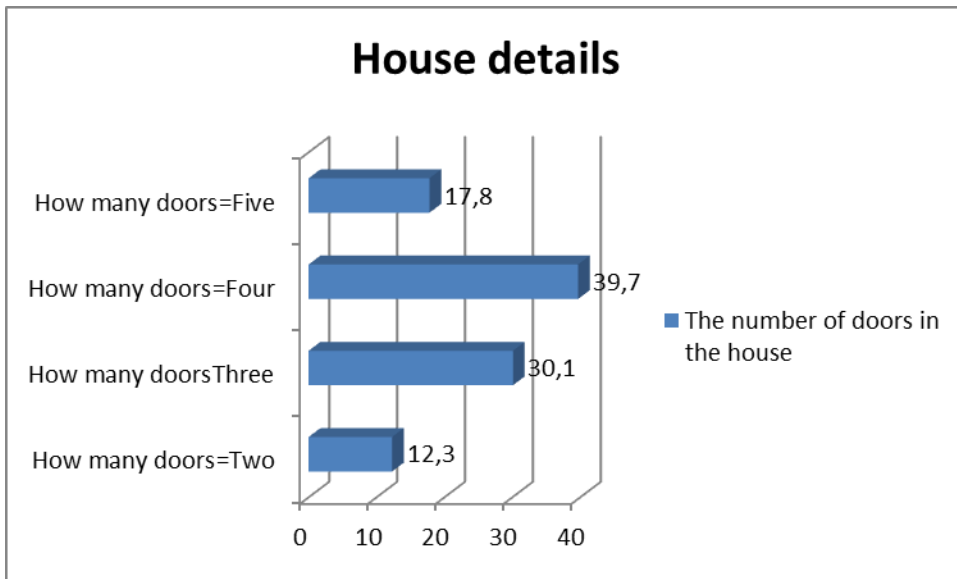


Fig. 5.12: Represent the statistics of the number of doors of the house.

#### 5.2.3.4 The number of windows of the house

Windows plays an important role in the exchange of gases as for the doors, figure 5.13 below shows that the majority of beneficiaries with 32% indicated four windows in their houses, which is: one each bedroom, one in bathroom and one in the open plan kitchen. 29% of beneficiaries indicated five windows; here there is an addition one window in the open plan kitchen. 21% of beneficiaries indicated six windows with one bedroom with two windows. 19% of beneficiaries indicated three windows, in this case one bedroom does not have window.

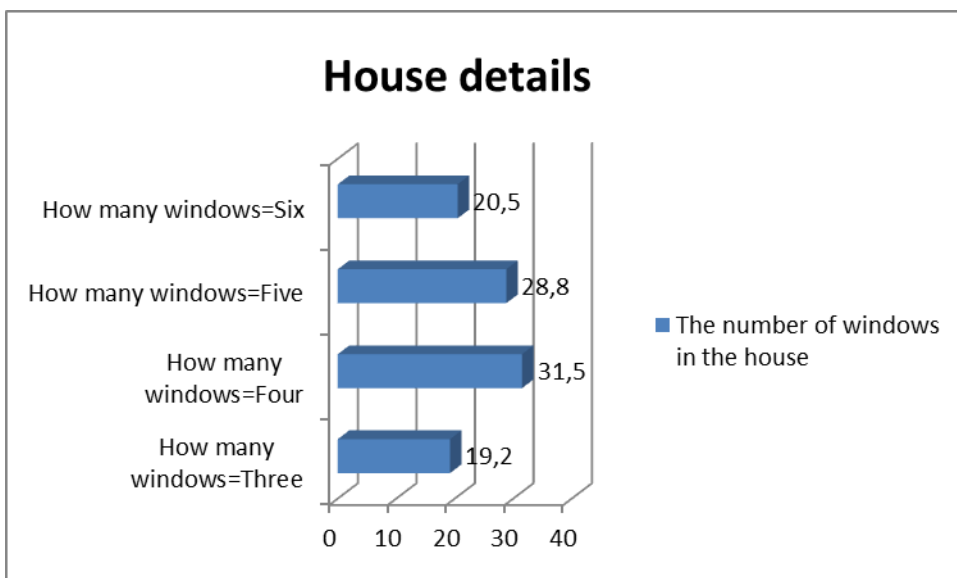


Fig. 5.13: Represent the statistics of the number of windows of the house.

### 5.2.3.5 The number of air-vents of the houses

The air-vents as the name suggest, they are constructed for the primarily exchange of gases inside the house. The figure 5.14 below shows that the majority of beneficiaries with 37% according to the responses retrieved highlighted there are no air-vents. This raise concerns about the respiratory problems on beneficiaries health. 25% of responses men indicated four air-vents, 19% of responses indicated two air-vents, 12% of responses highlighted six air-vents, 4% of responses indicated five air-vents and 3% highlighted three air-vents in their houses. The poor ventilation contributed to the reason for high humidity displayed in these houses. This resulted in humid walls as well as chipping of paint as the houses are bagged inside instead of plastering.

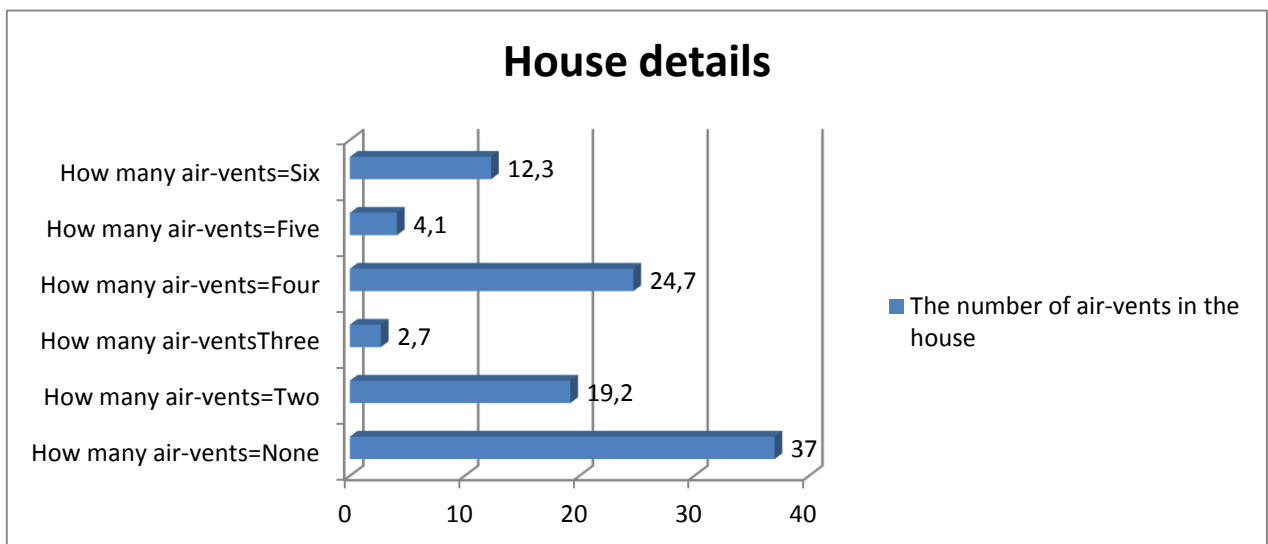


Fig. 5.14: Represent the statistics of the number of air-vents of the house.

The statistics on figures 5.10 to 5.14 shows that the houses constructed within four areas as shown were designed similarly. These similarities includes: the size of the house; number of rooms; windows; doors; bagged and plastered walls and some with air-vents. However, there were some differences in these areas. In Joe Slovo in Langa and Khayelitsha designs included gysers while Delft and Zone 26 in Langa were without geysers. Another difference noted was on roof structures as others were steel while others were timber. Roof covering as well was another concern of distinction within these areas. Most of these similarities in houses were assumed to have aggravated the beneficiary's health.

### 5.2.3.6 House details continues

The following house details as indicated is the continuation of the house details, shows some of the aspects that has an influence on the structural stability or structural instability of the house if not assembled, constructed or applied correctly during actual construction of the house. As mentioned above in 5.2.3.5 that the houses were designed similarly, these similarities in the figure 5.15 below included: ceiling, roof trusses, roof covering, plastering and backwashing, electricity, hot water, basic services, clean water and size of the house.

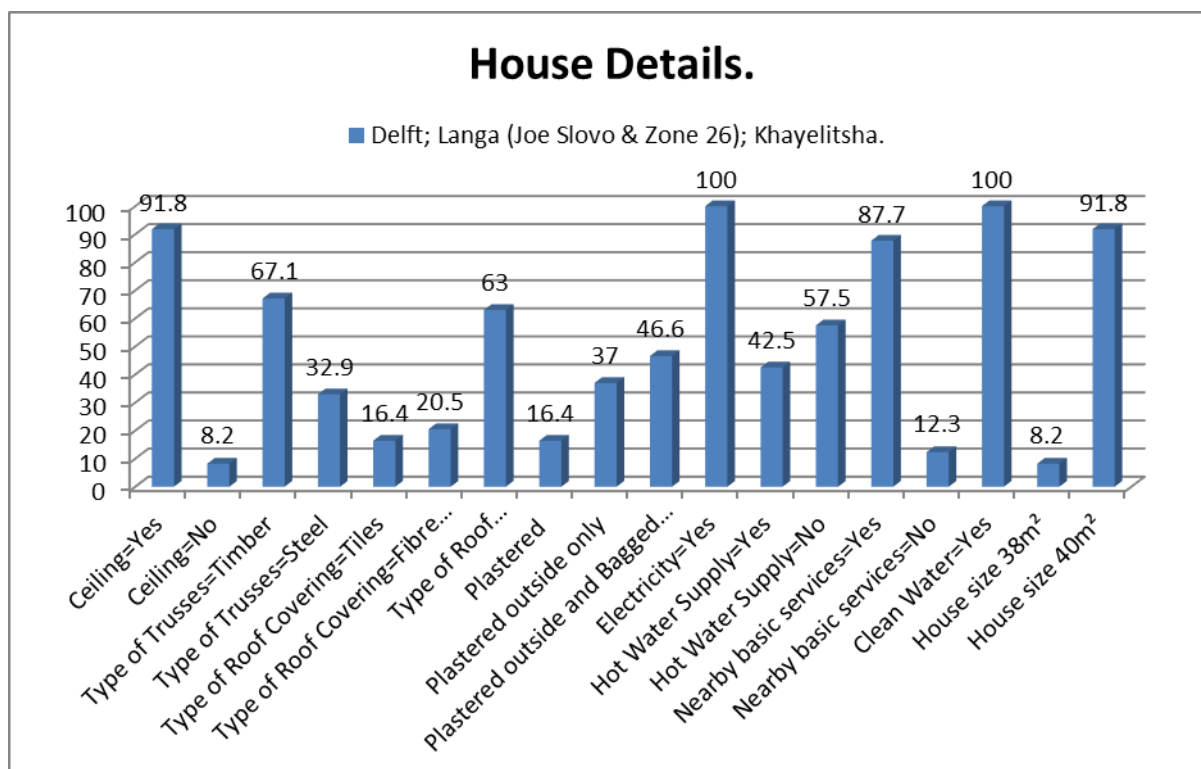


Fig 5.15: Represent the statistics on the house details.

The statistics on fig. 5.15 shows that 92% of beneficiaries confirmed their houses to have ceiling, while 8% responses said the houses do not have ceiling. 67% responses confirmed their houses have timber trusses, while 33% responses confirmed steel as their trusses. 16% responses confirmed their houses to have tiles as roof-covering, while 21% responses said roof-covering is fibre cement and 63% responses confirmed corrugated as roof-covering. When looking to plaster, 16% responses confirmed their houses as plastered internally and externally, while 37% responses said their houses are plastered externally only and 47% responses confirmed their houses as plastered externally and bagged internally. In all three areas beneficiaries (100%) confirmed their houses to have electricity. However, regarding hot water supply 43% responses confirmed to have hot water supply

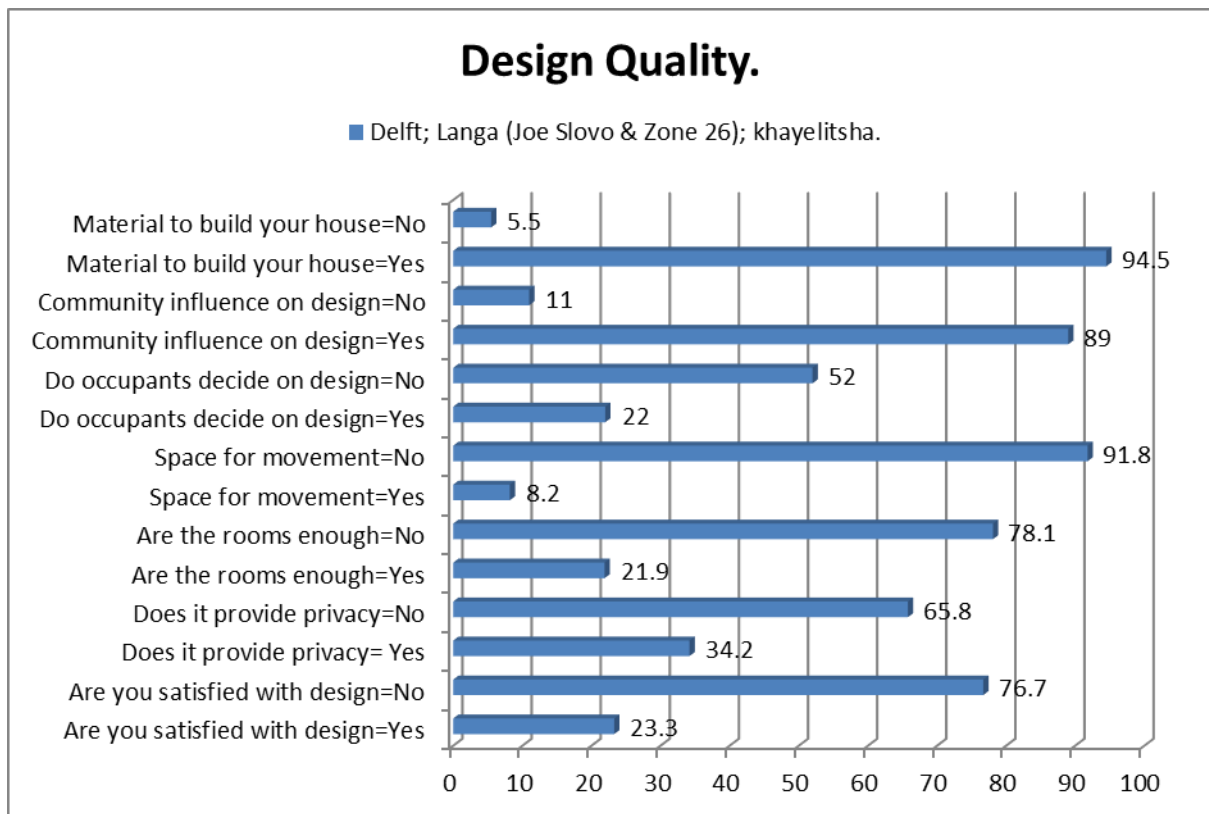
and 58% responses said their houses do not have hot water supply. The basic services are the most important aspect to look at when accommodating people. 88% responses confirmed their houses to be proximity to basic services, while 12% responses said their houses are far from basic services. The three areas (100%) were confirmed to have clean water. The size of the low-cost houses is uniform in the whole country; from figure 5.15 above 92% responses confirmed the size of the houses to be 40m<sup>2</sup> while 8% responses confirmed the size of the houses to be 38m<sup>2</sup>. However, there were some differences in these areas. In Joe Slovo in Langa and Khayelitsha designs included geysers while Delft and Zone 26 in Langa were without geysers. Another difference noted was on roof structures as others were steel while others were timber. Roof covering as well was another concern of distinction within these areas.

#### **5.2.4 SECTION C: Design Quality**

The design quality of the houses seem to be the repetitive design, this was assumed to be another aspect attributed to poor design quality. From figure 5.16 below, it is evident that majority of occupants felt that it would have improved the design and quality of their homes should they have been given a right to choose design type and materials to construct their houses. Within the three locations, occupants complained about inadequate space and move-ability inside the houses.

Wentzel (2010) suggested that this was not due to poor design processes. However, this was contradicted when saying that it is “ideally caused by problems which government is faced with, the housing backlog which gives rise to time and cost constraints and which puts a lot of strain on the designing teams and the design processes ultimately generating poor designs”. Therefore, certainly one can draw the conclusion that design processes have a major influence on the poor resultant quality of houses.

These designs are somehow the repetitive of the previous government and it raises concerns about the stability of the current government. It is not surprising therefore that from the three areas majority of occupants were not satisfied with the designs.



**Fig 5.16: Represent the statistics on the design quality.**

When analysing the data retrieved on design quality the results produced by SPSS in figure 5.16 above shows a great dissatisfaction by beneficiaries on the design quality. 95% responses indicated that it would be a good idea if government give them material to build their houses, while 6% responses confirmed they are fine with government building their houses. 89% responses felt that it would be a good idea if they have a say on design type, while 11% responses confirmed as it would not be a good idea to have a say on design type. 52% responses said occupants do not decide on design type, while 22% responses said occupants decide on design type. When asked about space for movement 92% responses complained about space and 8% responses said the space is fine. 78% responses complained about the number of rooms and 22% responses confirmed to have no problem with the number of rooms. 34% responses complained about privacy and 77% responses confirmed to have privacy. 77% responses showed dissatisfaction with the design and 23% responses confirmed to be satisfied with design.

Below table 5.2 shows the areas of the houses where occupants felt they would have improved the designs of the houses should they have been given a say to design type.

NO	If you were to improve the design, where would it be	Frequency	Per cent	Valid Per cent	Cumulative Per cent
1	Include air-vents, increase room size, separate kitchen from sitting room and provide with hot water	17	23.3	23.3	23.3
2	Increase room sizes, number of rooms and provide with hot water	32	43.8	43.8	67.1
3	Separate houses and yards	6	8.2	8.2	75.3
4	Steps inside are too steep and hazardous	2	2.7	2.7	78.1
5	Make concrete steps inside	1	1.4	1.4	79.5
6	Separate kitchen from sitting room and increase sizes of rooms	3	4.1	4.1	83.6
7	Provide with hot water	1	1.4	1.4	84.9
8	Increase room sizes and number of rooms	11	15.1	15.1	100.0
9	<b>Total</b>	73	100.0	100.0	

Table 5.2: **Represent the statistics of the improved designs.**

### **5.2.5 SECTION D: Workmanship Quality**

Figure 5.17 below indicates that inadequacy of skill in workmanship resulted in many flaws. It is evident in various parts of the houses; cracks in walls, leakages, doors and window fittings, cracking or chipping painting and humid walls. All these problems trigger moderate to extensive concerns when it comes to the quality of workmanship being employed in the delivery of low-cost housing. However, the poor quality of workmanship experienced is also influenced by the pressures passed down from government due to pressure applied by community members, time constraints and cost factors which directly affected the effectiveness of workmanship quality. The figure 5.17 below provides brief reasons for which occupants disapproved the quality of workmanship used in low-cost houses construction.



Fig 5.17: Represent the statistics of the workmanship quality.

From figure 5.17 above 56% responses indicated the rain water disposals assembled incorrectly, while 44% responses indicated the rain water disposals assembled correctly. 10% responses confirmed no water penetration into the walls, while 90% responses confirmed water penetration into walls causing humid walls. 11% responses indicated no cracking and chipping of paint on walls and 89% responses confirmed to have cracking and chipping paint on walls. 75% responses confirmed no dampness on floors, while 25% responses confirmed their houses to have damp floors. 67% responses said the roofs structures are stable and 33% responses confirmed the roof structure as unstable. 70% responses highlighted no problems with windows and door fittings, while 30% responses highlighted problems with windows and door fittings. 14% responses confirmed less heat

retention in summer and 86% responses confirmed too much heat retention in summer. 4% responses indicated the no loss of heat in winter and 96% responses confirmed the loss of heat in winter. 58% responses said the house does not have leakages and 43% responses indicated the house have leakages. 92% responses said their houses have no cracks on floor, while 8% responses confirmed the floors with cracks. 34% responses confirmed no cracks on walls and 66% responses complained about cracks on walls. 89% responses disprove the workmanship quality, while 11% responses approved the workmanship quality.

The table 5.3 below provide brief reasons for which occupants disproved the quality of the workmanship on low-cost house construction in all three areas (Delft, Khayelitsha and Langa).

NO	Provide a brief reason for your answer	Frequency	Per cent	Valid Per cent	Cumulative Per cent
1	Floor level lower than the curb in front allowing water to come inside	8	11.0	11.0	11.0
2	Rooms too small and cement sand mix ratio for plastering incorrect and wall humid	47	64.4	64.4	75.3
3	Cement sand mix ratio incorrect	3	4.1	4.1	79.5
4	Nothing to do with structural defect except the room sizes and numbers	8	11.0	11.0	90.4
5	Leakages, wet floors, doors stuck when wet and make lot of noise	7	9.6	9.6	100.0
6	<b>Total</b>	73	100.0	100.0	

**Table 5.3 Represent the statistics of the reasons behind disproving workmanship qualities.**

## 5.2.6 SECTION E: Ailments and Disabilities

The conditions of the house have the direct impact on the healthy lifestyle of those staying in the house, either positively or negatively. Therefore, from the data analysis on the house details, design quality and workmanship quality is imperative to consider investigating the impact caused by the resultant poor quality obtained through research questionnaires and analysed with the use of statistical package for social sciences (SPSS) to get the statistics presented on house details, design quality and workmanship quality displayed on 5.2.3; 5.2.4 and 5.2.5 respectively.

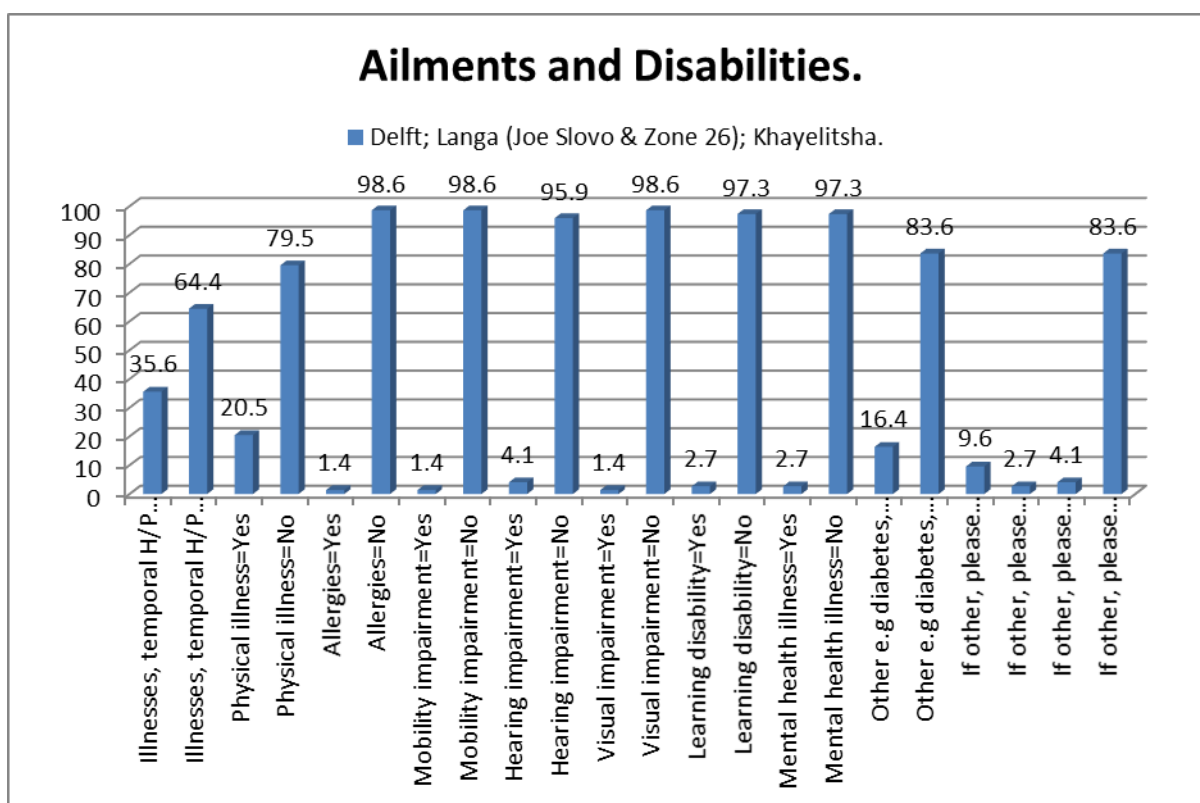
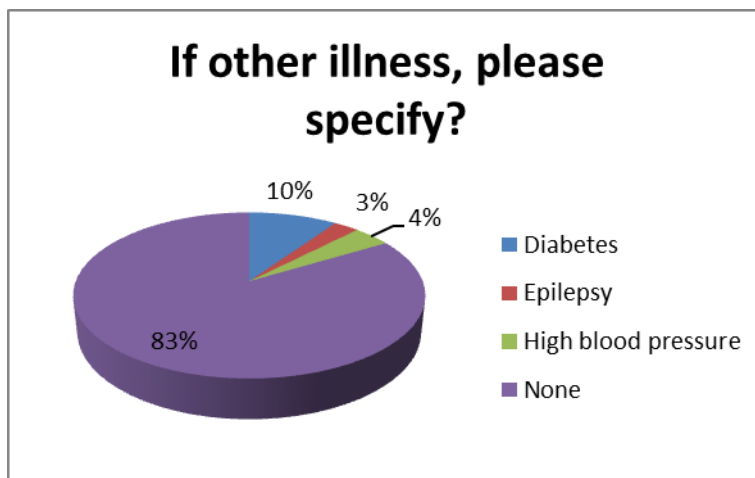


Figure 5.18: Represent the statistics of the ailments and disabilities.

Figure 5.18 indicates that 36% responses indicated there is member of the family with illnesses, temporal health problems or disabilities, while 64% responses said there is no member with these illnesses, temporal health problems or disabilities. 21% responses confirmed to have physical illness, while 81% responses confirmed no illness. 1% confirmed to have allergies, mobility impairment and visual impairment, while 99% responses confirmed to have no allergies, mobility impairment and visual impairment. 4% responses complained to have hearing impairment, while 96% responses confirmed to have no hearing impairment. 3% of responses indicated to have learning disability and mental health illness, while 97% of responses said they do not have learning disability and mental health illness.

16% of responses indicated diabetes and epilepsy as other illnesses, while 84% responses confirmed no other illnesses like diabetes and epilepsy. The figure 5.19 below shows if there are any of the members of beneficiaries with other illnesses or disabilities.



**Fig. 5.19: Represent statistics of other illnesses or disabilities**

Figure 5.19 above shows that 83% response to have no other illnesses, 10% responses to have diabetes, 4% responses to have high blood pressure and 3% responses to have epilepsy.

The ailments become more intensive during the winter months considering the results obtained concerning house details, design quality and workmanship qualities respectively which aggravate certain aspects which bring about these ailments or illnesses. The analysis above clearly confirms the persistence of poor resultant quality in low-cost houses and responds to the research question stated in the first chapter.

### **5.2.7 SECTION F: Government involvement on low-cost housing**

The African National Congress (1994) initiated Reconstruction and Development Programme (RDP) and stated that the provision of adequate, affordable social housing and services was a key component of the RDP. Apart from being seen as a national priority in its own right, future housing strategy has a direct bearing on the success of all five key programmes of the RDP and one of these was meeting basic needs. The Reconstruction and Development Programme (RDP) planned to provide a service to improve housing conditions of the underprivileged members of society. This aims at building adequate social houses for the poor; hence the house is not just a structure with a roof on top but also

performs significant role in the lives of beneficiaries such as privacy, security and most importantly health (Department of Public Works, 1999).

### 5.2.7.1 Priority for houses

The City of Cape Town on the other side is working towards the goal of delivering a minimum of a 40m<sup>2</sup> RDP (a subsidized house built between 1994 and pre-September 2004) or Breaking New Grounds (BNG) house (a house built according to the BNG policy in the post September 2004 period) to waiting list families, the low-income earners between R0 - R 3 500 per month (with the subsidy amount provided by the National Housing Department). Recipients must be on the City's waiting list and meet the requirements.

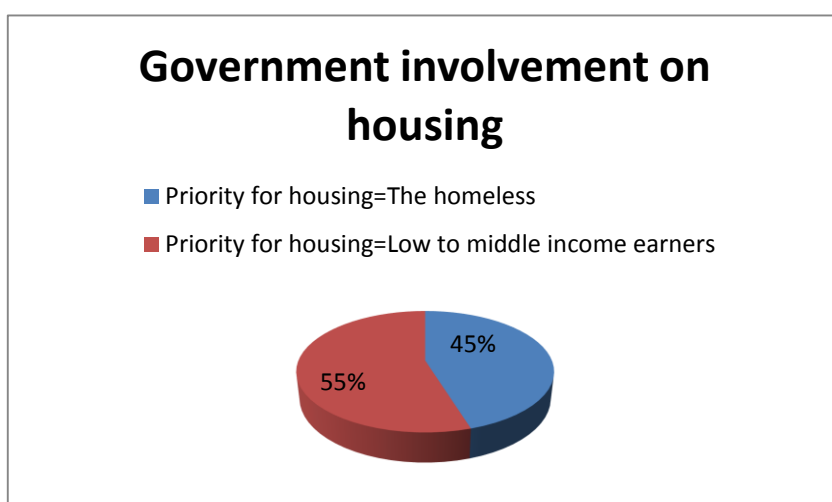
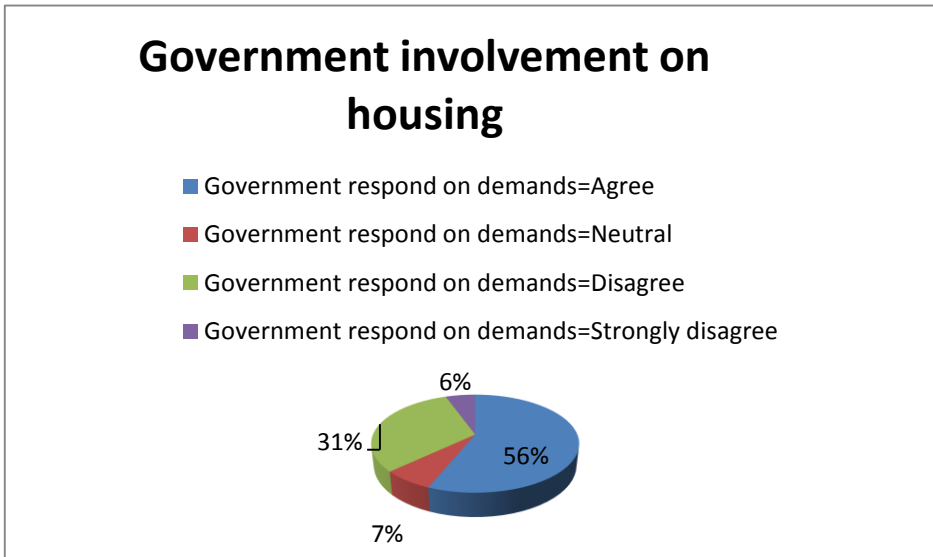


Fig. 5.20: Represent the statistics on priority for housing.

Figure 5.20 above shows 45% of responses said government should prioritize the homeless for low-cost houses and 55% of responses said government should prioritize low to middle income earners for low-cost houses, which is the government initial objective. The majority of responses felt that government gives priority for housing from low to middle income earners.

### 5.2.7.2 Government response on community demands

As housing is one of the Maslow needs, from time to time communities gather and demand for better living conditions from government. This includes the provision of clean water, power supply, better roads, schools, hospitals and shopping centers. There are a numerous projects initiated by government in an effort to respond to communities demands on housing. The figure below will show how government is responding to the demands of people.

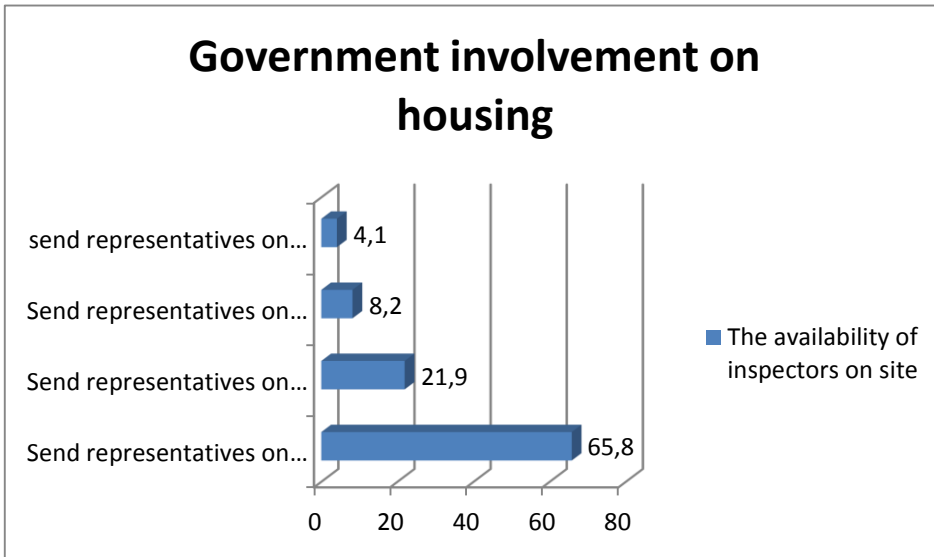


**Fig. 5.21: Represent the statistics of responses to demands of beneficiaries.**

Figure 5.21 shows that majority with 56% of responses agreed that government responds to demands raised by community members regarding the provision of adequate houses. While 30% of responses disagreed that government responds to community members concerning the provision of adequate houses. 7% of responses were either agreeing or disagreeing (neutral) and 6% of responses have strongly disagree that government responds to community members regarding the provision of adequate housing.

#### **5.2.7.3 Availability of inspectors on site**

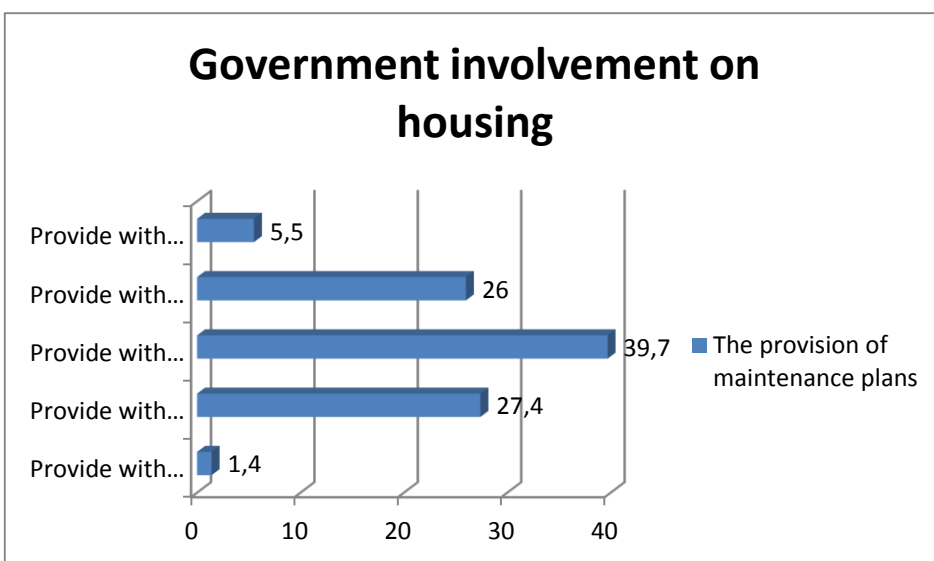
Government is not only expected to give tenders away to contractors to continue with the actual construction process but also expected to monitor the progress of the project. This help to identify non-compliances at the early stages and request contractor to rectify those non-compliances. At the end of the project the quality assurance will be achieved and good resultant quality in low-cost housing will be attained. Usually, National Home Builders Registration Council (NHBRC) have an inspector on site ensuring good quality, the client have an inspector on site ensuring that the project progresses and that the quality is attained, the consultant (engineers) have a clerk of works (cow) responsible for the structural strength and stability of the house.



**Fig. 5.22: Represent the statistics on the availability of inspectors on site**

When it comes to the availability of inspectors on site during construction of low-cost houses fig. 5.22 above shows that 4% of responses strongly disagree that government sends inspectors on site. While 8% of responses disagree that government sends inspectors on site. 22% of responses is either agreeing or disagreeing (neutral) about government sending inspectors on site during construction of low-cost houses. 66% of responses agree that government sends inspectors on site during the construction of low-cost houses for inspections to ensure compliance is achieved.

#### 5.2.7.4 The provision of maintenance plans



**Fig. 5.23: Represent the statistics on the provision of maintenance plans**

When it comes to the provision of maintenance plans by government to beneficiaries on the official handover of houses figure 5.23 above shows that 6% of responses strongly disagree that government gives beneficiaries maintenance plans. 26% of responses disagree with the provision of maintenance plans. 40% of responses are either agreeing or disagreeing. 27% responses agree that government provide beneficiaries with maintenance plans on the handover of the houses. While 1% responses strongly agree that government provide beneficiaries with maintenance plans.

### 5.2.7.5 The fight over homelessness

Government seems to be fighting homelessness throughout the country. There are a lot of developments in the entire country. The only question would be, are the houses delivered of good quality, proximity to infrastructural services, and provides a healthy lifestyle.

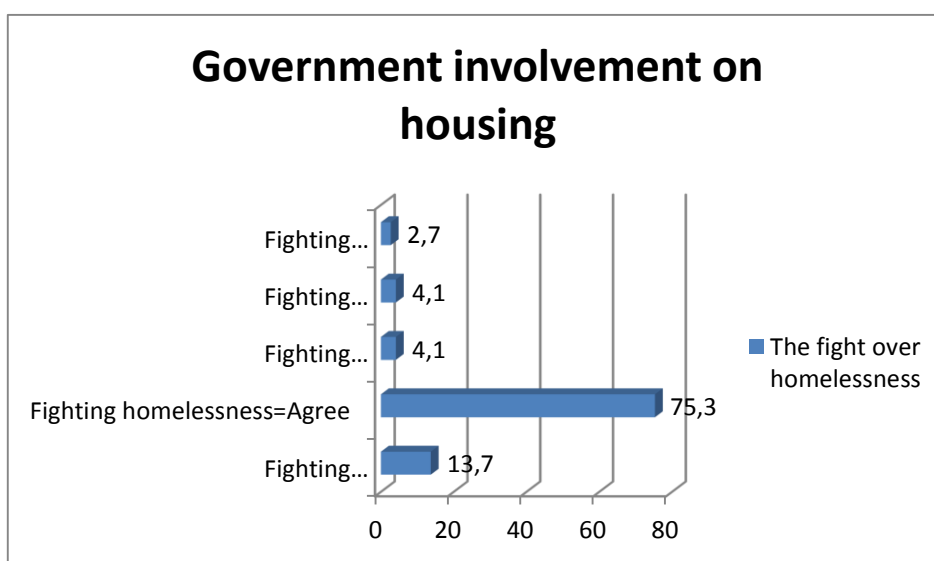


Fig. 5.24: Represent the statistics on the fight over homelessness by government

When it comes to the government's effort to fight homelessness figure 5.24 shows that 3% of responses strongly disagree that government fights homelessness. 4% responses disagree that government fights homelessness. 4% responses are either agreeing or disagreeing (neutral) that government fights homelessness. The majority of responses with 75% agree that government fights homelessness by providing communities with adequate houses. 14% responses strongly agree that government fights homelessness.

### 5.3 Structured Interviews (qualitative)

These interview responses are subjective due to the Building Inspector, Contractor and designer wishing to remain anonymous. Refer to Appendix B, C & D.

#### 5.3.1 Building Inspector (respondent 1)

*Based on the interview conducted with the Building Inspectors, they defined “quality” as the extent of conformance to the norms and standards of use as defined in the literature review by (McLaughlin, 1995:32). “Quality assurance” is what the client of construction does to determine that contractor’s quality control system is effective adequately and that the product therefore will meet the client’s needs. Then inspectors said “quality assurance systems” will be the set of systems in place to ensure quality is attained. The Building Inspector from the City of Cape Town local government/or municipality seem to understand the quality assurance systems as the City of Cape Town adopted ISO 9001:2008 and slowly introducing it to all departments.*

*The inspector said the strategy used in the organization is assisting in the delivery of low-cost housing in Cape Town. The housing backlog directly affects the availability of land and hence the tension amongst communities. In additionally, the inspector said that National Government has set up unrealistic time-frames to eliminate or better the backlog at present. The building inspector concurs with a contractor that National Home Builders Registration Council (NHBRC) to develop or enhance its training programmes to help elevate community member’s skills in construction of their communities. This will help cancel the comparison between the skilled labours and resultant quality of the product being produced.*

*The only solution would be increasing the numbers of growing companies and support the companies financially. This will reduce the stress received at government level through fast community developments. The building Inspector also highlighted the importance of better procurement measures, appropriate benchmarking measures as well as more skilled labour in order to bring about a quality product. Lastly, the inspector suggested that their organizations need to intensify training on quality assurance systems to all employees working on low-cost housing construction.*

### **5.3.2 Building Inspector (respondent 2)**

*Based on the interview conducted with the Building Inspectors, they defined “quality” as the extent of conformance to the norms and standards of use as defined in the literature review by (McLaughlin, 1995:32). “Quality assurance” is what the client of construction does to determine that contractor’s quality control system is effective adequately and that the product therefore will meet the client’s needs. Then inspectors said “quality assurance systems” will be the set of systems in place to ensure quality is attained. However, it is sad but true that there is lack of knowledge of quality assurance systems from the Human Settlements building inspector. Hence there is a lack of adequate/ or appropriate inspection services on sites.*

*According to responses received from the inspector from the Human Settlements shows that they are still lagging behind on quality assurance systems. However, they measure their performance to that of other competitors, said the inspector. This is linked to benchmarking. Therefore, the South African low-cost housing problem has not been adequately resolved if there are certain individuals in key positions with little knowledge of quality assurance systems. Inspector said the strategy used in the organization is assisting in the delivery of low-cost housing in Cape Town. The housing backlog directly affects the availability of land and hence the tension amongst communities.*

*Furthermore, the inspector said that National Government has set up unrealistic time-frames to eliminate or better the backlog at present. The building inspector concurs with a contractor that National Home Builders Registration Council (NHBRC) to develop or enhance its training programmes to help elevate community member’s skills in construction of their communities. This will help cancel the comparison between the skilled labours and resultant quality of the product being produced. The only solution would be increasing the numbers of growing companies and support the companies financially. This will reduce the stress received at government level through fast community developments. The building Inspector also highlighted the importance of better procurement measures, appropriate benchmarking measures as well as more skilled labour in order to bring about a quality product. Lastly, the inspector suggested that their organizations need to intensify training on quality assurance systems to all employees working on low-cost housing construction.*

### **5.3.3 Contractor (respondent 3)**

*When asked about quality, quality assurance and quality assurance systems, the contractor said there is a correlation between these words. To the contractor quality means “fit for use” and quality assurance the means of achieving the quality. The quality assurance system is the mechanism to ensure quality assurance is attained in order to achieve a good quality. It is always anticipated that workmanship in any construction project would be identified as prime suspects when it comes to poor resultant quality concerns. When analysing the interviews conducted with the Contractor, it was made clear that workmanship quality in low-cost housing is not up to standard and that it is dropping significantly, considering the unrealistic time-frames and tight budgets allocated by government as well as procurement systems being a major threat.*

*One way or the other for workmanship quality to improve the above mentioned threats need to be attended to, especially procurement systems which play a major role when it comes to factors such as time, cost and more so quality. Pressures exerted by government such as time constraints and inadequate financial support also have a major influence towards poor workmanship in the construction process. Furthermore, the Contractor stresses the use of benchmarking mechanisms as a critical tool in achieving good workmanship quality and more so quality assurance in the low-cost housing fraternity.*

*The Contractor also mentioned that the low-cost housing projections are promising in South Africa. However, stating that the constant monitoring and support from government representatives is required, as well as developing communities gaining the trust and full confidence in one another to make these developments a success. The Contractor when asked about quality assurance system also seems to be familiar with the term. The Contractor mentioned that they have been comparing their work output/or production and quality of their work to other competitors. The contractor said the strategy of comparison is working for their company, as it motivates workers to do more to beat the competitors. The Contractor also put emphasis on National Home Builders Registration Council (NHBRC) to develop or enhance its training programmes to help elevate community member’s skills in construction of their communities. Lastly, the contractor also suggested that the introduction and training of people working on low-cost housing about quality assurance systems would be of great importance.*

#### **5.3.4 Designer (respondent 4)**

*According to the Designer the words “quality” and “quality assurance” are closely correlated to each other. It is stated that the word “quality” is understood very differently by each individual based on their own perception. As for the Designer the word “quality”, when looking at the low-cost housing field means a house which is fit for its purpose. However, to the Designer the words “quality assurance” refers to a policy or promise put in place to achieve a quality product. The Designer when asked about quality assurance systems responded as familiar with the quality assurance systems. The designer described quality assurance systems as the instrument to ensure quality assurance is attained. The Designer further mentioned that there are certain aspects which threaten the design of low-cost housing within South Africa, for example, government’s incorrect criteria used to deploy individuals in relevant offices hence poor decision-making as to what challenges facing low-cost housing should be addressed to the entire South African community. The designer said he has been introduced to benchmarking. The designer was confident that the system used in their company assist the company as they always measure their performance to that of other companies. The other aspect is the current backlog of housing in the communities which put too much pressure on government to deliver more balancing/or matching up with the ever increasing populace within specified time. This is automatically impacts the design and development of the low-cost housing system due to load and amount of work at hand.*

*According to the Designer the housing backlog affects all provinces in the country but more over the Metro Cities and generally Western and Eastern Cape dramatically. The pressure experienced at a government level is directly exerted down to the designers who must develop certain model designs in a specified time period within a tight budget. The Designer made mention the influence of the minimum time periods and tight budgets allocated to low-cost housing that they can eventually give rise to a selection of inappropriate materials, approving a defective product and adamant clients (government) forcing their decisions on certain construction products resulting in the construction processes to fail.*

*Apparently another aspect attributing still today to the poor design is the repetitive design models which are being constantly employed, which is politically incorrect. In terms of low-cost housing delivery the administrative process is one of the major threats concerning low-cost housing design.*

*The procurement system employed on housing was identified as another predicament by the Designer, saying it affects design quality due to the fact that comprehensible design processes with their checks and balances are not in place. The Designer however suggested that the involvement of local skills should be prioritised during construction of low-cost houses to reduce costs concurrently minimizing procurement misfortunes. Lastly, the Designer suggests that it is imperative to use the appropriate benchmarking in order to achieve good design quality and through this he ensures that quality assurance will be achieved in low-cost housing for years to come. The designer thought the strategy would be to introduce quality assurance systems and develop training to all relevant employees.*

## **5.4 Discussion of findings**

From the data retrieved through questionnaires sent to beneficiaries regarding the structural performance of their houses and data analyzed with SPSS soft-wear (version 22), it was discovered that poor resultant quality are still persistent. This was retrieved from the quantitative questionnaires sent to beneficiaries concerning the structural performance of their houses under section A personal details, section B house details, section C design quality, section D workmanship quality, section E ailments and disabilities and section F government involvement. This is discussed in details below.

### **5.4.1 Personal details factors**

With the quantitative questionnaire survey conducted in all three areas name Delft, Langa and Khayelitsha in Cape Town it was discovered from fig. 5.1 and fig. 5.2 respectively that women are leading in owning houses (low-cost houses) with 55% between the ages of 40 to 50 years with 38% followed by the age group between 30 to 40 years with 37% unlike in previous surveys where it used to be males owning the houses. This indicated that there is significant change in trying to balance gender equity and even spread of houses to different age group and gender in the South African communities. The majority of these people in these areas are black people with 90% as shown in fig. 5.3. When looking in the ability to maintain their houses fig. 5.5 and 5.6 respectively shows employment and monthly incomes as a huge concern due to most occupants with 63% confirmed to be employed and only earning between R1000-R3000 per month with 73%. However, the monthly income does not qualify beneficiaries to the government low-cost houses but it is acceptable. Contrary, comparing to ever increasing cost of living this is alarming because beneficiaries will not be

able to meet up with maintenance servicing of their houses. Considering that maintenance does not start and end with a day to day cleaning. Living space is another huge concern due to quantities of people staying in houses which was range from 3-5 occupants per house at 57.5%.

#### **5.4.2 House details factors**

Initially the house size was said to be 42m<sup>2</sup> in the initial stages of the reconstruction and development programme (RDP) in 1994. However, it seems as if there was a revision to the size of the house hence it is 40m<sup>2</sup> now as shown in fig. 5.15 with 92% of responses confirmed. When considering the size of the houses 40m<sup>2</sup> with room spaces less than 2.9m x 2.8m this gives an indication that the quality of life within these homes is not as satisfactory as it should be and confirmed in fig. 5.16 that 92% responses highlighted space for movement not enough. When it comes to location, it is supposed to be close to infrastructural services like schools, hospitals and transport services. From fig. 5.10 shows that 70% responses agree to the right location for houses. The number of rooms seems to be insufficient as 49% response in fig. 5.11 shows. This shows that the people are overcrowded in these houses as shown in fig. 5.4 that 58% responses confirmed to have 3 to 5 occupants in the house.

#### **5.4.3 Design quality factors**

When looking at the details and design of these low-cost houses within the three areas, it is clearly noticeable that a design model used has many similarities across the three areas. This is another aspect attributing to poor design quality as in fig. 5.16 shows that 89% responses confirmed that beneficiaries felt that it would have improved design quality should they have been given a say in design type. 77% responses confirmed not satisfied with the design. 78% responses complained about number of rooms, while 92% responses complained about limited space for movement inside rooms. Lastly, 95% responses confirmed that beneficiaries felt it would be better if they were given materials to build their houses.

#### **5.4.4 Workmanship quality factors**

The findings showed that poor workmanship qualities were identified throughout the project. Many structural flaws were noticed, for example, cracks in walls, floors, unstable roof structures, chipping paints, incomplete plumbing, falling ceilings etc. The workmanship quality raised concerns when assessing the statistics presented in fig. 5.17. When looking at rain water disposal assembling 44% responses confirmed rain water disposal assembled

incorrect. 90% responses highlighted water penetration through walls causing humid walls and chipping paint as it shows that 89% responses confirmed paint is chipping. 86% responses confirmed too much heat retention in summer; with the statistics of poor ventilation this is suffocating the beneficiaries. From 5.17 it is shown that 96% responses confirmed heat losses during winter months. 66% responses highlighted that walls have cracks.

#### **5.4.5 Ailments and disabilities factors**

Concurrent to this, many ailments and disabilities were evident within the three communities which are either caused or enhanced by the poor quality homes in which they live. These ailments according to the statistics are more severe in the rainy winter months. This tends to suggest that poor cross-flow ventilation in the units intensifies the ailments. From fig. 5.18 it shows that 36% responses indicated there is member of the family with illnesses, temporal health problems or disabilities and 21% responses confirmed to have physical illness. When observing the situation regarding the illnesses, temporal health problems, these were linked to respiratory health problems. Whereas, fig. 5.19 shows that 10% responses highlighted diabetes as other illness faced by beneficiaries, 3% responses confirmed epilepsy and 4% response confirmed high blood pressure.

#### **5.4.6 Government involvement factors**

Government plays a fundamental role in providing adequate houses to South African communities and making sure quality is attained during the construction of low-cost houses. Figure 5.20 shows that 55% responses said government should prioritize low to middle income earners for low-cost house. Figure 5.21 shows that 56% responses agreed that government is making effort to respond to demands raised by communities regarding provision of adequate houses. Figure 5.22 shows that 66% responses said government sends inspectors on site for inspections during construction of low-cost houses. Figure 5.23 shows that 27% responses agreed that government provide beneficiaries with maintenance plans. Lastly, fig. 5.24 shows that 75% of responses agreed that government is fighting homelessness.

#### **5.4.7 Building inspector factors**

The inspector from the City of Cape Town confirm to know quality assurance systems, saying that the City have adopted the international organisation for standardisation (ISO) 9001 of 2008 and they been introducing ISO to all relevant departments. The inspector also confirmed that system is working for the delivery of low-cost houses. The only challenge

facing the Western Cape Government and Local government of Cape Town (City of Cape Town) is huge backlog, said the inspector. Adding to that the inspector said government has set unrealistic time-frames to eliminate the backlog. The only solution to a complete implementation of quality assurance systems is first: the training of inspectors to quality assurance systems; the involvement of management in the implementation of the systems.

The inspector from the Human Settlements concurred with the inspector from the City of Cape Town in everything except they are using benchmarking at Human Settlements as their quality assurance system and the inspector also confirmed that the system is working in the delivery of low-cost houses in Cape Town.

#### **5.4.8 Contractor factors**

The contractor said there is correlation between quality, quality assurance and quality assurance systems. Then the contractor describes what these words meant to him as the contractor as shown in the contractor responses above. However, the contractor said the company have not yet adopted the quality assurance system but in order for the company to improve they compare their performance to that of the competitors. Hence, suggesting the use of benchmarking mechanism as the tool to confirm to quality workmanship standards. The contractor said that the strategy of competing with other competitors is assisting/or working for the company because they are improving daily. The contractor mentioned that the low-cost housing projections are promising in the country particularly in Cape Town. However, highlighting what will be hindrance as inadequate skill, inappropriate inspection/or monitoring sequences. The contractor stressed the use influence that NHBRC can make if they enhance their training programmes to help elevate community member's skills in construction of their communities.

#### **5.4.9 Designer factors**

Like the contractor the designer also said the words are closely correlated and he described the three words according his own understanding as shown in the designer responses above. The designer confirmed that the company introduced all relevant employees to benchmarking and it is working for the company. The only predicament as mentioned by the designer is the repetitive design model use in the delivery of low-cost housing in the entire country. This is unconsciously destroying the skill/or creativity of South African designers. Like the contractor the designer touched based on many factors to be looked at like the selection of appropriate procurement system in the early stages of the project, and the introduction of appropriate benchmarking in each organisation working in the delivery of low-cost housing.

## 5.5 Chapter summary

This chapter presented all the data and findings based on the three batches of quantitative questionnaire surveys conducted within the three Cape Town communities mentioned: Delft, Khayelitsha and Langa as well as the qualitative interviews carried out with the Building Inspectors, Contractor and Designer.

From the data retrieved from the locations mentioned above, it was discovered that there were problems around resultant quality that the houses possess, many of which are falling apart or incomplete and not accommodating families adequately. Many questions and comments arose around procurement measures, time constraints, tight budgets, appropriate quality assurance system and pressures surrounding the current housing backlog which filters down from government to **Designers** and **Contractors** which ultimately causes design processes to fail and construction workmanship quality to drop, resulting in a poor resultant quality housing unit.

The interviews carried out with the Building Inspectors, Contractor and Designer, it was discovered that similar comments were suggested. The designer, contractor and the Building Inspector from Human Settlements did not seem to have adequate skill on quality assurance systems, though they are using benchmarking as their quality assurance system. However, the Building Inspector from the City of Cape Town seems to understand quality assurance systems and it was anticipated that quality assurance is the major priority in their projects. City of Cape Town adopted ISO 9001:2008 and slowly introducing it to all departments.

## Chapter 6

### Conclusion and Recommendations

#### 6.1 Introduction

In the previous chapter the questionnaires and structured interviews were carefully analysed in order to reflect a true result to the hypothesis/or research questions structured in chapter 1.

Chapter 5 gathered valuable data to test the hypothesis/or research questions to a certain extent. In this chapter the findings, recommendations and conclusions will be presented to round off this phase of the research study.

#### 6.2 Summary/Findings

In **chapter 1**: a brief introduction to quality assurance in low-cost housing construction was presented. **Chapter 1**: also focused on the background of South Africa's construction industry, highlighting various factors affecting the concept of quality assurance. Drawing from this, a problem statement, hypotheses/or research question as well as objectives were drawn up around design and workmanship fundamentals.

**Chapter 2**: reviewed literatures on previous research executed, based on quality, quality assurance and barriers to quality, procurement systems, poor workmanship in the design process, poor workmanship in the construction process and the assessment of quality assurance systems in practice.

**Chapter 3**: discussed in detail the two research methods available namely quantitative and qualitative. From these two methods various research tools such as questionnaires, surveys, interviews, case studies and triangulations were examined.

This chapter concluded by justifying the reason for selecting quantitative questionnaires together with qualitative structured interviews as the most appropriate methods to collect data.

**Chapter 4**: scrutinized the formulation of the questions set and the comparisons of the results derived from the literature review. With this being done, the research results, scenarios and factors, which affect the data validity were highlighted and undertaken.

From this an assessment was made as a result of the responses to the questionnaires and structured interviews as to how quality assurance in affordable housing construction could be properly implemented and improved upon in order to eliminate the poor quality prevalent in affordable housing construction.

**Chapter 5:** In this chapter the actual data collection and presentation process took place based on the selection of the tools (questionnaires and structured interviews) in chapter 4. Chapter 5 analysed the questionnaires and the structured interviews correlating to the objectives established in Chapter 1. This was completed to test and validate the hypothesis and research questions.

### **6.3 Conclusion**

From the data retrieved through questionnaires sent to beneficiaries regarding the structural performance of their houses and data analyzed with SPSS 22, it was discovered that poor resultant quality are still persistent after the houses have been handed-over to beneficiaries. When looking at the details and design of these low-cost houses within the three areas, it is clearly noticeable that a design model used has many similarities across the three areas. There are also concerns raised as to the privacy and move-ability that the house offers its occupants since the size of houses has been highlighted as 40m<sup>2</sup>. The two quality assurance systems in use in the construction process of low-cost houses were identified by the researcher as benchmarking and international organization for standardization (ISO). However, from the data analyzed concerning the persistence of poor resultant quality in these houses and the knowledge of professionals concerning quality assurance systems seems as these systems are not assisting in the delivery, but that is incorrect.

The findings showed that poor workmanship qualities were identified throughout the project. Many structural flaws were noticed, for example, cracks in walls, floors, unstable roof structures, chipping paints, incomplete plumbing, falling ceilings, incorrect installation of water pipes inside the houses etc. Concurrent to this, many ailments and disabilities were evident within the three communities which are either caused or enhanced by the poor quality homes in which they live. These ailments according to the statistics are more severe in the rainy winter months. This tends to suggest that poor cross-flow ventilation in the units intensifies the ailments. There are many other flaws that have been identified as the root cause of other ailments in beneficiaries or anyone staying with beneficiaries. To mention few that are of real concern and have negative impact in lives of beneficiaries are: humid walls, chipping paint, cracks in walls, poor ventilation. This therefore triggered the need for the

community involvement in design processes of low-cost houses, to afford better space utilization to increase better living conditions.

The dissertation discovered that **Designer** and the processes followed cannot be held as directly responsible for poor resultant quality transpired in low-cost housing being delivered. They are affected due to a demanding client (government) after absorbing pressure from time constraints and financial budgets resulting in the backlog of housing provided. This is eventually put tremendous pressure on the design teams. However, the **Designer's** limited knowledge of quality assurance systems is another factor attributed to poor resultant quality. The **Designer** also suggested the importance of using the appropriate benchmarking is in order to achieve good design quality and through this he ensures that quality assurance will be achieved in low-cost housing for years to come.

Similar to **Designer** much can be said about the **Contractor**. The contractor as well showed the limited knowledge of quality assurance systems and confirms that they have not yet adopted any of the quality assurance systems in the company. They are also affected by government requirements. However, the **Contractor** is responsible for the delivery of the actual house structure and this is the area where poor workmanship qualities are evident. This does not suggest that they are entirely liable but creates a bigger picture as to where the problem originates from. When analysing the interviews conducted with the contractor, it was made clear that workmanship quality in low-cost housing have inadequate skill and that it is dropping significantly, considering the unrealistic time-frames and tight budgets allocated by government as well as procurement systems and benchmarking being major threats.

One way or the other for workmanship quality to improve the above mentioned threats need to be attended to, especially procurement systems which play a major role when it comes to factors such as time, cost and more so quality. Furthermore the **Contractor** stresses the use of benchmarking mechanisms as a critical tool in achieving good workmanship quality and more so quality assurance in the low-cost housing fraternity.

The **Building Inspector** from the City of Cape Town had been introduced to quality assurance systems and the City of Cape adopted ISO 9001:2008 as their quality assurance system. However, the **Building Inspector** from Human Settlements in Cape Town showed limited knowledge of quality assurance systems when interviewed. Government should ultimately be held responsible for the delivery process of low-cost housing as well the

procurement and quality assurance systems being implemented. The budget is another factor identified as the biggest issue affecting the quality of low-cost houses around the country. Furthermore, government should be held responsible for the poor resultant quality evident in low-cost houses around the country for failing to introduce and provide adequate training on quality assurance systems to government representatives involved in the construction and inspection of low-cost houses. Lastly, the building inspectors also highlighted the importance of better procurement measures, appropriate benchmarking measures as well as more skilled labour in order to bring about a quality product.

These stakeholders came to conclusion that government should set more realistic time-frames and provide better budgets in conjunction with improved procurement measures and appropriate quality assurance system being put in place, to allow a better resultant housing quality product.

#### 6.4 Table showing correlation between research question, objectives and conclusions

The correlation between research question, objectives and conclusions will be tabulated in the table below to ensure that research questions have been answered positively or negatively, objectives have been adequately reached.

Research question	Response	Positively/negatively answered	Objectives	Adequately/inadequately reached
Are the poor resultant quality problems still persistent in low-cost housing construction?	From the data retrieved through questionnaires sent to beneficiaries regarding the structural performance of their houses and data analysed with SPSS 22, it was discovered that poor resultant quality are still persistent.	Answered positively.	To identify the existence, prevalence and depth of the poor resultant quality in low-cost housing areas.	Adequately reached.
What types of	City of Cape Town	Answered	To identify the quality	Adequately

<p>quality assurance systems are in practice in the delivery of low-cost house construction?</p>	<p>adopted ISO 9001:2008 and slowly introducing it to all departments. Human settlements are using benchmarking as their quality assurance systems. This was discovered when the inspector said they measure their performance to that of other competitors. Hence, this was linked to benchmarking.</p>	<p>positively.</p>	<p>assurance systems in current use in construction of low-cost housing.</p>	<p>reached.</p>
<p>Are the quality assurance systems assisting in the delivery of low-cost housing?</p>	<p>From the data analysed concerning the persistence of poor resultant quality in these houses, it seems as if the quality assurance systems are not assisting in the delivery. However, inspectors maintained that the systems assist in the delivery.</p>	<p>Answered positively.</p>	<p>To evaluate the extent to which the existing quality assurance systems used assist in current low-cost house construction.</p>	<p>Adequately reached.</p>
<p>How can the systems be implemented to achieve the objective of NHBC of good quality standards?</p>	<p>The training of government representatives of quality assurance systems. Benchmarking is more about competing/or measuring ones performance to that of other competitors. ISO encourages the</p>	<p>Answered positively.</p>	<p>To evaluate the effectiveness of quality assurance systems in current use.</p>	<p>Adequately reached.</p>

	involvement of all members including management to work towards the successful of the project.			
What are the factors hindering the successful implementation of quality assurance systems in low-cost housing construction?	Inadequate skill/or lack of knowledge of quality assurance systems. Moreover, the inappropriate working system/strategy by government representatives In low-cost house construction.	Answered positively.	To determine whether the poor resultant quality is the consequence of poor application of the systems or the lack of knowledge from the professionals involved in the construction process.	Adequately reached.
What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost house construction?	The introduction and appropriate training of quality assurance systems to all government representatives working on low-cost house construction. Government should set realistic timeframes to achieve certain objective and focus on quality over quantity. The involvement of management in the construction process and the measurement of their performance to that of others.	Answered positively.	To establish the mechanism to ensure the effective use of quality assurance systems in the construction of low-cost houses.	Adequately reached.

**Table 6.1: the correlation between research question, objectives and conclusions**

## 6.5 Recommendations

It is known that shelter is one of Maslow's basic human needs. However, the quality should not be compromised in this basic need. It has been established through this research study that the word 'Quality' is interpreted very differently by each individual and therefore each one's quality standards would be of a different view. *When it comes to housing, these ideas and standards make the delivery process very difficult. It is recommended that the common grounds as mentioned in the NHBRC regulations and National Building regulations SANS be followed and implemented. Granted each homeless family would appreciate a solid roof over their heads, but this does not mean that any given 'standard home' would be the answer, it recommended that government prioritize the quality of the houses delivered.*

Over the years and currently a repetitive 'design model' is being implemented giving community no freedom of choice when it comes to low-cost housing units. This is evident in the data presentation presented within chapter 5. The data illustrates that there is a common design model within Cape Town. The implementation of this common design model was established to be rooted within the three locations each facing a huge housing backlog.

*It is recommended that government need to allow the designers in the country to practice their skills fully and come with different design models. The backlog in the three locations identified creates pressure at government levels via tight budgets and time constraints to speedily and economically house the homeless but simultaneously suffocating and pressurising the design team and their processes enforcing designers to work under tight timeframes and low budgets anticipated to deliver a good quality of house design to accommodate the homeless. It was also established that pressures from the design team are passed down to the contractor who in turn needs to deliver the actual product within tighter timeframes and even lower budgets. From the data presentation it is also recommended that community involvement and the incorporation of sustainable methods in the design and construction process should be practiced. Therefore, for the integrity of government and shift towards development of skills in decision making, the design model needs to be rehabilitated and look out for new ideas in design model.*

Furthermore, the literature and the findings create a view around procurement systems and its measures. *These systems should therefore be closely looked at together with quality assurance systems to structurally alleviate the housing backlog allowing for sufficient timeframes and flexible budgets to deliver a quality product.*

Likewise, from the data collected through interviews conducted with the building inspectors, contractors, and designers it was identified that there was a limited knowledge concerning

quality assurance systems. *Government should enable its representatives by introducing quality assurance systems to qualified representatives and provide with appropriate training.*

Moreover, the building inspector, contractor and designer stresses the use of benchmarking mechanisms as a critical tool in achieving good workmanship quality and more so quality assurance in the low-cost housing fraternity. Lastly, the building inspector, contractor and designer also highlighted the importance of better procurement measures; appropriate benchmarking measures (as one of quality assurance systems) as well as more skilled labour in order to bring about an acceptable quality product.

According to the researcher's point of view with the knowledge government project procedures, there is a procurement system which is followed throughout the country. Usually, government approaches consulting engineers as the representative of government on day-to-day site activities monitoring all construction stages ensuring compliance to any standards required there after by NHBRC and National Building regulations. The government (client) and the consulting engineers (project managers) agree on design together then appoint the contractor through 'score card' to take over the construction of the houses. Therefore, this form of undertaking projects is closely associated with a traditional procurement, *it only needs to be understood and implemented procedurally.* Refer to the literature review for appropriate implementation of the system.

In terms of benchmarking, there are numerous types of benchmarking. *Hence, the researcher considers as necessary for government, contractors and designers to thoroughly implement the full package of benchmarking (all nine types) for the successful objective. Especially, local governments must evaluate their benchmarking system and their effectiveness for the cause. For example: The municipality should compare its performance to the performance of other municipalities and improve its own and that goes to their products as well. The contractor as well should constantly evaluate quality of their resultant product to that of other competitors and always improve to protect the reputation of the company in business world to increase their score card for future tender's bid.* The researcher though felt that there is less to give to the designers as in this context, the designer receives/or take instructions from the client which design must be followed.

*When trying to figure the appropriate quality assurance system to be identified as the adequate assurance system for the delivery of low-cost houses, the researcher identified two effective quality assurance systems which seem to fit the delivery of low-cost houses. These two assurance systems stood out from others because they seek to improve the production efficiency in an organisation. These were identified as:*

- *Benchmarking*
- *ISO 9000 and 9001*

However, for more information about either of the two refer to literature review in chapter two. *Therefore, the best mechanism for the implementation of the appropriate quality assurance system on government project is as follows:*

- *Organisations involved in government projects must have their quality assurance system registered.*
- *They must have their quality assurance officer on site.*
- *The inspectors from municipalities must have their offices on site and be visible at all times for the successful completion of the project objectives.*
- *The consulting engineers (project managers) must not only identifies problem rather must provide solution as experts for example in concrete and structures.*

This study has proved or answered the hypothesis and research questions and covered its objectives extensively which gives rise to broader research which will be utilized to generate more conclusive evidence around low-cost housing quality and the housing backlog to be addressed.

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**Faculty of Engineering, Department of Construction Management and Quantity Surveying**

1<sup>st</sup> Floor, room L12, Business Building, Symphony Way (off Robert Sobukwe Road) Bellville, 7530, P.O Box 1906,  
Bellville, 7535

Dear Sir/Madam,

**RE: PARTICIPATION IN A QUESTIONNAIRE SURVEY**

As an endeavor to deliver and bring acceptable low-cost housing standards, this questionnaire attempts to get your opinion about your houses. This is an invitation to participate and express your innermost feeling about the living conditions within your house since handover (meaning day-to-day experience). This has been motivated by an on-going quality concerns in the resultant low-cost housing delivered. The parties involved in the delivery of low-cost houses are Designers, Contractors, and Building Inspectors. This questionnaire is also anticipated to assist in the fulfillment of Master of Technology Degree in Construction Management at Cape Peninsula University of Technology in the Department of Construction Management and Quantity Surveying. The title of the thesis is: "Analysis of the effectiveness of Quality Assurance Systems towards delivering low-cost housing in the Western Cape South Africa".

Please read and answer each question carefully. The survey should take about 20 MINUTES to complete and participants are asked to return them before..... All the information obtained from the participants will be kept strictly CONFIDENTIAL.

**Return the survey to:**

Vuyo Ngquba

Cape Peninsula University of Technology

Tel: 021 959 6074/6631

Cell: 073 775 7399

Email: [vngquba@gmail.co.za](mailto:vngquba@gmail.co.za)

**Thank you for your co-operation and assistance**

**APPENDIX A**  
**QUESTIONNAIRE**

**Community Survey on Low-Cost Housing**

**Western Cape**

**SECTION A**

**Personal Details of the Occupant**

1.1 Address.....

.....

1.2 Age.....

1.3 Gender (Indicate by making a tick in the box).

Male	<input type="checkbox"/>	Female	<input type="checkbox"/>
------	--------------------------	--------	--------------------------

1.4 Race (Indicate by making a tick in the box).

Black	<input type="checkbox"/>	Coloured	<input type="checkbox"/>	Indian	<input type="checkbox"/>
-------	--------------------------	----------	--------------------------	--------	--------------------------

1.5 Duration of occupancy.....

1.6 Number of occupants.....

1.7 Place of birth.....

1.8 How old is the house? (Indicate by making a tick in the box).

Less than 5 yrs	<input type="checkbox"/>	5 to less than 10 yrs	<input type="checkbox"/>	10 to less than 15 yrs	<input type="checkbox"/>	15 to less than 20 yrs	<input type="checkbox"/>	20 yrs and more	<input type="checkbox"/>
-----------------	--------------------------	-----------------------	--------------------------	------------------------	--------------------------	------------------------	--------------------------	-----------------	--------------------------

1.9 Indicate the appropriate option regarding beneficiary's employment status. Tick with X in the box.

Employed	
Self-employed	
Not employed	
Never worked	

1.10 Monthly income (Indicate by making a tick in the box).

Less than R1000		R1000- R3000		R3000- R7000		R7000- R12000		More than R12000	
-----------------	--	--------------	--	--------------	--	---------------	--	------------------	--

1.11 State how important is it to own a house of your own? (Indicate by making a tick in the box).

Very important		Fairly important		Neither	
----------------	--	------------------	--	---------	--

1.12 Select the appropriate option(s) by marking with X in the box.

Are you the beneficiary	
Did you buy the house	
Are you renting the house	

## **SECTION B**

### **Details of the house**

2.1 What is the size of the house? (Indicate by making a tick in the box).

38 m <sup>2</sup>		40m <sup>2</sup>		52m <sup>2</sup>	
-------------------	--	------------------	--	------------------	--

2.2 How many rooms does your house consist of? (Indicate by making a tick in the box).

Two		Three		Four		Five	
-----	--	-------	--	------	--	------	--

**2.3** Indicate the appropriate answer concerning the number of rooms. Tick with X in the box.

The rooms are not enough	
The rooms are enough	
The number of rooms is not a problem	

**2.4** Indicate the appropriate answer concerning the space for movement. Tick by X in the box.

There is not enough space for movement	
There is enough space for movement	

**2.5** How many doors does the house have? (Indicate by making a tick in the box).

Two		Three		Four	
-----	--	-------	--	------	--

**2.6** How many windows does the house have? (Indicate by making a tick in the box).

Three		Four		Five		Six	
-------	--	------	--	------	--	-----	--

**2.7** How many air-vents does your house have? (Indicate by making a tick in the box).

None		Two		Three		Four	
------	--	-----	--	-------	--	------	--

**2.8** Indicate the appropriate answer concerning the design of the house. Tick by X in the box.

The house does not have a ceiling	
The house have a ceiling	
The house have the under-site of the slab	

**2.9** What type of roof trusses is used? (Indicate by making a tick in the box).

Timber	<input type="checkbox"/>	Steel	<input type="checkbox"/>
--------	--------------------------	-------	--------------------------

**2.10** What type of roof covering made of? (Indicate by making a tick in the box).

Tiles	<input type="checkbox"/>	Fibre cement	<input type="checkbox"/>	Iron roof	<input type="checkbox"/>
-------	--------------------------	--------------	--------------------------	-----------	--------------------------

**2.11** Is your house plastered or bagged? (Indicate by making a tick in the box).

Plastered	<input type="checkbox"/>	Bagged	<input type="checkbox"/>
-----------	--------------------------	--------	--------------------------

**2.12** Kindly indicate the appropriate answer concerning the power supply of the house. Tick by X in the box.

The house use solar as power supply	<input type="checkbox"/>
The house use electricity as power supply	<input type="checkbox"/>
The house use generator as power supply	<input type="checkbox"/>

**2.13** Kindly indicate the appropriate answer regarding the hot water supply Tick by X in the box.

The house uses the solar gyser	<input type="checkbox"/>
The house uses the electrical gyser	<input type="checkbox"/>
The house does not have a gyser	<input type="checkbox"/>

**2.14** Kindly indicate the appropriate answer regarding the basic services. Tick by X in the box.

The house is near to transportation services	<input type="checkbox"/>
The house is near to schools	<input type="checkbox"/>
The house is proximity to shopping center	<input type="checkbox"/>
The house is close to administrative facilities	<input type="checkbox"/>
The house is close to health facilities	<input type="checkbox"/>

**2.15** Please indicate the appropriate answer regarding clean water supply. Tick by X in the box.

The house is connected to municipal water supply	
The municipality supply the houses with trucks daily	

**2.16** In your opinion who should get priority for low-cost housing? (Indicate by making a tick in the box).

Public Sector Employee		The homeless		Low to middle income earners	
Other (please specify)					

## **SECTION C**

### **Design Quality**

Choose the most appropriate answer by ticking.

**3.1** Kindly indicate the appropriate answer regarding privacy. Tick by X in the box.

The house does not offer privacy	
The house offers privacy	

**3.2** Kindly indicate the appropriate answer regarding the choice of house design. Tick by X in the box.

The community members decide on house design	
Municipality decide on the design of the houses	
The contractor decide on the house design	
The designer decide on the house design	

**3.3** Please indicate the appropriate answer concerning the design of the house. Tick by X in the box.

The beneficiary is happy with a design	
The beneficiary is not happy with a design	

**3.4** Indicate the appropriate answer concerning the say on design. Tick by X in the box.

The beneficiary would be happy to have been given a say on design	
The beneficiary does not have any idea on design of houses	

**3.5** If you were to improve the design of your house, where would you improve the design?

.....

.....

.....

**3.6** Indicate the appropriate answer concerning house construction. Tick by X in the box.

The beneficiary would have been happy to be given materials to build the houses	
The beneficiary does not have any idea in construction	

## **SECTION D**

### **Workmanship Quality**

4.1 Indicate by ticking either a **yes** or **no**, which of the problems in the table below relate to your house? Also rate the degree and extent of the problems with a scale from 3,6,9, where 3 minimal and slightly dangerous, 6 moderate and unsafe, 9 bad and extremely hazardous.

	<b>Possible faults</b>	<b>Yes</b>	<b>No</b>	<b>3</b>	<b>6</b>	<b>9</b>
1	Cracks in the walls					
2	Cracks in the floors					
3	Leakages					
4	Loss of heat during winter months					
5	Too much heat retention during summer months					
6	Problems concerning windows and door fittings					
7	Roof structure unstable					
8	Damp floors					
9	Paint work on walls cracks or chipping					
10	Plaster not preventing water penetration causing dampness					
11	Rain water disposal e.g gutters and downpipes not in good condition and position to serve their purpose					

## **SECTION E**

### **Illnesses and Disabilities**

5.1 Kindly indicate the appropriate answer regarding the family member(s) with impairment which limits their daily activities or attitude on how they do work. Tick by X in the box.

Long term illnesses	
Temporary health problem	

**5.2** Indicate by ticking the appropriate impairment in the table below. (Indicate by making a tick in the box).

	<b>Nature of Impairment</b>	<b>Tick</b>	<b>Permanent?</b>	<b>Recurring?</b>	<b>Winter/Summer?</b>
1	Physical illness				
2	Allergies				
3	Mobility impairment				
4	Hearing impairment				
5	Visual impairment				
6	Learning disability				
7	Mental health illness				
8	Other e.g diabetes, epilepsy				

**5.3** If other, please specify.....

**5.4** Kindly indicate the appropriate answer regarding the quality of workmanship. Tick by X in the box.

The workmanship had proper training	
The workmanship lacked training	

**5.5** Provide a brief a reason for your answer.

.....

.....

.....

.....

## **SECTION F**

### **Government involvement**

**5.6** Indicate by stating agree, strongly agree, disagree, strongly disagree, neutral.(Indicate by making a tick in the box).

<b>Activity</b>	<b>STRONGLY AGREE</b>	<b>AGREE</b>	<b>NEUTRAL</b>	<b>DISAGREE</b>	<b>STRONGLY DISAGREE</b>
Government responds immediately or on time to community grievances on housing demands					
Government chooses right locations for the houses					
Relevant government representatives are involved during the execution of low-cost housing					
Government provide users with education on how to maintain the house after handover					
Government is trying its best in tackling homeless					

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Bellville, 7535

**RE: INTERVIEWS**

As an endeavour to deliver adequate social housing to under privileged communities, simultaneously meeting National Building Regulations as set out, and ensuring their efficiency by NHBRC concerning the quality and well-being of owners of low-cost housing. This interview question is expected to get the knowledge and experience of Designer, Contractor and Inspector of the procedures and policies in use from inception to completion. This interview also intended to identify plans and strategies to make the Quality Assurance System effectively towards the delivery of low-cost houses. Construction is a multi-disciplinary industry involving different personnel from different departments with various skills, their inputs in this endeavour will assist the interviewer to; after completing conducting interviews and data analysis from the responses retrieved decide which mechanism is best to respond to quality concerns in low-cost housing. This interview is also anticipated to assist the interviewer in fulfilment of Master of Technology Degree in Construction Management (course) at Cape Peninsula University of Technology in the Department of Construction Management and Quantity Surveying. The title of the thesis is: "Analysis of the effectiveness of Quality Assurance Systems towards delivering low-cost housing in the Western Cape South Africa". Acquiring procuring

**Research Questions**

The research questions for the research are as follows:

- Are the poor resultant quality problems still persistent in low-cost housing construction?
- Which types of quality assurance systems are in practice in the delivery of low-cost housing?
- Are the quality assurance systems assisting in the delivery of low-cost houses?
- How can the system be implemented to achieve the objective of NHBRC of good quality standards?
- What are the factors hindering the successful implementation of quality assurance systems in low-cost housing?

- What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost houses?

**APPENDIX B**  
**STRUCTURED INTERVIEWS**  
**Building Inspector Survey**

**SECTION A**

- 1.1 As an inspector on site during construction what are your responsibilities?
- 1.2 Which areas of inspection are your responsibilities?
- 1.3 As an inspector what do the words quality, quality assurance and quality assurance system mean to you?
- 1.4 Have you been introduced to quality assurance system in your department?
- 1.5 Which quality assurance system adopted and in use at your department?
- 1.6 What is your view on resultant quality of low-cost housing in terms of structural performance within South Africa?
- 1.7 Is the quality assurance system adopted in your department assisting?
- 1.8 What are the problems affecting low-cost housing developments within South Africa more so in the Cape Town Metropole as appeared that Cape Town is facing the huge backlog of between 360 000 to 400 000 currently and expected to reach 460 000 by 2020?
- 1.9 Has Government set realistic time frame targets to eliminate this backlog or are there any strategies to tackle this predicament?
- 1.10 Don't you as Government Department feel that you are exerting too much pressure on designers and contractors in their area of expertise? Give reason for your answer?
- 1.11 If you answered yes above, how do you plan to achieve a good resultant quality?
- 1.12 Would it be appropriate to incorporate procurement systems as one of the problems affecting design quality? Give reason for your answer?
- 1.13 Does the process of benchmarking play a pivotal role in achieving a good end product?
- 1.14 Considering the huge backlog in housing, do you see a successful implementation of quality assurance systems to inform quality assurance in low-cost housing?
- 1.15 What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost houses?

## APPENDIX C STRUCTURED INTERVIEWS

### Contractor survey

#### **SECTION A**

- 1.1 As a contractor what do the word quality, quality assurance and quality assurance system mean to you?
- 1.2 What is your view on low-cost housing design and quality within South Africa?
- 1.3 Have you been introduced to quality assurance system in your company?
- 1.4 What type of quality assurance system adopted in your company?
- 1.5 Is the system adopted assisting in the delivery of low-cost houses?
- 1.6 Are there any problematic issues relating to the construction processes for low-cost housing? If **yes**, state what these problems are?
- 1.7 Is government an influential player in the cause of these problematic issues? Give reason for your answer?
- 1.8 What can be done to achieve good resultant quality in the construction of low-cost housing?
- 1.9 Would it be appropriate to incorporate procurement systems as one of the problems affecting design quality? Give reason for your answer?
- 1.10 Does the process of benchmarking play a pivotal role in achieving a good end product?
- 1.11 Considering the huge backlog in housing, do you see a successful implementation of quality assurance systems to inform quality assurance in low-cost housing?
- 1.12 What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost houses?

## APPENDIX D

### STRUCTURED INTERVIEWS

#### Designer Survey

##### **SECTION A**

1.1 As a designer what do the word quality, quality assurance and quality assurance system mean to you?

1.2 What is your view on low-cost housing design and quality within South Africa?

1.3 Have you been introduced to quality assurance system in your company?

1.4 What type of quality assurance system adopted in your company?

1.5 Is the system adopted assisting in the delivery of low-cost houses?

1.6 Are there any problematic issues relating to the construction processes for low-cost housing? If **yes**, state what these problems are?

1.7 Is government an influential player in the cause of these problematic issues? Give reason for your answer?

1.8 What can be done to achieve good resultant quality in the construction of low-cost housing?

1.9 Would it be appropriate to incorporate procurement systems as one of the problems affecting design quality? Give reason for your answer?

1.10 Does the process of benchmarking play a pivotal role in achieving a good end product?

1.11 Considering the huge backlog in housing, do you see a successful implementation of quality assurance systems to inform quality assurance in low-cost housing?

1.12 What strategies are put in place to ensure the complete implementation of quality assurance systems in low-cost houses?

## APPENDIX E

### POOR RESULTANT QUALITY (DELFT, LANGA, SITE C 2004-2012)



Fig. 1: Representation of the complete house in Delft.



Fig. 2 Represent damaged sewer pipe.



Fig. 3 Represent damaged defective sewer pipe and opened wall.



Fig. 4 Represent narrow Stair cases in Delft.



Fig. 5 Represent humid walls through moisture.



Fig. 6 Represent structural wall defects due to poor resultant quality.



Fig. 7 Represent structural wall defects due to poor resultant quality.



Fig. 8 Represent shoddy works, baths left without trap door for water overflow.



Fig. 9 Represent a typical bath, hand wash-basin and water connection.



Fig. 10 Represent a typical water connection of the bath tap and the position the tap is being installed.



Fig. 11 Represent a house in Delft.

## APPENDIX F

### IMPROVED RESULTANT QUALITY MEASURES (UPINGTON 2014-2015) SITE PHOTOS



Fig. 1 Represent excavation of 400mm x 600mm footing of a 40m<sup>2</sup> meter BNG house.



Fig. 2 Represent 600mm x 250mm footing (high strength 25Mpa).



Fig. 3 Represent a step footing.



Fig. 4 Represent a two skin foundation brick-wall.



Fig. 5 Represent a complete foundation brickwork.



Fig. 6 Represent a backfilled, stumped, leveled with spacers and mesh wire.



Fig. 7 Represent the casting of concrete floor slab.



Fig. 8 Represent a complete floor slab.



Fig. 9 Represent the size of the room 2.9m x 2.8m and a house division.



Fig. 10 Represent the laying of dpc for superstructure.



Fig. 11 Represent the hoop-iron tied to the brick-force in every fourth course.



Fig. 12 Represent typical hoop-irons positioned correctly every fourth course and the typical external door frame positioning.



Fig. 13 Represent the window frame installed.



Fig.14: Represent superstructure on the window level.



Fig. 15 Represent a complete superstructure (internally & externally).



Fig. 16 Represent a complete and correct positioned roof trusses.



Fig. 17 Represent a complete roofing with beam filling.



Fig. 18 Represent the brandering installed at 500mm c/c and electric conduit pipes.



Fig. 19 Represent the zinc supported by bracket on either sides, tap and P-trap pipe underneath.



Fig. 20 Represent a typical complete toilet set installed correctly along is the baths trap installed.



Fig. 21 Represent a complete basin with an S-trap pipe underneath and a flexi, water pipe and a tap.



Fig. 22 Represent a complete baths with tap, bath trap.



Fig. 23 Represent a complete ceiling, cornice with trap-door.



Fig. 24 Represent a complete ceiling installed with electric lights installed.



Fig. 25 Represent plastering works in progress.



Fig. 26 Represent a house with complete plastering and roofing.



Fig. 27 Represent plumbing works in progress (sewer and water pipes).



Fig. 28 Represent a complete Plumbing works (water and sewer pipes).



Fig. 29 Represent the gully stone installed correctly.



Fig. 30 Represent waist pipe installed ready to be back-filled.



Fig. 31 Represent a complete house (roof, window panes, plumbing and paint).



Fig. 32 Represent a complete house with door installed.



Fig. 33: Representation of successful hand-over of a house to a happy beneficiary.

THANK YOU FOR BEING SUPPORTIVE THROUGHOUT THIS RESEARCH DISSERTATION.

THANK YOU FOR THE CONTRIBUTION IN COMMUNITY DEVELOPMENT EFFORT IN SOUTH AFRICA.