

QUALITY ASSURANCE IN LOW-COST
HOUSING CONSTRUCTION PROJECTS
IN THE METROPOLE

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**QUALITY ASSURANCE IN LOW-COST HOUSING
CONSTRUCTION PROJECTS IN THE METROPOLE**

By

**MANELISI RARANI
(206017960)**

**Dissertation is submitted in fulfilment of the requirements
for the degree in Master of Technology: Business
Administration in Project Management in the Faculty of
Business at the Cape Peninsula University of Technology**

Supervisor: Mr Stanley Fore

Cape Town Campus

2013

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DECLARATION

I, Manelisi Rarani, declare that the contents of this dissertation represent my own unaided work, and that the dissertation has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Signed

Date

ABSTRACT

In 1994, the South African government introduced low-cost housing construction through Reconstruction and Development Programme. The programme was intended to improve the quality of lives of the country's citizens. Many communities across the country benefited from the programme. However, concerns regarding the quality of low-cost housing produced through this programme have been raised. The programme has produced low-cost housing with many structural defects such as gaping wall cracks, roof leaks, unstable roof, water penetration and seepage.

To protect the beneficiaries of low-cost housing against the inferior workmanship, unsuitable material and inappropriate construction methods, building standards and regulations have been introduced. The low-cost housing inspectors have been given power to enforce and ensure that the building standards and regulations are followed and met by low-cost housing contractors. Regardless of the measures, the programme still produces low-cost housing built with many structural problems.

Hence, the researcher has conducted a research to assess the effectiveness and adequateness that inspection process contributes to quality assurance in low-cost housing construction projects in the Metropole. The findings of the research provided an overall low-cost housing inspectors' experience in the construction industry, education, training, knowledge, roles and responsibilities and the perception of the low-cost housing inspectors on the current housing inspection.

The primary conclusion of this research suggest that the low-cost housing inspectors lack training in housing inspection, are not aware of their roles and responsibilities and lack knowledge in building standards and regulations. This resulted to failure to enforce and ensure that the contractors comply with building standards and regulations during the low-cost housing construction projects in the Metropole.

The primary recommendations are to establish a standard continuous training and education for low-cost housing inspectors. Provide courses and training to improve the level of knowledge of building standards and regulations by low-cost housing

inspectors and review the roles and responsibilities of low-cost housing inspectors and establish awareness of them among the affected parties.

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- My wife, Bongiwe Rarani for being a supportive partner during this period.

DEDICATION

This dissertation is dedicated to my grandmother Nosifanelo Violet Rarani, my wife Bongiwe Rarani and my son Tumelo Rarani.

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GLOSSARY

RDP	Reconstruction and Development Programme
RSA	Republic of South Africa
NHSD	National Human Settlements Department
PHSD	Provincial Human Settlements Department
SPSS	Statistical Program for the Social Sciences
RDP	Reconstruction and Development Programme
NHBRC	National Home Building Registration Council
SANS	South African National Standards
NBR	National Building Regulations
RICS	Royal Institution of Chartered Surveyors Foundation
SABS	South African Bureau of Standards

KEYWORDS

The following are keyword for this research:

- Quality
- Quality Assurance
- Housing
- Low Cost Housing
- Housing Inspection
- Building legislations
- Building Standards

1. CHAPTER 1 - INTRODUCTION

This chapter presents the introductory part of this research. It also contains the background, statement of research problem, research questions, research objectives, delineation of the research, and significance of the research, expected outcomes, expected results and contributions of the research.

1.1. BACKGROUND TO THE RESEARCH

Addressing the inequalities and injustice that are consequences of the apartheid government, housing development has been the essential part of South African government's commitment to reduce poverty and to improve the quality of people's lives (South African Government Information, 2006: 1).

In the year of 1994, the South African government introduced low-cost housing projects through its Reconstruction and Development Programme (RDP). Henceforth, the houses built through this programme were commonly known as RDP houses (South Africa Year Book, 2003: 367). Through the programme many low-cost houses were built and delivered to beneficiaries, this was in line with what people expected after the first democratic elections (Mkuzo, 2011: 1).

In 1996, the constitution of the Republic of South Africa was adopted. The constitution establishes the right to basic needs and this includes the right to housing. Section 26 of the constitution, act number 108 of 1996 states that everyone has the right to have access to adequate housing and the government must make reasonable legislative and take measures within its available resources to achieve the recognition of this right (Constitution of the Republic of South Africa, 1996: na).

A number of housing projects throughout South Africa have been launched by government (Mkuzo, 2011: 2). The South African government has spent billions of Rand in low-cost housing since 1994 (South Africa Year Book, 2003: 367). The National Human Settlements Department (NHSD) spends millions of Rand on low-cost housing construction projects every financial year (Product Development, 2010:

3). To protect the general public against inferior workmanship, unsuitable material and inappropriate construction methods in housing construction projects, building legislations have been introduced in South Africa (SABS, 1990: na).

However, despite the fact that there is a large pool of financial funding, technical expertise and technical information, and legislative information on housing construction, complains regarding the poor quality of low-cost houses built through government's projects have surfaced (Mahachi, Goliger and Wagenaar, 2001: na). Over the years, many communities have shown their growing disapproval about quality of low-cost houses built through government projects. These issues have become regular news items, as a number of articles have been sighted in the media illustrating major quality concerns in housing delivery, especially low-cost housing built all over the country (Govender, 2009: 1). This matter has been raised in numerous forums at both national and provincial levels (Makhaye, 2000: 4) and (Mabandla, 2003: 4). It has also engaged the minds of politicians, administrators, researchers, community leaders and industry leaders, all aiming at achieving one of the ideals of South African's new constitution that everyone has a right to adequate housing (Schlotfeldt, 2000: 1).

Public Protector, Thuli Madonsela, reported to the Members of Parliament about the low-cost housing problems that her office have encountered. These included houses that lacked foundations and houses that had been built from material which crumbled on touch (Fokazi, 2013: na). The Public Protector also reported that in two months in the year 2013, her office has received over 5000 complaints with regard to poor quality of low-cost housing (Fokazi, 2013: na).

A number of studies have been published showing that the beneficiaries of government low-cost houses are not always satisfied with the quality of their houses (Mkuzo, 2011: 2). A research conducted by Makamu (2007: 77), regarding the beneficiaries of the Nobody Mothapo housing project established that 25 out of 30 beneficiaries, who were participants were not satisfied with the conditions of their houses because they were of poor quality. Another study conducted by Mokgohloa (2008: 64) in Luthuli Park, also found that 80.8% of the beneficiaries were not happy with the quality of their houses.

Over the past several years millions of Rand have been spent by the South African government to facilitate repairs on low-cost housing (Mpambane, 2008: 1). The National Home Building Registration Council (NHBRC) spent more than ten million Rand on remedial works during the year 2010 (NHBRC, 2011: na). Cole (2003: na) said that the remedial expenditure on existing low-cost housing is unacceptable, when many people are without shelter. In November 2009, the National Minister of Human Settlement at the time, Tokoyo Sexwale criticised the huge amount of money required by the National Department of Human Settlements to do the reconstruction and remedial work on low-cost housing as a result of poor quality (Sexwale, 2009: 2).

1.2. STATEMENT OF RESEARCH PROBLEM

Regardless of the measures that the South African government has put in place over the years, low-cost houses built through government programmes are still of poor quality.

1.3. RESEARCH QUESTIONS AND OBJETIVES

This research attempts to answer the following primary research questions:

- Is the inspection process currently applied by low-cost housing inspectors to assure quality in low-cost housing construction projects in the Metropole effective and adequate?

The primary objective of this research is to investigate and determine the effectiveness of the current inspection process applied by low-cost housing inspectors in assuring quality in low-cost housing construction projects in the Metropole.

In addressing the primary research question and objective, the research attempts to answer the secondary research questions and objectives listed in table 1.

Table 1: Secondary Research Questions and Objectives

Sub-Questions	Method	Objectives
Are housing inspectors adequately and appropriately educationally qualified?	Questionnaire	To determine the competency of low-cost housing inspectors in relation to their occupation.
What is the housing inspectors' level of experience?	Questionnaire	
Have the housing inspectors undertaken any continuing education and training while in the position?	Questionnaire	
Has the Provincial Human Settlement Department provided any continuing education and training in inspection to housing inspectors?	Questionnaire	
Are housing inspectors knowledgeable in building regulations and legislations?	Questionnaire	To establish whether the low-cost housing inspectors know the building regulations well enough to enforce them effectively.
Are housing inspectors aware enough of their roles and responsibilities to fulfil them?	Questionnaire	
What are views of housing inspectors regarding the contribution that inspection has on material, workmanship and construction methods used in low-cost housing construction?	Questionnaire	To gain insight into the effectiveness of the inspection process applied by low-cost housing inspectors.
What stages of a house construction are inspected by inspectors?	Questionnaire	
What are the methods, tools and techniques that the inspectors use to inspect?	Questionnaire	

1.4. DELINEATION OF THE RESEARCH

The research was limited to the low-cost housing inspectors within the Cape Metropole, Western Cape. The research excluded the analysis of the following:

- The structural design of the low cost housing.
- The low cost housing beneficiaries perspectives on the quality of houses.
- The policies around housing.
- Corruption practises linked to the construction of low-cost houses.

1.5. SIGNIFICANCE OF THE RESEARCH

According to Mkuzo (2011: 17), each research breaks new ground, for the research can never be an exact technical replication of any previous work, and the social world is never the same twice. This research was undertaken as the requirement for the completion of Masters of Technology of Business administration in Project Management. It is also the opinion of the researcher that the research will contribute meaningfully to the field of research and construction industry, specifically in low-cost housing and also helps to stimulate a constructive dialogue on the subject.

1.6. THE STRUCTURE OF REMAINING PARTS OF THIS RESEARCH

The remaining parts of this research contain of four chapters. The details of the remaining chapters are as follows:

- Chapter 2 is the literature review. This chapter present the related literature on the subject of housing. It begins with the clarification of basic terms and concepts and definition of housing. It further explains the details of housing in South Africa, housing legislations, policies and constitution and also uncovers the constraints on housing in South Africa. It provides the general roles of housing and explains quality assurance and also how to ensure quality during and after in housing construction projects. It

establishes the functions of an inspector. The literature review that is part of this research was obtained from books, research papers and media statements.

- Chapter 3 present the formulation of the research methodology which was used to conduct this research. A hybrid approach was used in order to count behaviours, correct answers or errors, and all measures are recorded in terms of quantity. And also the approach was used to establish the meaning of relationships in terms of influences and actions, to make sense of an individual's actions and experiences. This chapter further give clarity to the extent or region which the research was conduct and the people of interest from which the sample is selected from. It establishes the process which was used to select the participants to represent the entire population. It also explains the instruments that were used by the researcher to collect data from the participants and analyse. Collecting data from the participants raises ethical concerns, these ethical concerns are further explained and details how the researcher met these concerns are provided.
- The research findings of the questionnaire surveys carried out from the low-cost housing inspectors in the Metropole are presented in detail in chapter 4. In this chapter evidence is analysed in detail and interpreted in relation to the experience, education, training and knowledge of the low-cost housing inspectors have in the construction industry, the awareness and fulfilment of inspectors' roles and responsibilities, the last inspection that the inspectors did, their perception regarding the contribution that inspection make in use of suitable material, good workmanship and quality construction methods during housing construction.
- The final chapter, conclusions and recommendations, presents the conclusions and recommendations are drawn from the research and answers to the primary research question and secondary research questions are given. Finally the little published research is described along with recommendations for further research.

2. CHAPTER 2 - LITERATURE REVIEW

2.1. INTRODUCTION

This chapter presents the literature review related to this current research, this include clarification of basic terms and concepts, definition of housing, housing in South Africa, housing quality, quality assurance in housing construction, housing inspectors and results of poor housing quality. The literature review that is part of this research was obtained from books, research papers, media statements and the Internet. Also reviewing the existing literature helps to justify the necessity of this research.

2.1.1. CLARIFICATION OF BASIC TERMS AND CONCEPTS

In the context of this research, the following are the clarification of basic terms and concepts:

- Housing –refers to the permanent residential structures with secure tenure, ensuring internal and external privacy and providing adequate protection against the elements (South African Government Information, 2008: na).
- Quality Housing – refers to three areas which are structural durability of the house, services of the equipment, facilities and conveniences which the house provides, and also the state of maintenance and caretaking (Mpambane, 2008: 13).
- Quality Assurance - is the evaluating of overall performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards (PMI, 1996: 182).
- Inspection – is an activity in the housing project that is designed to detect faults or rejects in completed or partly completed houses against building legislations (Glock and Kunz, 2000: 211).
- Building legislation – refers to relevant regulations and the deemed-to-satisfy rules relative to housing construction (Mpambane, 2008: 3).

- Specifications and standards - A detailed description of what is required, to ensure conformance to the housing design (Chase and Aquilano, 1995: 173).
- Respondents - The primary participants of the research (Mkuzo, 2011: 18).

2.2. HOUSING DEFINITION

Formulating a definition of housing is not an easy achievement, for what establishes as adequate housing depends on the specific background and circumstances, needs and priorities of households and individuals (Tissington, 2010: 28).

According to the Constitution of the Republic of South Africa, act No.107 of 1997 (South African Government Information, 2008: na) as amended, housing development is defined as an establishment and maintenance of habitable, stable and sustainable public and private residential environments to ensure viable households and communities. Golland and Blake (2004: 5) further mentions that housing involves many processes in which almost all aspects of everyday life have some input.

Houses are the core ingredient of neighbourhoods, villages and towns, and have influenced the sitting of schools, super markets, health centres and children's play areas. Together with community facilities and local roads, houses make up the residential landscape that most people fondly associate with their childhood and adolescence (Golland and Blake, 2004: 5).

From the above, one can deduce that housing is a broad concept and does not only relate to the walls of the physical structure. There are other appropriate factors that make up a house. The environment is an important element in housing. Factors such as social and economic sustainability should be considered when planning any housing project. For the purpose of this research the focus is on the permanent residential structure subsidise and constructed through South African government programmes.

2.3. HOUSING IN SOUTH AFRICA

South African's constitution state that everyone has a right to adequate housing and the state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realisation of this right (Schlotfeldt, 2000:1). To deliver on its mandate, the democratic government adopted an income based capital subsidy scheme to build the low-cost houses and building legislation to protect the beneficiaries of the low-cost houses (Bank, Makubalo and Maqasho, 2010: 9). The building legislations have been introduced in South Africa to protect the general public against inferior workmanship, unsuitable material and inappropriate construction methods in housing construction projects (SABS 0400, 1990: na). The building legislation put inspectors at an integral part of the construction process, to ensure that the quality of construction and health and safety of occupancy remain top priorities (National Technical Information Service, 2000: na).

According to the constitution of South Africa, the state must take reasonable measures within its available resources to provide adequate housing to its citizens (Pottie, 2004: na). Fulfilling this has been the country's government major challenge over the years since 1994. Starting with addressing the inherited inequalities of apartheid has established a complex and challenging circumstance for meeting basic needs for South Africa citizens. Given the physical and political discrimination of apartheid, meeting the demand for housing has been a central development challenge (Pottie, 2004: na).

Since 1994, the South African government has been trying to establish a sustainable housing process to enable all South Africans to obtain housing with quality, secure tenure, safe and healthy environment. This is to be done in a manner that would make a positive contribution to a non-racial, non-sexist, democratic and integrated society within the shortest possible period (White Paper, 1994: na). The provision of adequate housing for the country's population is a high priority on the agenda of the South African government, because it also creates jobs, improves productivity and raises income (Watermeyer and Milford 2003: 3).

One of the unsurpassed mechanism ever achieved in the national unity government in South Africa, was the crafting of a democratic constitution immediately after the great change in 1994 (Mkuzo, 2011: 27). The constitution became the cornerstone against which the hope of never returning to the past injustices rests. An essential document obliges the government not only to commit to protect the rights of every South African, but also strive towards ensuring that the lives of the poor are improved. One of the areas that it touches on is housing (Mkuzo, 2011: 28).

According to the Constitution of the Republic of South Africa (1996: na) promotes and emphasizes the rights of all South Africans to adequate housing as follows:

- Everyone has the right to have access to adequate housing.
- The state must take reasonable legislative and other measures, within its available resources, to achieve the progressive realization of this right.
- No-one may be evicted from their home, or have their home demolished, without an order of court made after considering all relevant circumstances.
- No legislation may permit arbitrary eviction.

President Zuma has mention Human settlement is not just, it is about transforming the cities and towns and building cohesive, sustainable and caring communities with closer access to work and social amenities including sports and recreation facilities (Parliamentary Monitoring Group, 2010: na).

The Botshabelo Accord which is a landmark of the late Minister of Housing, Joe Slovo stipulates that government must strive for the establishment of viable, socially and economically integrated communities which are situated in areas allowing convenient access to economic opportunities, health, educational and social amenities and within which South Africa's people will have access on a progressive basis to (Mkuzo, 2011: 25):

- A permanent residential structure with secure tenure, ensuring privacy and providing adequate protection against the elements

- Portable water, adequate sanitary facilities, including waste disposal and domestic electricity supply.

2.3.1. HOUSING ROLE

Mkuzo (2011: 21) agrees with Balchin and Rhoden (1998: na) that housing is humankind's most essential material need and usually housing is the largest item in one's personal expenditure. It is also an important determinant of people's quality of life and, next to agriculture, housing normally constitutes the largest single land use. Apart from nourishment, shelter is humankind's most essential material need (Balchin and Rhoden, 1998).

In 1994, it was agreed that housing should play a pivotal role in economic growth and development (Burgoyne, 2008: 15). Housing delivery was seen as a means to kick-start growth with development. According to this view, the delivery of houses satisfied basic needs and simultaneously stimulated the economy (Hassen, 2003: 117). It does so by the imperative role it plays in the economy, by generating income and employment, according to the Macro-Economic Research Group (MERG) (Hassen, 2003: 117). Secondly, housing construction creates demand across sectors with high levels of employment-intensity, with limited demands on the balance of payments and with the potential, in South Africa, to be non-inflationary, since there is ample excess capacity (Hassen, 2003: 117).

According to the Constitution of the Republic of South Africa, act No.107 of 1997 in the areas allowing convenient access to economic opportunities and to health, educational and social amenities in which all citizens and permanent residents of the Republic will, on a progressive basis, have access to (South African Government Information, 2008: na):

- Permanent residential structures with secure tenure, ensuring internal and external privacy and providing adequate protection against the elements.
- Potable water, adequate sanitary facilities and domestic energy supply.

There is also a broad agreement on the fact that housing plays an importance role in everyone's quality of life and health, with respect to considerable economic, social, cultural and personal significance (Erguden, 2001: 2). Hassen (2003: 117) state that according to this view, the delivery of houses satisfied basic needs and simultaneously stimulated the economy. It does so by the authoritative role it plays in the economy, by generating income and employment (Hassen, 2003: 117).

2.3.2. HOUSING CONSTRAINTS

The White Paper discuss under the New Housing Policy and Strategy for South Africa (1994: na) that there are numerous constraints that exist in housing delivery. The White Paper (2004: 13) six years later identifies several constraints, which it states that these are the key constraints that hinder housing development in South Africa. For the purpose of this study, only the relevant constraints are discussed.

The White Paper discuss under the White Paper (1994: na) mentions that the building materials supply, building and civil sector also face significant constraints:

- Inadequate development framework - the lack of identified land, poor access to bulk infrastructure networks and confused and lengthy planning procedures hamper developers' ability to undertake housing development expeditiously.
- Limited capacity - at present, South Africa's construction sector and building materials supply industry are emerging from an economic recession and production slump, significant capacity will have to be built to enable it to deliver the number of houses required.
- Potential bottlenecks - significant potential bottlenecks exist in certain sub-sectors of the construction and building materials supply industries, from the lack of basic and managerial skills and building material production and supply constraints.
- Incompatibility of demand and supply - geographic distribution of demand does not match present location of construction capacity and building materials suppliers.

2.3.3. HOUSING CRISIS

Despite considerable progress that has been achieved in the South African housing sector in the past decade in policy formulation, there is a widening gap between policy formulation and the implementation process, and the status of low- cost housing delivery is far beyond being satisfactory (Watermeyer and Milford 2003: 3). A study by Mbachu and Nkado (2003: 117) recommends a critical review of the functions of the National Home Builders Registration Council (NHBRC) in respect of the routine inspections of the quality of materials and workmanships by the team of the NHBRC inspectors. Such a review is needed to address the problems of poor quality materials and workmanship complained about by housing beneficiaries.

2.3.4. ROLES AND RESPONSIBILITIES OF GOVERNMENT

According to the Housing Act (1997: 107) the roles and responsibilities of the three levels of government with respect to housing are summarised below:

- National government must establish and facilitate a sustainable national housing development process by formulating housing policy. It must also monitor implementation by broadcasting the National Housing Code and establishing and maintaining a national housing data bank and information system.
- Provincial government must create an enabling environment by doing everything in its power to promote and facilitate the provision of adequate housing in its province. Provincial government must act within the framework of national housing policy.
- Local government, i.e. municipal government (e.g. Metropole) must implement policy, settlement planning and the delivery of housing. Every municipality must take all reasonable and necessary steps within the framework of national and provincial housing legislation and policy to ensure that the constitutional housing right is realised. In 2002 the municipal government

received the power to become developers of low-income housing projects themselves.

2.4. HOUSING QUALITY

Achievement of acceptable levels of quality in the construction industry has long been a problem. Considerable amounts of time, money and resources are spent inefficiently to construct inferior quality and less durable houses. The situation is even worse in the case of low-cost and mass housing projects (Kazaz and Birgonul, 2005: 1549). In South Africa many instances of unacceptable construction quality within the home building industry are apparent throughout the low to high – income spectrum of the housing industry (Mahachi, 2004). Studies have showed that 40% of faults in home building relate to site work and fewer than 10% to materials quality. The National Minister of Human Settlement, Tokoyo Sexwale criticised the huge amount of money required by the National Department of Human Settlements to do the reconstruction and remedial work on low-cost housing as a result of poor quality (Sexwale, 2009: 2).

2.4.1. QUALITY DEFINITION

ISO 9001 (2008: na) define quality as a degree to which a set of inbuilt characteristics fulfil the initial requirements of the product or service. Summers (2009: 92) further discuss that people expect a product or service quality as evidenced by performance, features, conformance to requirements, reliability, durability and aesthetics. Summers (2009: 92) also points out that quality is a customer determination which is based on the customer's actual experience with the product or service, measured against his or her requirements.

Mpambane (2008: 13) on his unpublished research integrates Lawrence and Morris measures of quality and identified three areas of housing quality:

- Structural quality, which refers primarily to durability of the house.

- Service quality, which is concerned with the kinds of equipment, facilities, and conveniences which the dwelling provides.
- The state of maintenance and caretaking.

While there are a many definitions of quality, the bottom line is the same. Naoum and Behbehani (2005: 483) study conclude it is evident that quality is the key for achieving customer satisfaction. In the extremely competitive housing market many contractors offer broadly the same range of houses. The principal differentiating factor, in the eyes of consumers is often the quality of the final product.

2.4.2. QUALITY FAILURE

Quality failure of a house in this research refers to structural failure. When a structural failure occurs in a house it often does not denote failure in the entire structure rather implies performance of remedial works. Remedial work, when in process, may cause damage to other work, which has already been completed (Mpambane, 2008: 14). The costs, which have to be considered regarding faults in construction, inter alia, include the following:

- Repair in cases where it is possible and replacement with new work in cases where repair is not possible.
- Reconstruction in cases where actual demolition may be necessary.
- Reconstruction following demolition can also interfere with adjacent new work, and lead to problems of damage, dust, access, and making good the join between old and new work.
- Delay in progress of the project may be one of the less obvious costs but is certainly a real one.

Mpambane (2008: 14) states that under the traditional prevention-appraisal failure (PAF) approach to cost of quality analysis, non-conformance costs are normally grouped into the following four categories:

- Prevention costs - stopping non-conformance from occurring, including education, training and process study.
- Appraisal costs - stopping non-conforming products being shipped, including checks and grading to ensure specifications have been met.
- Internal failures - costs incurred due to scrapping or reworking defective product or compensation for delays in delivery.
- External failures: costs incurred after delivery of a product to the customer ± costs of repairs, returns, dealing with complaints and compensation (ideally, this should also include loss of future business through customer Dissatisfaction).

Mpambane (2008: 15) highlights the hazards highlighted by Blanford, Nelson and Wilcox, (1997: na), which result from improper construction they include the following:

- Unstable or poorly installed foundations that can result in unsafe structures.
- Structures which do not meet minimum weight-bearing requirements or seismic related standards that could collapse.
- Buildings not built to codes that may not withstand the force of winds.
- Improper electrical installations and use of unapproved materials cause injury, deaths, and property loss.
- Improper plumbing installations also create hazards within a structure and can contaminate water supplies.

2.5. QUALITY ASSURANCE

During World War II, the military had many problems with parts not working, not being suitable for use, and failing in use. Military safety and the need for true interchange ability led to development of many military specifications (Faulkner, 2008: 10). During the war, the liberty ships and the victory ships were being built at a rate of about one a week. Unfortunately, they initially had the problem of breaking in half while sailing the oceans. This led to material studies and the adoption of both material and welding specifications. Once these were incorporated into the building

process, the ships stopped breaking in half (Faulkner, 2008: 10). The Japanese adopted the concept of quality assurance and instituted statistical quality control (Faulkner, 2008: 10).

PMI (1996: 192) state that quality assurance is the evaluating of overall project performance on a regular basis to provide confidence that the project will satisfy the relevant quality standards. Perhaps the most important outcome of employing a quality assurance in a project is that it guarantees to keep the project well ahead. PMI (2008: 201) further state that quality assurance is the process of auditing the quality requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used throughout the project.

In the case of low-cost housing construction projects, housing inspectors have been an in essential part of quality assurance. The low-cost housing inspectors ensures that the quality of construction and health and safety of occupancy remain top priorities (National Technical Information Service, 2000: 168). Low-cost housing inspectors enforce and ensure that building standards and regulations are followed and met by the housing contractor during construction.

It must be understood that quality assurance is about independently checking that the project and processes are in place for quality planning and quality control. Quality assurance to be classified as independent, it should be carried out by a third party, working alongside of the implementing contractor and/or consultant (Jewaskiewitz, 2011: 12). That's why housing inspectors have been from the provincial government.

2.5.1. QUALITY ASSURANCE VS QUALITY CONTROL

In the past, there has been a failure in distinguishing between quality assurance and quality control. Rose (2005: 41) explains that quality assurance is used in conversation and writing when the term quality control would be more accurate and more properly applied. This maybe because people are not well informed about the difference between the two. Assuming equivalent meaning, people consider

assurance to be a nicer, less offensive word than control, which may have strongly negative, personal associations. Whatever the reasons for possible confusion, the project team must understand the difference between quality assurance and quality control (Rose, 2005: 41). Both are essential elements of project quality management and both are necessary for project success.

During and after the construction of a house, there are several requirements that need to meet, to see if the house fit for its purpose. Quality assurance in housing is about evaluating the house being if it satisfies the requirements. In cases where the minimum requirements are not met, the procedure offers an opportunity to begin the necessary action to bring the existing conditions up to a level that will be acceptable under provisions of the regulations, that opportunity is called quality control (National Centre for Environmental Health, 2000: 168).

Joseph M. Juran, like Deming, taught Japanese manufacturers how to improve their productivity, stressing the importance of top management commitment to continuous product quality improvement (Schwalbe, 2010: 299). Top management can have the greatest impact on quality of projects by doing a job of quality assurance (Schwalbe, 2010: 299). ISO (9000: 2005) describes the role of top management and emphasises the importance of leadership by top management in implement quality management. The top management must continually review the company's resources to ensure that adequate staff, equipment and materials are available to meet customer requirements (Schwalbe, 2010: 299).

Even though top management have a great commitment in quality, Schwalbe (2010: 301) state that all staffs share the authority and responsibility of identifying noncompliance or possible improvements, and recording these instances such that corrective action can be taken, both to rectify the immediate situation and to prevent recurrence. Bolles and Hubbard (2007: 12) explain that for any quality assurance function to be established, sustained, retained and operated effectively within an organisation; it must have a defined purpose and visible support from the top management.

In case of quality housing delivery May and Wood (2003: 117) state that the inspectors are in the front line of service delivery, charged with the day-to-day interpretation of building regulations and enforcement of regulations. Inspectors decide, subject to the purpose of any given inspection, what to inspect, what changes to require, and whether or not to issue stop work orders or formal notification of violation.

Schwalbe (2010: 299) state that many companies understand the importance of quality assurance and have entire departments dedicated to this area. Performing quality assurance is an execution process that uses data created during the performing quality planning and quality control (PMBOK, 2008: 201). There are three stages of implementing quality assurance:

- Inputs
- Tools and techniques
- Outputs

2.5.2. PERFORMING QUALITY ASSURANCE PROCESS

Performing quality assurance is a process that involves auditing the requirements and the results from quality control measurements to ensure appropriate quality standards and operational definitions are used (PMI, 2008: 201).

2.5.2.1. Quality Assurance Inputs

According to PMI (2008: 203) and Heldman (2011: 256) and there are several inputs to perform quality assurance and they are used to measure the project quality management processes against:

- Quality Management Plan - The quality management plan describes how the project management team will implement the organization's quality policy. The quality management plan is a component or a subsidiary plan of the project management plan. It provides input to the overall project management plan

and must address quality control, quality assurance and continuous process improvement for the project.

- Quality Metrics - A metric is an operational definition that describes what something is and how the quality control process measures it. A measurement is an actual value. the project management team must also indicate whether every activity must start on time or only finish on time and whether individual activities will be measured, or only certain deliverables and if so, which ones. Quality metrics are used in the quality assurance and quality control processes. Some examples of quality metrics include defect density, failure rate, availability, reliability, and test coverage.
- Quality Checklists - A checklist is a structured tool, usually component-specific, used to verify that a set of required steps has been performed. Checklists may be simple or complex. They are usually phrased as imperatives or interrogatories. Many organizations have standardized checklists available to ensure consistency in frequently performed tasks.
- Process Improvement Plan - The process improvement plan is a subsidiary of the project management plan. The process improvement plan details the steps for analysing processes that will facilitate the identification of waste and non-value added activity, this will increase customer value such as:
 - Process boundaries - Describes the purpose, start, and end of processes, their inputs and outputs, data required, if any, and the owner and stakeholders of processes.
 - Process configuration - A flowchart of processes to facilitate analysis with interfaces identified.
 - Process metrics - Maintain control over status of processes.
 - Targets for improved performance - Guides the process improvement activities.
- Work Performance Information - Work performance information, including technical performance measures, project deliverables status, required corrective actions, and performance reports are important inputs to quality assurance and can be used in areas such as audits, quality reviews, and process analyses.

- **Approved Change Requests** - Approved change requests can include modifications to work methods, product requirements, quality requirements, scope, and schedule. Approved changes need to be analysed for any effects upon the quality management plan, quality metrics, or quality checklists. Approved changes are important inputs to quality assurance and can be used in areas such as audits, quality reviews, and process analyses. All changes should be formally documented in writing and any verbally discussed, but undocumented, changes should not be processed or implemented.
- **Quality Control Measurements** - Quality control measurements are the results of quality control activities that are fed back to the quality assurance process for use in re-evaluating and analysing the quality standards and processes of the performing organization.

2.5.2.2. Tools and Techniques

The perform Quality Assurance process has three Tools and Techniques (Heldman, 2011: 257) and (PMI, 2008: 204).

- **Quality Audits** - A quality audit is a structured, independent review to determine whether project activities comply with organizational and project policies, processes, and procedures. The objective of a quality audit is to identify inefficient and ineffective policies, processes, and procedures in use on the project. Quality audits may be scheduled or at random, and may be carried out by properly trained in-house auditors or by third parties to the performing organization. Quality audits confirm the implementation of approved change requests, corrective actions, defect repairs, and preventive actions.
- **Process Analysis** - Process analysis follows the steps outlined in the process improvement plan to identify needed improvements from an organizational and technical standpoint. This analysis also examines problems experienced, constraints experienced, and non-value-added activities identified during process operation. Process analysis includes root cause analysis, a specific

technique to analyse a problem/situation, determine the underlying causes that lead to it, and create preventive actions for similar problems.

- Quality Control Tools and Techniques - The first seven of these are known as the Seven Basic Tools of Quality (PMBOK, 2008: 204):
 - Cause and Effect Diagram - also called Ishikawa diagrams or fishbone diagrams, illustrate how various factors might be linked to potential problems or effects.
 - Control Charts - A control chart's purpose is to determine whether or not a process is stable or has predictable performance. Control charts may serve as a data gathering tool to show when a process is subject to special cause variation, which creates an out-of-control condition.
 - Flowcharting - helps to analyse how problems occur. A flowchart is a graphical representation of a process. Flowcharting can help the project team anticipate what and where quality problems might occur.
 - Histogram - is a bar chart showing a distribution of variables. Each column represents an attribute or characteristic of a problem/situation. This tool helps identify the cause of problems in a process by the shape and width of the distribution.
 - Pareto Chart - is a specific type of histogram, ordered by frequency of occurrence, which shows how many defects were generated by type or category of identified cause.
 - Run Chart - shows the history and pattern of variation. A run chart is a line graph that shows data points plotted in the order in which they occur.
 - Scatter Diagram - shows the pattern of relationship between two variables. This tool allows the quality team to study and identify the possible relationship between changes observed in two variables. Dependent variables versus independent variables are plotted.
 - Statistical Sampling - involves choosing part of a population of interest for inspection. Appropriate sampling can often reduce the cost of Quality Control.
 - Inspection - is the examination of a work product to determine whether it conforms to standards. Generally, the results of an inspection include measurements. Inspections can be conducted at any level.

- Defect repair review - is an action taken by the quality control department or similarly titled organization to ensure that product defects are repaired and brought into compliance with requirements or specifications.

2.5.2.3. Quality Assurance Process Outputs

The perform Quality Assurance process outputs has four outputs (Heldman, 2011: 258) and (PMI, 2008: 205).

- Organisational Process Assets Updates - Elements of the organisation process assets that maybe updated include, but are not limited to the quality standards.
- Change Requests - Quality improvement includes taking action to increase the effectiveness and efficiency of the policies, processes, and procedures of the performing organization, which should provide added benefits to the stakeholders of all projects.
- Recommended Corrective Actions - Quality improvement includes recommending actions to increase the effectiveness and efficiency of the performing organization. Corrective action is an action that is recommended immediately as a result of Quality Assurance activities, such as audits and process analyses.
- Organizational Process Assets Updates - Updated quality standards provide validation of the effectiveness and efficiency of the performing organization's quality standards and processes to meet requirements. These quality standards are used during the perform quality control process.
- Project Management Plan Updates - The project management plan will be updated through the inclusion of a subsidiary quality management plan and process improvement plan. Requested changes to the project management plan and its subsidiary plans are process by review and disposition through the integrated change control process.
- Project Document Updates -Project documents that may be updated include, but are not limited to (PMI, 2008: 205):
 - Quality Audits Reports

- Training Plans
- Process Documentation

2.6. **QUALITY ASSURANCE IN HOUSING CONSTRUCTION**

The South African government's policy on housing for the poor in 1994 was originally based on maximizing the volume of delivery. Many stakeholders have raised concerns regarding the resultant quality of units that have been delivered (Sisulu, 2005: 5).

The report highlights that slightly better quality is achieved where people built their own homes through the "People's Housing Process", but the roll out of such a programme at a large scale may be limited. The report also identifies the need for more environmentally and energy efficient housing (Charlton, et al, 2003: 10), to improve asset value (Charlton, et al, 2003: 53). It identifies the need for long term usage of houses with improved designs, positioning and construction that enables a range of uses (Charlton, et al, 2003: 10), through innovative design (Charlton, et al, 2003: 53). It acknowledges that construction quality improvements research is required but that this should not detract from deeper concerns of location and integrated development (Charlton, et al, 2003: 17). The report also identifies inadequate aftercare from provincial and municipal levels.

According to Harrison (2005: na) the quality assurance systems currently implemented in the low-cost housing sector are:

- Document Control: To ensure employees have the correct procedures and that the procedures are properly maintained.
- Audits: To verify that quality procedures are being followed.
- Non-conformance Tracking: To monitor and track quality issues and those defects are kept from customers.
- CAPA (corrective action and preventative action): To correct flawed processes (i.e. quality procedures) when detected via audits and non-conformance tracking and to prevent defects from reoccurring.

- **Management Review:** Reviewing quality systems data (performance) (quality metrics) to determine if the quality system is working and if it is not, taking the appropriate action to improve the system.

Managing quality in the housing construction industry consists of a range of inspection processes within all the areas in the industry to ensure that the house meets the standards set in the building legislations. The discussion on quality assurance will be divided into pre-construction processes, during construction processes and post-production processes.

2.6.1. QUALITY ASSURANCE IN PRE- HOUSING CONSTRUCTION

CSIR (2005: 12) state that client's requirements are usually translated into a series of specifications that the builder or contractor undertakes to construct through a planning, briefing and design process. Appropriate specifications and compliance with the specifications are therefore key measures of construction quality.

This section looks at the quality assurance before the housing construction takes place.

2.6.1.1. Housing Legislation

In South Africa, the South African National Standards (SANS) 10400:1990 formally known as South African Bureau of Standards (SABS) (1990: na) that is a document issued by the South African Bureau of Standards contains the relevant regulations and the deemed-to-satisfy rules relative to construction. These formed the basis for the development of the National Home Building Registration Council (NHBRC) home building manual (Mpambane, 2008: 3). The intent of the building regulations in South Africa is to provide an acceptable level of safety, health and welfare during the design, construction and use of buildings. The building inspectorate organisation decides to go down the path of enforcing its legislation through inspection (SABS, 1990: 10).

Federation International des Ingenious Counsels (FIDIC) (2004: na) define quality as that which meets and exceeds the requirements of the employer, as specified in the contract documents, complying with law, codes, standards and regulatory policy which apply to the contract.

According to Balchin and Rhoden (2002: 215), there are a range of standards that apply to housing. These standards include building regulations and target standards for new developments. However, there is legislative standard of fitness which provides a benchmark for the assessment of housing conditions and is one of the main triggers for enforcement actions. The legislative standard is based on the minimum fit for human habitation conditions. Criteria must be met if a dwelling is to be considered fit for human habitation to (Balchin and Rhoden, 2002: 215). These cover the following aspects:

- Structural sustainability
- A lack of dampness
- The provision of adequate heating, lighting and ventilation
- Adequate piped supply for water
- An effective drainage system

South Africa has a well-developed, but out-dated, set of technical standards that can be used to describe the standards of material and workmanship for construction works (CSIR, 2011: 12). There are a range of South African National Standards (SANS) and ISO standards that can be applied in housing construction, such as:

- The SANS 1200 and 2001 series of Construction Standards;
- The SANS 1921 series of construction and management requirements for works contracts;
- The SANS 10155 code of practice for accuracy in buildings

CSIR (2011: 12) reported that there are numerous standards relating to products and processes such as roof installations, ceramic installations and plastering installing

and many others. The SANS and ISO standards are managed by the South African Bureau of Standards (SABS) and the SANS standards have been largely developed by industry task team and volunteer support from the associations (CSIR, 2011: 12).

Various technical standards and specification exists in the construction industry. Specifically for housing development the technical standard and specification that exist is the National Home Builder's Registration Council (NHBRC) (CSIR, 2011: 12). NHBRC is a statutory body that aspires to achieve quality to protect homeowners (Department of Housing, 2005: na). It has identified the following quality concerns in house construction in general, but the extent in the context of low income housing is not provided:

- Poor quality bricks
- Insufficient cement in mortar mix
- Poor plaster applications to exterior walls
- Poor storm-water management
- Structural failure due to poor founding conditions
- Incorrect use of brick force
- Incorrect or no brick bonding
- Vertical cracks in plaster – poor quality sand and mix
- Not built to plan
- Poor workmanship
- Structural defects
- Use of substandard building material
- Lack of general maintenance
- Storm-water management control non-existent
- No on-site quality control and supervision
- Sagging and leaking roofs

Furthermore, the Housing Consumers Protection Measures Act (1998: na) has been established to make provision for the protection of housing consumers and to provide for the establishment and functions of the NHBRC. NHBRC has been mandated in terms of the Housing Consumers Protection Measures Act of 1998, to

serve as a statutory body for homebuilders. The launch was part of efforts and interventions to improve the quality of houses in the country and avoid rectification of government built homes in the future. The objects of the Council as set out in the Act are to:

- Represent the interests of housing consumers by providing warranty protection against defects in new homes.
- Regulate the home building industry.
- Provide protection to housing consumers in respect of the failure of home builders to comply with their obligations in terms of the Act.
- Establish and promote ethical standards in the home building industry
- Improve structural quality in the interests of housing consumers and the home building industry.
- Promote housing consumer rights and provide housing consumer information.
- Communicate with and assist home builders to register in terms of the Act.
- Assist home builders, through training and inspection, to achieve and maintain satisfactory technical standards of home building.
- Regulate insurers
- Achieve the stated objects of this section in the subsidy housing sector

2.6.1.2. Design Process

There are several aspects that can contribute to excellent design processes and which can lead to design success. They are the selection of appropriate materials, innovative designs, approving a standard product, selected products and quality of design staff (Wentzel, 2010: 9).

The SFU provides specifically for the selection of professional services for the appointment of design services based on quality criteria (CSIR, 2011: 15). This point out the appointment of the design team is important as the actual design process.

The client is responsible for the selection of the design staff. This task should be carried out in a professional manner, with the same amount of care as in the

selection of the contractor. Although some situations will demand prompt negotiation with a proven team, if circumstances allow, proposals should be sought from three to six consultants. The information submitted by the consultants should include the design and supervision methodology as well as a fee proposal (Ashworth and Hogg, 2007: 440).

Wentzel (2010: 9) further states that the consultant should make sure that the people writing specifications and making product selections are of the appropriate calibre. The design team must be kept up to date with current standards, regulations and detailing applications. There must be in place some form of quality management with regime of checking all work leaving the office. Therefore if selection of inappropriate materials, innovative design, approving a defective product, client-selected products and quality of staff are not constantly examined, quality assurance will be compromised.

Today everything is made of some material, but it is not only the properties of materials that dictate poor performance or the failure of structures. It is through the rational use of mechanics, linked with intelligent material choice-part of a process called design, which will assure success (Rossmanith, 2012: 561).

Problems can arise when the designer selects an inferior product or a good product, but which is not suited to its specific application. This problem also arises because of the workload or inexperience of the designer, which leads to improper evaluation taking place of the product being specified. In addition, smaller design consultancies cannot afford to keep a full technical and product library and those that can will often have staff who still keep by their desk their own personal library which soon becomes out-dated (Wentzel, 2010: 9).

In today's lifestyle, designers like to produce modern computer-generated designs and in so doing, sometimes use materials in a way that they have not been used before or use new materials that have not been tried and tested. The risk of failure in one way or the other when incorporating innovative design is high and requires above-average skill and care from the designers themselves to succeed (Wentzel, 2010: 9). Douglas and Ransom (2007: 16) postulate that there is of course nothing

wrong with introducing new products and processes in construction. The main requirement for doing so is that they are adequately tried and tested, and that those installing them are aware of any special fixing requirements.

Within specifications produced by the designer a product may be specified with the option for the contractor to offer an alternative product of equal standard and quality for approval. Complications come about when comparing the two products in every respect. Therefore the product that the designer specifies originally, is a product which the designer has confidence in. When the designer is offered an alternative product he or she must take great care in evaluating it. If this is not done, quality will be compromise (Wentzel, 2010: 9). Furthermore when compromising quality, threats to structural failure are almost a certainty, which in turn is thought of as an unplanned or unintentional negative effect of one or a combination of faults, which leads to a shortfall in structural performance (Douglas and Ransom, 2007: 16).

Wentzel (2010: 11) state that clients are well informed when it comes to construction and hence know what they want and take decisive steps to achieve it. Some know nothing about construction and need help and guidance to formulate their wishes and match them to the available budget. Now and then, the client will select a particular product and ask the consultant who will be the designer to incorporate it into the project. The potential problem here is that the consultant is not aware of the product and that there is insufficient information available from the manufacturer to give the designer confidence in selecting the product. Alternatively the product could be of inferior standard and not appropriate to the application. Another scenario is if the project is over the budget, which is available and the consultant is instructed to make cost savings by changing the specifications to a lower cheaper standard (Wentzel, 2010: 9).

2.6.1.3. Procurement Process

Ashworth and Hogg (2007: 440) postulate that procurement is the process, which is, utilise to deliver construction projects. The Royal Institution of Chartered Surveyors Foundation (RICS) (2002: na) adds that procurement facilitates the formal configuration and realisation of a project, where a project is define as the investment

of resources for return. In the context of construction, procurement deals with the arrangements for acquiring construction goods and facilities by various clients, is it private individuals, corporate establishments or public institutions.

CSIR (2011: 19) reported that the procurement process together with the actual process of construction, have the largest impact on construction quality. CSIR (2011: 19) further state that the key factors within the procurement process that influence construction quality are:

- The ability to match a contractor's capabilities to the requirements of the project; and
- Political interference, cronyism, and fraud and corruption.
- Wentzel (2010: 9) mention three different types of procurement, which are:
- Traditional – In this system, the design should be complete before tenders are invited and the main construction contract is awarded.
- Design and Build - In this system the client approaches the contractor directly without approaching the architect. With this method of procurement the contractor accepts the risk for the design element of the project.
- Management Contract - this system the client appoints the managing contractor at an early stage so that the contractor's expertise can be brought in to assist the development of the project during the procurement phase.

CSIR (2011: 19) mention that matching a contractor's capabilities to the requirements of the project depends largely on:

- The ability to recognise a contractor's capabilities
- A procurement system that provides for the recognition of a contractor's capabilities.

The cidb and CSIR (2007: na) requires that the Board must establish a national register of contractors, which categorises contractors in a manner that facilitates public sector procurement and promotes contractor development. The aim of the cidb Register of Contractors is not only to facilitate public sector procurement, but

also it is mandatory that only cidb registered contractors be used for public sector procurement. This process excludes the contractors for home building (cidb, 2007: na).

The contractors for home building must be registered with the NHBRC and a contractor's registration is evaluated in terms finance, technical, construction and management (CSIR, 2011: 19). CSIR (2011: 19) further mention that the low quality observed in the low-cost housing sector, the credibility of the NHBRC contractor registration system is certainly in question.

2.6.2. QUALITY ASSURANCE DURING HOUSING CONSTRUCTION

CSIR (2011: 31) mention that during construction related barriers to quality are namely process issues, skills and competence issues, as well as the effectiveness of the client's representative in ensuring compliance by the contractor with the client's quality specification.

This section looks at the quality assurance during the housing construction.

2.6.2.1. Skills and Competence

The survey undertaken for this study on construction quality clearly highlights the importance of skills, and education and training, in attaining quality (CSIR, 2011: 33). Shortages of skilled artisans and first level supervisory staff are impacting negatively on construction quality.

While many of the larger contractors are implementing programmes to address their skills requirements, smaller contractors, and in particular new entrants, generally do not have the resources necessary to address these quality factors (CSIR, 2011: 33). CSIR (2011: 33) reported that currently an intervention is being implemented or under development which include the following:

- The skills development component of the Construction Charter;

- The cidb Requirements and Guidelines for Contractor Competence Assessment, which sets competence standards for contractors and site supervisors;
- The cidb Requirements and Guidelines for Indirect Targeting for Enterprise Development of Sub- Contractors, which promotes skills development;
- The cidb Building Skills Policy under development, requiring skills development leading to nationally accredited outcomes on qualifying public sector contracts
- The cidb construction industry ESDA currently being piloted, which facilitates the placement of unemployed learners.

2.6.2.2. Time

Chan and Chan (2004: na) postulate that time in the construction industry refers to the duration to complete the project. It is schedule to allow the building to be in use by a date determined by the client's plans. Ashworth and Hogg (2007: 440) mention that project duration or completion dates may be critical to the success of a project and in some situations if these dates are not meet due to poor workmanship, it could lead to total failure in meeting the clients' objectives.

Ashworth and Hogg (2007: 440) further state that while most clients' desire early building completion, it is important to distinguish between this and true need since attempting to meet the objectives of early completion is likely to have consequences such as poor workmanship which is not a project requirement. In conjunction with this, unrealistic deadlines and bonus work encourages workers to rush their jobs, which often leads to unnecessary mistakes or skimping on standards (Douglas and Ransom, 2007: 112). In general, clients could have the highest standards specified for their projects but through time constraints which contribute to poor workmanship; this will bring about a low quality product.

2.6.2.3. Cost

The cost of a product, whether it be a simple one like a length of timber or a complex item like a building, is the sum of all payments made to the factors of production engaged in the production of that product (Wentzel, 2010: 12). Wienand (2006: 111) mention that when manufacturing a quality product, providing a quality service, or doing a quality job with a high degree of customer satisfaction is not enough. The cost of achieving these goals however must be carefully managed, so that the long-term effect on the business, be it construction, is a desirable one.

When reducing cost in any construction project, workmanship and quality are often compromised (Wentzel, 2010: 9). Ashworth and Hogg (2007: 440) however postulate that if a limited capital budget is the prime consideration of the client, then the quality in the form of reduced specifications as well as workmanship is likely to be restricted. If the clients cost increases, a higher standard of workmanship will be specified (Ashworth and Hogg, 2007: 440).

Regular cost reports should be produced throughout the construction stage of the project. From these, potential overspending can be identified before it occurs and corrective action taken. The client should however, recognise that such corrective action is not always beneficial since it is likely that cost savings can be made only by reduction in standard which includes a lower standard in workmanship produced (Royal Institution of Chartered Surveyors Foundation, 2002: na).

2.6.2.4. Quality

Chan and Chan (2004: na) confer that in the construction industry, quality is defined as a totality of features required by a product or service to satisfy a given need. However the way in which quality is determined is by the extent to which a product or service successfully serves the purpose of the user during usage. Price and delivery are both transient features, whereas the impact of quality is sustain long after the attraction or the pain of price and delivery has subsided (Hoyle, 2006: 8). Nowadays, quality is the guarantee of the product that convinces the customer or the end-user

to purchase or use. The meeting of specifications by good workmanship is one way of measuring quality.

Specifications act as workmanship guidelines provided to the contractor by the client or the client's representative at the commencement of the project. If quality assurance mechanisms, such as benchmarking is not in place during construction, poor workmanship will be the end result affecting the quality directly (Ashworth and Hogg, 2007: 440).

2.6.2.5. Inspection Process

Inspection process is the most vital process in assuring quality during the construction of housing. The term housing inspection is generally understood to mean a close-up observation of actual conditions that exist in a dwelling and on its premises. It is usually carried out by a trained, qualified, and competent appointed official to determine whether the observed conditions meet the minimum requirements specified by the local housing regulations or authorities. In cases where the minimum requirements are not met, the inspection procedure offers an opportunity to begin the necessary action to bring the existing conditions up to a level that will be acceptable under provisions of the regulations (National Centre for Environmental Health, 2000: na). Inspectors are in the front line of service delivery, charged with the day to day interpretation of building regulations and enforcement of regulations. Inspectors decide, subject to the purpose of any given inspection, what to inspect, what changes to require, and whether or not to issue stop work orders or formal notification of violation (May and Wood, 2003: 117).

Within South Africa, the client's agent is responsible and accountable for accepting that the contractor has delivered the construction works to specification. Where such work has not been delivered to the required specification, the client's agent has the right to ensure that the contractor undertakes the necessary remedial action. The client's agent is therefore the primary mechanism to ensure compliance with the client's specification (CSIR, 2011: 35).

May and Wood (2003: 117) further state that building inspection differs in two key respects from other regulatory functions. For most regulatory functions the frequency and timing of inspections are highly variable because of employment limitations. Building inspections differ from the norm in that inspection of compliance to building regulations are both certain and frequent. Each newly constructed building structure is inspected at several points in the construction process in order to obtain an occupancy permit. A second difference is that whereas for most regulatory settings inspection is primarily aimed at preventing harm in the first place, building inspection is aimed at identifying and rectifying problems. Inspectors expect to find problems for which the inspection process is typically viewed by both inspector and homebuilders as a form of quality control.

CSIR (2011: 35) further mentions that in relation to the role of the client's agent, this dissatisfaction with the quality of construction can be attributed to several factors, including:

- A lack of skills or experience of the client's agent
- The client overruling the client's agent.

Similarly, houses enrolled with the NHBRC are also required to be inspected to check for compliance with the NHBRC home building technical manual. Inspections of subsidy housing are undertaken by the NHBRC itself, while inspections of housing other than the subsidy sector have been outsourced to agencies (CSIR, 2011: 35). Research and subjective information suggests that the capacity of the NHBRC inspectorate is severely lacking. Recent study by Mpambane (2008: na) into the role of the building inspector on construction in the homebuilding industry in the Gauteng and Western Cape provinces considered inspectors not only from the local authorities, but also inspectors from the Department of Housing and the NHBRC.

Mpambane (2008: 16) agrees Cordova and Webb (2005: na) that the proper functioning of a society and economy is dependent upon the existence of appropriate approaches for ensuring that businesses comply with legislation and regulations. If these approaches are not in place, the protection of the public welfare can be

significantly jeopardized, and the ability of citizens and businesses to carry on their everyday activities in a normal manner can be effectively undermined. Inspections conducted by public officials, when carried out in a fair, efficient and effective manner, with appropriate accountability, accessibility and transparency, play an important role.

Cordova and Webb (2005: na) also state that for inspections to be effective and credible, public transparency, accessibility, and accountability of the initiative and its on-going operation are to be nurtured from the beginning. These concepts are expanded below namely:

- Public transparency refers to the ability of members of the public, the private sector, and other interested stakeholders to obtain accurate and comprehensive information concerning how the program operates. Failure to provide such information leaves the program open to assertions that it is undermining public policy objectives, and that special arrangements are being made that favour some parties over others.
- Accessibility refers to the ability of firms who are subject to the program or potentially so, and those that are benefited by the program, to participate in program decision-making in a meaningful and appropriate manner, including establishing the level of the standard. If, for example, a particular factory cannot determine who is administering a program, and cannot obtain the appropriate information to obtain a certificate, then the program is not accessible to that factory. If a worker or community member is negatively affected by the program's operation, or wishes to bring a possible incident of non-conformity to the attention of those responsible for program administration, and cannot do so, then the program is not accessible to that stakeholder either.
- Accountability refers to the answerability for a program's operation, should problems arise. It is essential that the government and non-governmental parties responsible for program operation are clearly identified. In addition the consequence for failure to properly administer the process to ensure that the

bodies responsible for program operation properly administer the program is provided.

The inspection procedure is considered a technique, which is used in concert with other techniques. It intended to improve continually the housing quality throughout the housing sector. The inspection procedure, if properly used, is an effective tool in achieving code compliance. The following are the benefits of inspection identified by the National Centre for Environmental Health (2000: na):

- It provides a reasonably accurate measurement of actual dwelling and premises conditions to indicate improvement or slippage in housing quality when compared with previously collected data.
- It provides a convenient opportunity for consultation to take place between the occupant and the inspector regarding conditions that do not meet code requirements.
- It provides a means of measuring the effectiveness of techniques, such as use of neighbourhood improvement projects, which may also be employed to help improve community housing quality.
- It provides information that can be later used if some form of legal action becomes necessary to bring about code compliance.

The focus of the inspection process is primarily related to the improvement of the housing quality rather than to the mere enforcement of a housing regulation (National Centre for Environmental Health, 2000: na).

2.6.3. QUALITY ASSURANCE IN POST- HOUSING CONSTRUCTION

South African Housing Information (2000: na) agrees that there is extensive evidence that housing consumers are not adequately informed of their rights and corresponding obligations, and that relevant housing information is not readily accessible. This has resulted in exploitation of housing beneficiaries. To protect the rights of the beneficiaries, after the house has been completed, quality assurance continues in the form of quality audits by analysing finished house.

A quality audit is a structured, independent review to determine whether project activities comply with organizational and project policies, processes, and procedures. The objective of a quality audit is to identify inefficient and ineffective policies, processes, and procedures in use on the project (PMI, 2008: 203). Quality audits may be scheduled or at random, and may be carried out by properly trained in-house auditors or by third parties to the performing organization. Quality audits confirm the implementation of approved change requests, corrective actions, defect repairs, and preventive actions (Heldman, 2011: 256).

Glock and Kunz (2005: 219) describe quality audits as a means of evaluating the level of defects of a particular plant in order to ensure that defective garments are prevented from entering the distribution centre. The auditor evaluates and records the number of defects as major or minor defects as well as the appearance of the finished house.

2.7. HOUSING CONSTRUCTION INSPECTORS

The best legislation, designs and contracts will be of little use if those responsible for monitoring compliance during construction fail to carry out their tasks (Yates, 2002: 04). According to SABS (1990: 47), inspection means the general inspection by a competent inspector of a system or measure or installation of a building, or part thereof, at such intervals as might be necessary in accordance with accepted professional practice to enable such competent person to be satisfied that the design assumptions are valid, the design is being correctly interpreted and the work is being executed generally in accordance with the designs, appropriate construction techniques and good practice, but shall exclude detailed supervision and day-to-day inspection.

A competent inspector means a person who is qualified by virtue of his or her education, training, experience and contextual knowledge to make a determination regarding the performance of a building or part thereof in relation to a functional regulation or to undertake such duties as may be assigned to him or her in terms of

these regulations (SABS, 1990: 46). According to American Society of Home Inspectors (ASHI) (2007: 6) housing inspectors do not just perform housing inspections, but they also write housing inspection reports. Inspectors are in the front line of service delivery, charged with the day to day interpretation of building regulations and enforcement of regulations and are expected to be physically fit, adequately equipped and very competent to carry out inspections (May and Wood, 2003: na).

2.7.1. EDUCATION

In almost any field of endeavour, it is widely accepted that education plays a key role in professional development (Mpambane, 2008: 3). According to ASHI (2007: 8) and (1990: na), the general or basic formal education requirement for any individual desiring to enter the housing inspection profession should be a matriculation certificate or its equivalent. Mpambane (2008: 3) further states that the qualifications and professional status of building inspectors were identified as a major concern in a study by the Business Roundtable that examined factors affecting the ability of building departments to administer and enforce building regulations effectively.

2.7.2. CONTINUATION EDUCATION AND TRAINING

The homebuilding industry is constantly evolving as new materials and techniques are introduced and housing inspectors must be aware of these changes (ASHI, 2007: 8). According to SABS 1990: na), to ensure that the housing inspectors are knowledgeable, additional education and training must be an essential requirement of any regulation. ASHI (2007: 8) further states that to enforce building regulation, continuing education and/or technical training can increase and standardise skills of housing inspectors and also assures consumers that housing inspectors are staying current. For lack of adequately trained housing inspectors contributed to inconsistent administration and enforcement of building codes and unwarranted delays resulting in increased project costs and needless aggravation (Mpambane, 2008: 4).

Though many localities require the inspectors to be a licensed architect or engineer, the technical skill involved in code administration does not always require the degree

of engineering competence and professional development of a licensed architect or engineer (Mpambane, 2008: 36). Continuing education and training is needed to help prevent sub-standard enforcement and to open doors to careers in code enforcement and a good inspector is to be well versed in management and code-related legal concepts. Training in these regard is rarely included in professional design curricula (Mpabmbane, 2008: 37).

2.7.3. EXPERIENCE

According to the SABS (1990: na), for anyone to carry the duties of an housing inspector and enforce National Building Regulations they must be in position of a three years experience post-matriculation certificate in the Built Environment. The housing beneficiaries must be assured that the housing inspectors caring the inspection are experienced (ASHI, 2007: 8). ASHI (2007: 8) further states that experience of housing inspectors demonstrate their ability to apply the knowledge and skills gained and applied.

2.7.4. KNOWLEDGE OF LEGISLATION

The South African Bureau of Standards (SABS) formally known as South African National Standards (SANS) contains the relevant regulations and the deemed-to-satisfy rules relative to construction. These regulations form the basis for the development of the National Home Building Registration Council (NHBRC) home building manual (SANS, 1990: na). The intent of the building regulations in South Africa is to provide an acceptable level of safety, health and welfare during the design, construction and use of buildings. Individuals performing housing inspections must demonstrate knowledge of each component and system of the home (ASHI, 2007: 8). For linking a technical failure or breach with legislation and prepare a case for presentation in a court or other formal hearing in a legally admissible form is not so simple, for knowing that a contractor has done something wrong is not good enough (Mpambane, 2008: 3).

2.7.5. CODE OF ETHICS

According to ASHI (2007: na), any government regulations must include ethical standards. The public must be assured that the housing inspector is independent and has no hidden alliances or conflicts of interest. Code of ethics is critical for the home inspection profession, and faithfulness to a code of ethics will not just protect both the public and the housing inspector from outside influences, but will also ensure that consumers are treated in a fair, impartial and professional manner (ASHI, 2007: na).

2.8. IMPACT OF POOR QUALITY HOUSING DELIVERY

Poorly built houses impacts negatively on the government' striving towards sustainable development. South Africa is a resource scarce country and every available rand in the government's coffers needs to be spent as wisely as possible. This section focuses on the cost effect incurred by the South African Government as a result of poor quality housing delivered to beneficiaries.

It is vital to highlight that the fundamental worth of housing programmes cannot only be measured in terms of the amount of units delivered, but the quality of the units being delivered (Hassen, 2003: 11). The Human Settlement Minister, Tokyo Sexwale has recently invited the demolition squad to help him remove the decay houses (Fin week, 2011: na). After a national housing audit, the Human Settlement Minister is preparing to spend 10% of 2011 housing budget tearing down and reconstructing badly built government houses. The minister has acknowledged that corruption is a problem in his department (Fin week, 2009: na).

The department of Human Settlement has spent R863.9 million on nationally fixing more than 131 000 low-cost houses and rebuilding 368 in the last financial year. The department has to demolish and rebuild poorly build houses totalling to 2489 in the 2010 to 2011 financial year. More than 5000 houses with faults will be fixed in the 2010 to 2011 financial year at a cost of R971.1 million. About 386 houses nationally

have been demolished and rebuild in the last financial year at a cost of R14.3 million (South African Government Information, 2012: na).

So far 131380 houses have been corrected, these houses did not need to be rebuild but certain aspects had to be fixed so that they conformed to quality standards. It cost the government R849.6 million to correct poor workmanship. Gauteng has the highest number of correction works with 117 451 units that had to be fixed in the last financial year at a cost of R528 million. Another 4 010 houses still have to be repaired in the 2010 to 2011 financial year at a cost of R18 million. The Eastern Cape and Northern Cape are also proving to be expensive with R73 million spent and R300 million still to be spent in this financial year fixing bad workmanship (Kathu Gazette, May 20, 2010).

CSIR (2011: 23) reported that an empirical study undertaken in 2005 indicated significant areas of concern developing with regard to ethical standards practiced within the South African construction industry. The range of ethical problems identified include collusion, bribery, negligence, fraud, dishonesty, and unfair practices of which significant parts of the issues resided with contractors among other identified participants in the construction process. It is notable that Architects (100%), Quantity Surveyors (94%), Consulting Engineers (67%), and Contractors (60%) all stated that they have observed / experienced professional negligence in South African construction with poor material quality and poor workmanship indicated as the most frequent professional negligence (CSIR, 2011: 23).

Corruption in the low-income sector in particular has been reported that on widely in the press and other media, and Minister Tokyo Sexwale recently provided an update on his department's anti-corruption investigations (Mkuzo, 2011: 3). The Minister further state that department was taking civil and criminal action against companies, developers or contractors who had built flawed houses for the government housing schemes.

2.9. CONCLUSIONS

The literature review has revealed essential aspects that affect housing in general. It has also highlighted key factors that point to the South African housing problems and government's commitment of providing adequate housing for everyone.

Even though progress has been made on the provision of housing, poor quality housing has been a huge step back for the government and development. As a result of shoddy workmanship, unsuitable material and bad construction methods, many houses delivered to beneficiaries have to be demolished, rebuild and those with minor defects have been fixed. It can be deduced that the need for quality assurance in construction of low-cost housing is easy to demonstrate, due to project delays, finger pointing, lost time, cost and other quality issues that have been raised in newspapers, industry journals and political debates over the past years. Many of these issues pointed to the Human Settlement Department, low-cost housing sector. Poorly built houses impacts negatively on the government' striving towards sustainable development.

3. CHAPTER THREE - RESEARCH METHODOLOGY

3.1. INTRODUCTION

Research methodology is the principles and values, philosophies and ideologies that underpin the research (Holmes, 2005: 21). Silverman (2000: 79) further states that methodology is how one will go about studying any phenomenon. According to Mkuzo (2011: 58), it is impossible to conduct a meaningful research without a plan or a road map on how research is to be carried out.

The methodology that was used to achieve the research objectives mentioned in chapter one is presented in this chapter. The research methodology used comprises of the research approach, area of study, population, sampling and data collection method and data analysis method.

3.2. RESEARCH DESIGN

Bless and Higson-Smith (2000: 63) describe a research design as a carefully thought out strategy assisting the researcher to achieve the objectives of the research. Kruger and Welman (2001: 46) also argue that a research design is the plan according to which one obtains research subjects and collects information.

Therefore, undertaking a research it is important and it requires a careful and scientific planning. It is impossible to conduct a meaningful research without a plan on how the important factors such as information gathering, population sampling, data collection and analysis are to be carried out (Mkuzo, 2011: 58).

According to Miller and Salkind (2004: 49) any meaningful research design is constructed with the following principles in mind and these principles have been considered in constructing the research plan used in this research:

- Research design is presented in all researches, uncontrolled or controlled and subjective or objective. It is not a case of scientific or not scientific, but rather

one of good or less good design. The degree of accuracy desired, the level of proof aimed at, the state of existing knowledge, all combine to determine the amount of concern one can have with the degree of science in one's design.

- The proof of hypotheses is never definitive. The best one can do is to make more or less plausible a series of alternative hypotheses. In most cases, multiple explanations are given. Demonstrating one's hypotheses does not rule out alternative hypotheses and vice versa.
- There is no such thing as a single correct design. Different researchers will come up with different designs favouring their own methodological and theoretical predispositions.
- All designs represent a compromise dictated by the many practical considerations that go into social research. None of us operates except on limited time, money, and personnel budgets. Further limitations concern the availability of data and the extent to which one can impose upon one's subjects.
- The research plan presented is constructed for a perfect research. If in the course of this research things do not go as planned, all the issues that arise, a planned of action shall be constructed then.

In conducting this research a quantitative research method used by the researcher to investigate the state of housing inspection in assuring quality in low-cost housing construction projects, explain whether the housing inspectors add value to quality assurance in low-cost housing construction projects and also capture the true feelings and perceptions of the respondents regarding the current inspection applied in low-cost housing construction.

3.2.1. QUANTITATIVE RESEARCH

The quantitative research method is essentially about collecting numerical data to explain particular questions and analyse the data using the right data analysis tool (Sagepub, 2010: 2). The American Psychological Association (2007: 69) further explains that quantitative research involves studies in which the data are analysed in the form of numbers. In this research approach, behaviours are counted, correct

answers or errors are counted, and other types of measures are recorded in terms of quantity. Bouma (2001:19) states that quantitative research is used to answer questions on specific things.

As according to Neuman (2001:123) and Bryman and Bell (2007:154), the researcher characterised the quantitative research as follow:

- Can be used to measure the research hypothesis or answer research questions.
- Concepts are shown as separate variables.
- Measures are put in place before the collection of data.
- Data is presented in the form of numbers from accurate measurement tools.
- Standard procedures are used and replication is acceptable.
- This is followed by the analysis of data using various mathematical techniques in order to illustrate the relation to the objectives.

Quantitative research method is good at providing information in breadth, from large number of units, but when the researcher wants to explore a problem or concept in depth, quantitative methods can be too shallow (Sagepub, 2010: 8). Hence the use of open-ended, closed-ended and scaled-response questions in a quantitative research method provided some advantages in this research (Northon, 2007: 120).

3.2.1.1. Open-Ended Questions

Frazer and Lawley (2000: 26), describe open-ended questions as being suitable when the researcher wants precise information but the answers may be difficult or too lengthy to list. Respondents are encouraged to have freedom of expression. It is best to limit the use of open-ended questions in large scale survey as they are time-consuming and difficult to analyse.

In this research the open-ended questions were used by the researcher because they provided the following advantages (Northon, 2007: 120):

- Respondents are free to convey how they feel.
- It is not necessary to list all possible answers.
- Give respondents an opportunity to answer in their own words.

3.2.1.2. Close-Ended Questions

Close-ended questions either provide two alternative responses, for example the yes or no answer. Or a list alternative response is provided for the respondent to select from (Frazer and Lawley, 2000: 26).

In this research the closed-ended questions were used by the researcher because they provided the following advantages (Northon, 2007: 120):

- Both respondents and researcher finds them easier to use.
- It is easier to recognise a response than to remember it.
- Gathered data can be easily analysed.
- Responses do not vary much and can be meaningfully prepared.
- Response rate is higher as more questions are answered.

3.2.1.3. Scaled-Response Questions

Frazer and Lawley (2000: 28), describe scaled-response as the use of a scale to measure the attributes of the construct. The respondent can choose whether they agree or disagree with a question that has been asked.

In this research the scaled-response questions were used by the researcher because they provided the following advantages (Northon, 2007: 120):

- Where information is difficult to quantify they are useful.
- Useful to use for sensitive topics.
- Easy to use.
- It is possible to reword items to check reliability.

3.3. RESEARCH AREA AND POPULATION

A research area is an extent or region of the where the research will be conducted (Oxford, 2013: na). The research area for this research was limited to the South African Metropole. For the Metropole are areas where the municipalities execute all the function of local government (South African Government Information, 2009: na). There are eight Metropole in South Africa. The research focused on the City of Cape Town Metropolitan Municipality for a research study.

According to Madzidzela (2008: 40) population is the larger group of all the people of interest from which the sample is selected. It is a group or a class of subjects, variables, concepts or phenomena. Population eligibility criteria specify the characteristics that people in the population must possess in order to be included in the study (UNISA, 2013: na). The population that participated in this research are the Human Settlement low-cost housing inspectors, with experience between 0 and 30 years.

A valuable importance of identifying the research area and population is that it enables a researcher to connect the research to the literature (Punch, 2006: 22).

3.4. SAMPLING AND SAMPLING PROCEDURE

Sampling refers to the process of selecting a portion of the population to represent to the entire population (Madzidzela, 2008: 40). According to Bless and Higson-Smith (2000: 86) a sample is the subgroup of the whole population which is actually investigated by the researcher and whose characteristics will be generalised. Kumar (2005: 164) further state that sampling is the process of selecting a few from the bigger sampling population to become the basis for estimating or predicting the prevalence of an unknown piece of information, situation or outcome regarding the bigger group.

The following elements of the sample were considered during the research as in according to Xesha (2013: 47):

- The sample must represent the population
- The sample must be of a reasonable size to enable the researcher to generalise his or her findings to that population.
- Anyone in the population can be included in the sample.

The sample for this research is the low-cost housing inspectors working for the Western Cape Human Settlement, under the City of Cape Town Metropolitan Municipality. The low-cost housing inspectors participated in this have an experience between 0 to 40 years in housing inspection.

3.5. DATA COLLECTION

Data collection instrument refers to the instrument that the researcher uses in gathering data from the participants (Makumu, 2007: 13). According to Gomez (2010: 1) the data collection instruments include questionnaire, interview, focus groups, observation and reading.

For in the literature review part of this research, information was obtained from books, research papers, media statements and the Internet. In conducting the research from this point onwards, the instruments that were used in obtaining the necessary information for this research are outlined below:

- A request for permission to conduct the research on the low-cost housing inspectors was sought from the Peoples Housing Empowerment Process Director. Refer to appendix 3 for the permission letter.
- The letter outlining the reasons for the research and also seeking participates consent for the research was forwarded to research participates beforehand and accompanied by the questionnaire. Refer to Appendix 1 for the consent letter.
- The questionnaire was prepared in such a way that it covered the research questions and the specific objectives of the research. Refer to Appendix 2 for the prepared questionnaire. All respondents received the same set of

questions in an attempt to maintain standardization. The questionnaires were self administered to the respondents. The completion and return time line for the questionnaires was agreed upon between the researcher and the participants beforehand.

3.6. ETHICAL CONSIDERATIONS

Apart from instrumentation and procedural concerns, collecting data from participants raises ethical concerns. These concerns include avoiding harm to people, privacy, respecting people as individuals and not subjecting them to unnecessary research (Madzidzela, 2008: 42).

The American Psychological Association (2007: 56) comment on the issues of ethic when conducting research by suggesting the following:

- Consent involves the procedure by which an individual may choose whether or not to participate in a study. The researcher must ensure that the participants understand that they have a right to withdraw from the study at any time.

A request for permission to conduct the research on the low-cost housing inspectors was sought from the Western Cape Human Settlement, Peoples Housing Empowerment Process Director. Refer to appendix 3 for the permission letter. The letter outlining the reasons for the research and also seeking participates consent for the research was forwarded to research participates beforehand and accompanied by the questionnaire. Refer to Appendix 1 for the consent letter.

- In the context of research ethics, harm may be broadly defined to include extreme physical pain or death, but also involves such factors as psychological stress, personal embarrassment or humiliation, or myriad influences that may adversely affect the participants in a significant way.

This researcher has taken reasonable steps to avoid any form of harming to the research participants and to others whom they work with.

- As with other ethical considerations, privacy has become an increasingly valued right. Seeking privacy is an act of seclusion or confidentiality - removed from public view or knowledge. The researcher is responsible for ensuring that the identity of the participants will be treated with strict confidentiality.

In this research participants shall be assured that they will not be identified in this research. This shall be done by not asking any participants' name, identity number or employ number. No identity of any participants shall be mentioned in this research. All the information obtained from participants it be used for no purpose other than the experiment for which it was intended for.

- Research deception involves an intentional misrepresentation of facts related to the purpose, nature, or consequences of an investigation. In this context, deception refers to either an omission or a commission on the part of the researcher in terms of interactions with participants. The researcher has to ensure that facts related to the purpose, nature, or consequences of the research are not misrepresented.

All information about the research was made available to the participated beforehand, so that they can make a decision about participating. They were not misled.

- The researcher should ensure that the participants are not coerced into participating.
- The research should have value – the research should be considered in terms of its usefulness in contributing to the advancement of human knowledge. If the research has no purpose, it should not be done.

When this research has been complete the researcher will complete his Masters in Project Management. This research will form part of the university's library and there is a possibility of being published in a journal.

Hence before commencing with the research a permission to conduct a research at the department of Human Settlement was obtained by the researcher. In the questionnaire provided to the participants, at the beginning there was a section required that the participant give consent to be used as one of the participants. It was also indicated to them in the questionnaire that if they did not give their consent,

that they must please discontinue with the questionnaire. The researcher also ensured that the respondents are aware their liberty to withdraw from the research at any time. No personal details were asked on the questionnaire and this research does not mention information that can give the identities of the individual who are participants of this research. This measure also ensures that the participants are protected from any harm, both physical and psychological. A letter was attached to the questionnaire explaining the details of the researcher and the research, these included what was the research about and what was is going to be used for. The researcher also understood that the respondents need to be treated with respect and every possible precaution was taken to protect them from harm.

An ethical clearance was required for this research. The researcher did apply for ethics clearance through the faculty of ethics committee of Cape Peninsula University of Technology and it was approved.

3.7. DATA ANALYSIS

Data analysis is a process of inspecting, cleaning, transforming, and modelling data with the goal of highlighting useful information, suggesting conclusions, and supporting decision making (Ader, 2008: 333). There are varieties of techniques for data analysis, because there are different questions to be addressed and different versions of social reality that can be expanded on (Punch, 2005:194).

Once the researcher has completed the data collection, the next step is to organise the data into a manageable format. This allows the researcher to prepare the data for analysis. In this research, after data was collected, it was captured on a Statistical Package for Social Sciences software package. The IBM Statistical Package for Social Sciences (SPSS) Statistics 21 version was provided by university. Statistical Package for Social Sciences assisted with analysing the data collected. The results will be presented in the form of tables and graphs.

3.8. CONCLUSION

A road map of how the entire research was conducted is presented in this chapter. A clear framework regarding the procedure employed in this research for data gathering, processing and analysis data is given in detail. The research area which was the Metropole, population which was the low-cost housing inspectors, ethical consideration was approved by university ethics committee, data collection method that was used was a questionnaire and the collected data was analysis using Statistical Package for Social Sciences (SPSS) software package. The findings of this research in detail results are presented in the next chapter.

4. CHAPTER FOUR – PRESENTATION OF FINDINGS

4.1. INTRODUCTION

In an attempt to achieve the main objective of this research, a population was identified and a procedure employed to select an appropriate and representative sample, and a questionnaire was developed and distributed to the low-cost housing inspectors in the Metropole, by using the method mentioned in chapter three. The personal details of housing inspectors that participated in this research are being withheld in order to protect confidentiality of the housing inspectors.

There were 40 questionnaires that were distributed and 28 questionnaires were returned, given a rate of response of 70%. It is unclear why only 28 questionnaires were returned. In all questionnaires, the respondents indicated that they are housing inspectors. The IBM Statistical Package for Social Sciences (SPSS) Statistics 21 version was provided by the university was used to assist analysing the data collected.

The chapter presents the findings from the survey that was conducted to investigate the effectiveness of the current inspection process applied by low-cost housing inspectors in assuring quality in low-cost housing construction projects in the Metropole. Illustration instruments such as tables, graphs and charts have been used to provide clarity on some of the responses. The data has also been explained and interpreted in text form.

4.2. PRESENTATION OF FINDINGS

4.2.1. HOUSING INSPECTORS WHO RESPONDENT

Table 2 shows the number of questionnaires that were distributed, returned and not returned.

Table 2: Distribution of Questionnaires

Questionnaires	Respondents	Percentage
Distributed	40	100
Returned	28	70
Not Returned	12	30

The presentation and analysis of the results is based on the 28 questionnaires that were returned. The responses are analysed below and illustrations have been provided to simplify the results. In all questionnaires that were returned, the respondents indicated that they were housing inspectors.

4.2.2. EXPERIENCE AS A HOUSING INSPECTOR

The respondents were asked to indicate the years of experience working as low-cost housing inspectors, the results are shown in figure 1 below.

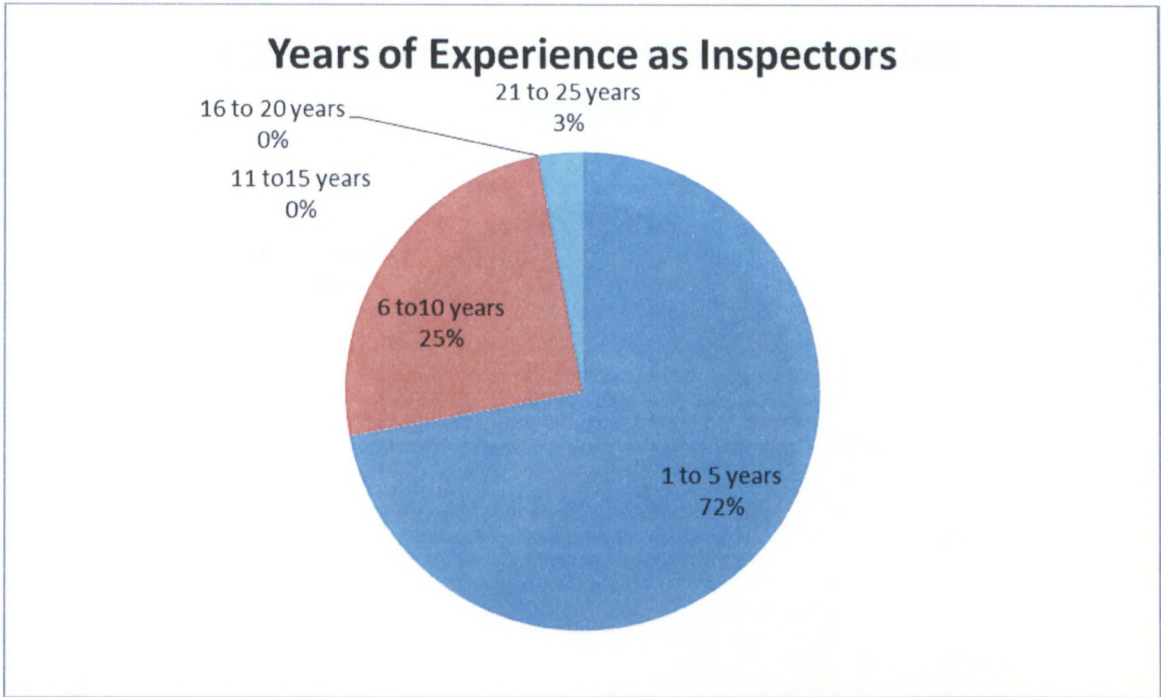


Figure 1: Years of experience as a low-cost housing inspector

The data in figure 1 shows that all the respondents are appropriately experienced as housing inspectors. The majority of the respondents (72%) have between 1 to 5 years of experience as housing inspectors, follow by 6 to 10 years (25%), and 21 to 25 years (3%). There are respondents with experience between 11 to 20 years.

4.2.3. EXPERIENCE IN THE CONSTRUCTION INDUSTRY

Figure 2 shows the years of experience the respondents have reported working in the construction industry.

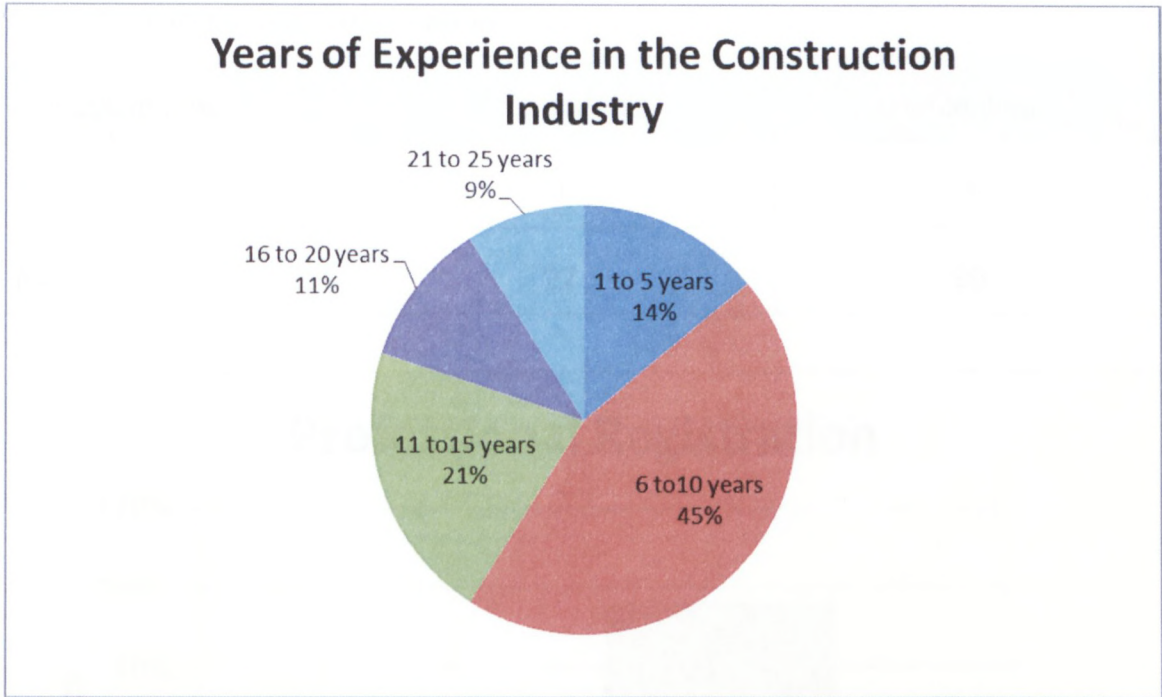


Figure 2: Years of experience in the construction industry

The data in figure 2, suggests that all the respondents are appropriately experienced in the construction industry. The majority of the respondents (45%) have between 6 to 10 years of experience in the construction industry; follow by 11 to 15 years (21%), to 5 years (14%), 16 to 20 years (11%), and 21 to 25 years (9%). There are not respondents with experience between 11 to 20 years.

4.2.4. PROFESSIONAL REGISTRATION

The respondents were asked to indicate whether they are registered as professional housing inspectors or not. The response is shown in table 3 and figure 3.

Table 3: Professional Registration

Questionnaires	Respondents	Percentage
Yes	1	4
No	27	96



Figure 3: Professional Registration

The data in table 3 shows that the majority respondents (96%) do not possess a professional registration in housing inspection. To establish the credibility of the professional registration, all the respondents who indicated “yes” as being registered professionally as a housing inspector, were further asked to state the professional organisational body that they are registered with. In which the one respondent, who

indicated “yes”, never provided the name professional organisational body he or she is registered with. The space for the answer was left blank.

4.2.5. HOUSING INSPECTOR PREVIOUS OCCUPATION

Figure 4 summarises the respondents’ previous occupations, when the respondents were asked to indicate their previous occupation before becoming the housing inspectors.

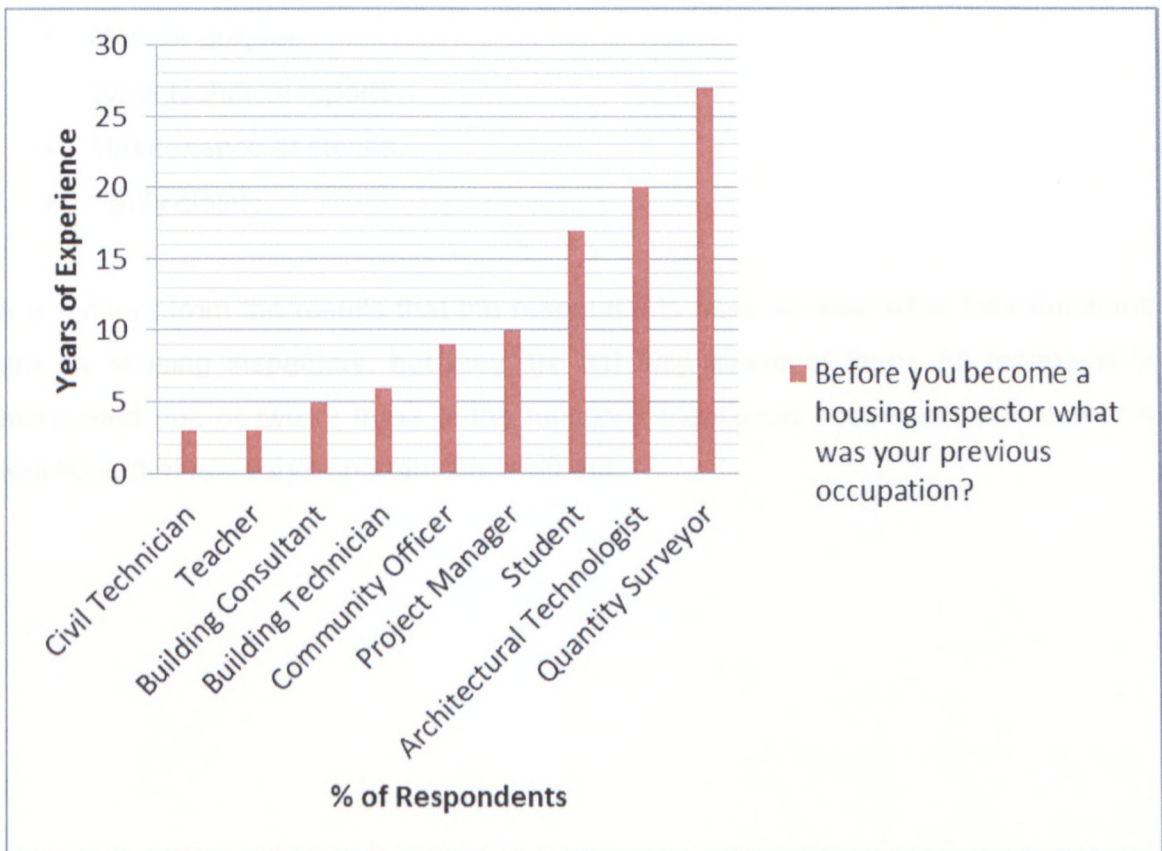


Figure 4: Previous occupation of low-cost housing inspector and tenure of experience of low-cost housing inspector

According to the data in figure 4, the findings suggest that majority of the respondents have been working in the construction industry, in very technical involving positions.

4.2.6. FUNCTIONS OF HOUSING INSPECTOR

To establish whether the housing inspectors are aware of their functions or not, the respondents were asked to state what they believe to be the functions of a housing inspector. The responses were combined and summarised to the following:

- Site Inspections
- Site meetings
- Quality Assurance/ Acceptance or rejection of work
- Monitor progress
- Write technical reports
- Maintenance of stocks
- Verify claims

It is evident from the results that the respondents have an idea what their functions are as housing inspectors, but they are not fully aware of them. All respondents mentioned one or two or three of the functions mentioned above, but still more are functions that are very important were left out.

Qualification	Percentage
National Trade Certificate	35%
National Certificate	20%
National Diploma	20%
Technical Learning Award	15%
Technical Certificate	10%

Table 4 shows that the respondents are appropriately qualified to be housing inspectors. The majority of respondents indicated to have National Trade Certificate (35%) as their highest qualification, followed by Technical Certificate (20%), National Diploma (20%), Intermediate Certificate (15%), and Progress Diploma (10%).

4.2.7. HIGHEST EDUCATION QUALIFICATION OF HOUSING INSPECTORS

The respondents were asked to indicate the highest education qualifications they have obtained. The details of the qualifications possessed by the respondents are indicated in Table 4.

Table 4: highest education qualification possess by low-cost housing inspectors

What is the highest education qualification that you have obtained	Highest Education Level	Qualification	Percentage
	Matriculation Certificate	Matric/Grade 12	8
	Trade Certificate	Carpentry and Plumbing	14
		N3 Carpentry	7
		N6: Building Practices	14
	National Diploma	Civil engineering	11
		Building	7
		Technical Educator	3
	Bachelor's Degrees	Quantity Surveyor	21
		Construction Management	3
		Project Management	3
		Civil Engineering	3
	Honours' Degrees	Technical Drawing Educator	6

Table 4 shows that the respondents are appropriately qualified to be housing inspectors. The majority of respondents indicated to have National Trade Certificate (35%) as their highest qualification, followed by Bachelor's Degrees (30%), National Diploma (21%), Matriculation Certificate (8%), and Honours' Degrees (6%).

4.2.8. CONTINUATION EDUCATION AND TRAINING

To establish whether housing inspectors participated in continuing education and training programmes to ensure that their skills were continually improved. The respondents were asked whether they have undertaken any continuation education and training. The results are shown in table 5 and figure 5.

Table 5: Undertaking of continuation education and training

Questionnaires	Respondents	Percentage
Yes	19	68
No	9	32

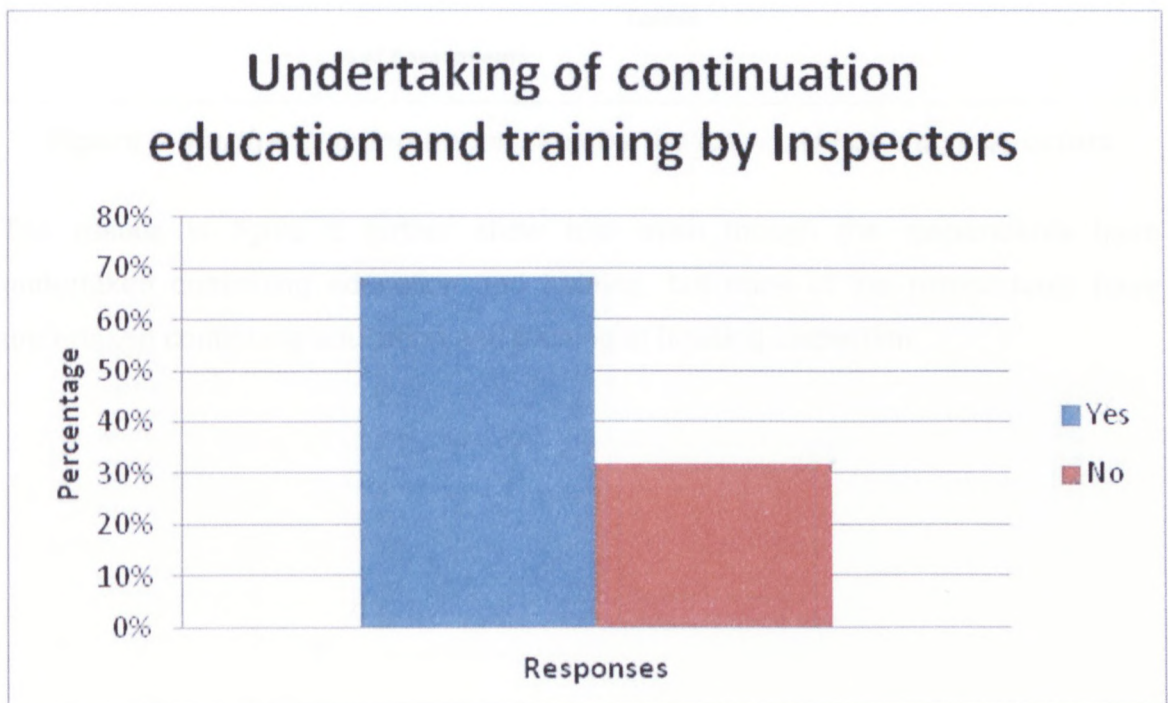


Figure 5: Undertaken of continuation education and training by Inspectors

Table 5 and figure 5 below shows that the majority of respondents (68%) reported that they have undertaken a continuation education and training and 32% indicated that they have not undertaken any continuation education and training.

To establish the nature of continuing education and training that was undertaken by the respondents (68%), they were further asked to state the continuing education and training they have undertaken. Figure 6 shows the details of the results.

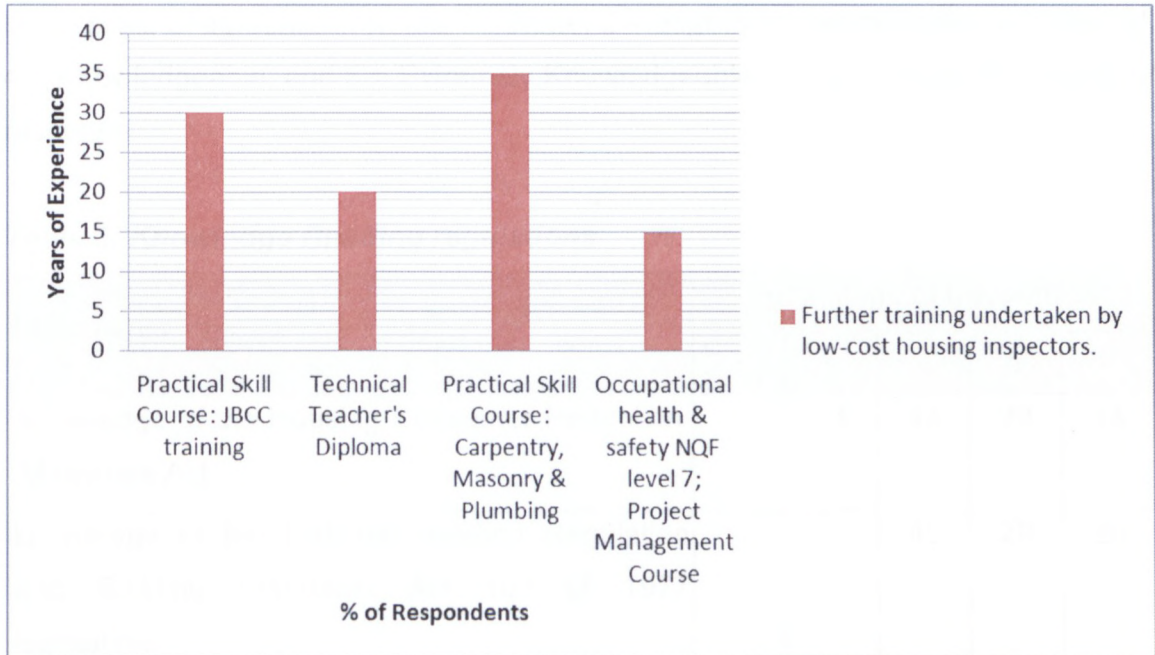


Figure 6: Further training undertaken by the low-cost housing inspectors

The results in figure 6 further show that even though the respondents have undertaken continuing education and training, but none of the respondents have undertaken continuing education and training in housing inspection.

4.2.9. HOUSING INSPECTORS KNOWLEDGE IN BUILDING LEGISLATIONS

To establish the respondents level of knowledgeable in building legislations, several statements were presented to which the respondents had to respond on a 5-point Likert scale of agreement, where 1 = None, 2 = Slightly Knowledgeable , 3 = Neutral, 4 = Knowledgeable, and 5 = Extremely Knowledgeable. Table 6 shows the details of response.

Table 6: Knowledge Building regulations

Statements	Percentage of Responses				
	1	2	3	4	5
knowledge of the Housing Consumer Protection Measures Act		14	43	29	14
knowledge of the National Building Regulation and Building Standards Act 103 of 1977 legislation			43	29	28
knowledge of the National Building Regulation		14	29	29	28
knowledge of the SABS 0400		14	43	14	29

The data in table 6 shows that the +/- 50% of respondents have positively responded that they are knowledgeable on Consumer Protection Measures Act, National Building Regulation and Building Standards Act 103 of 1977 legislation, National Building Regulation and SABS 0400. With +/-50% are either have indicated that they are not sure and/or they are slightly knowledgeable.

4.2.10. EDUCATION QUALIFICATION AND CONTINUING EDUCATION AND TRAINING CONTRIBUTION TO INSPECTION

The respondents were asked to indicate their opinion on whether lack education qualification and continuing education and training contributes to poor inspection process. Table 7 and figure 7 show the results.

Table 7: Inspectors' perception regarding education and training

Questionnaires	Respondents	Percentage
Yes	20	71
No	8	29

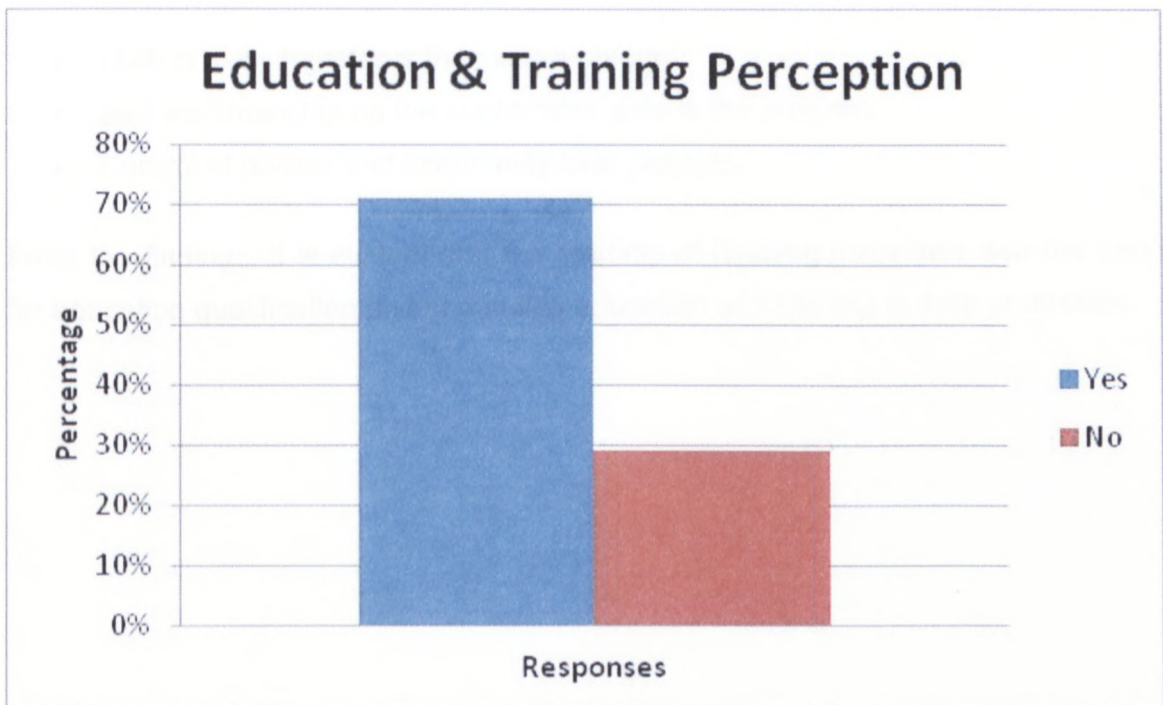


Figure 7: Education and training perception

Table 7 and figure 7 show that 29% of the respondents do not believe that lack education qualification and continuing education and training contribute to poor inspection process, while 71 % of the respondents believe so.

The respondents were asked to provide reasons for the answers they had given above. The respondents, who responded that they believe that lack education qualification and continuing education and training contribute to poor inspection process, substantiate their answer by providing the following reasons:

- Quality assurance and/or inspection needs to be explained.
- Everyone needs a background of his or her field.
- Inspectors should be knowledgeable regarding building practice policies.
- No education and no training lead to unskilled and then to poor quality.
- Theory and practise of building construction is very important.

Respondents, who responded that they do not believe that lack education qualification and continuing education and training contribute to poor inspection process, substantiate their answer by providing the following reasons:

- Lack of skills transfer is the main problem.
- Bad workmanship on the contractors' side is the problem.
- Control of politics and community over projects.

From the findings, it is evident that the majority of housing inspectors see the need for education qualification and continuing education and training in their profession.

4.2.11. INSPECTION AT THE FOUNDATION STAGE

To establish whether during housing construction the foundation stage is inspected, the respondents were asked to respond on several questions regarding their last inspection at a foundation stage of housing construction. Table 8 shows the respondents' reports.

Table 8: Inspection during a housing construction at a foundation stage

Remember your last inspection during a housing construction at a foundation stage. Please indicate if whether you inspected the following or not.	Questions	Percentage of Responses	
		Yes	No
	Did you inspect the trenches?	71	29
	Did you inspect the concrete before it was cast?	71	29
	Did you inspect the footings?	71	29
	Did you inspect the foundation slab?	100	0
	Did you inspect the foundation walls?	100	0
	Did you inspect the backfill and compaction?	71	29
	Did you inspect the underground plumbing?	55	45

The data in table 8 shows that 71% of respondents did inspect the trenches, concrete, footings, foundation walls and backfilling and compaction. All respondents indicated that they inspected the foundation slab and walls. While 55% of the respondents indicated that they inspected the underground plumbing.

The respondents were asked to indicate the methods they used to conduct inspection at this stage and provide reasons for using the methods. The answers the respondents provided are combined and summarised to the following:

- Visual method - You need to comply
- Plan, Department's norms and standards - Manual given by the department and Specification
- Levels - Check compliance with norms and standards of department

The respondents were asked to indicate the techniques they used to conduct inspection at this stage and provide reasons for using the techniques. The answers the respondents provided are combined and summarised to the following:

- Visual method - You need to comply
- Self knowledge -
- Tape measure, pegs - Experience
- Plan, Department's norms and standards – for compliance

The respondents were asked to indicate the tools they used to conduct inspection at this stage and provide reasons for using the tools. The answers the respondents provided are combined and summarised to the following:

- Plan, tape measure, level, square - Everything must be according to the plan, To check square, to check level - For compliance
- Plan, Department's norms and standards - For compliance

The respondents were further asked whether they believe that there are benefits at for conducting inspection at this stage, all respondents indicated that there are benefits, the reasons they provided for believing this are combined and summarised to the following:

- Delivery quality foundation
- Prevent encroachment of boundary lines
- Ensure the right size the house
- Ensure that the house is building as per plan

4.2.12. INSPECTION AT THE FRAMING AND WALL STAGE

To establish whether during housing construction the framing and walling stage is inspected, the respondents were asked to respond on several questions regarding their last inspection at a framing and walling stage of housing construction. Table 9 shows the respondents' reports.

Table 9: Inspection during a housing construction at a framing/ walling stage

Remember your last inspection during a housing construction at a walling stage. Please indicate if whether you inspected the following or not.	Questions	Percentage of Responses	
		Yes	No
	Did you inspect the wood or steel framing?	86	14
	Did you inspect the exterior walls?	86	14
	Did you inspect the interior walls?	86	14
	Did you inspect the roof sheathing?	86	14
	Did you inspect the exterior trim and sliding?	57	43
	Did you inspect the windows?	86	14
	Did you inspect the interior and exterior doors?	86	14

The data in table 9 shows that the majority of the respondents (86%) indicated that they inspected framing, exterior walls, interior walls, roof sheathing, windows, and interior and exterior doors. The respondents with 57% inspected the exterior trim and sliding on their last inspection.

The respondents were asked to indicate the methods they used to conduct inspection at this stage and provide reasons for using the methods. The answers the respondents provided are combined and summarised to the following:

- NHBRC norms and standards – it is the requirement of NHBRC
- Levels - Check compliance with norms and standards of department, square
- Tape measure – for length

The respondents were asked to indicate the techniques they used to conduct inspection at this stage and provide reasons for using the techniques. The answers the respondents provided are combined and summarised to the following:

- NHBRC norms and standards – it is the requirement of NHBRC
- Visual – ensure durability

The respondents were asked to indicate the tools they used to conduct inspection at this stage and provide reasons for using the tools. The answers the respondents provided are combined and summarised to the following:

- Spirit level, tape measure, plan – check compliance

The respondents were further asked whether they believe that there are benefits at for conducting inspection at this stage, all respondents indicated that there are benefits, the reasons they provided for believing this are combined and summarised to the following:

- Delivery quality walls
- Ensure that the house is building as per plan
- Eliminate water penetration

4.2.13. INSPECTION AT THE INSULATION AND DRY WALL STAGE

To establish whether during housing construction the insulation and dry wall stage is inspected, the respondents were asked to respond on several questions regarding their last inspection at a framing and walling stage of housing construction, the results are shown in table 10. The data in table 9 shows that 71% of the respondents did not inspect insulation and drywall, only 29% did.

Table 10: Inspection during a housing construction at an insulation and drywall stage

Remember your last inspection during a housing construction at an insulation and dry wall stage. Please indicate if whether you inspected the following or not.	Questions	Percentage of Responses	
		Yes	No
	Did you inspect the wall insulation?	29	71
	Did you inspect the dry wall installation?	29	71
	Did you inspect the tape and texture?	29	71

The respondents were asked to indicate the methods they used to conduct inspection at this stage and provide reasons for using the methods. The answers the respondents provided are combined and summarised to the following:

- Specification, norms, standards and agreement – it is a requirement by NBRBA

The respondents were asked to indicate the techniques they used to conduct inspection at this stage and provide reasons for using the techniques. The answers the respondents provided are combined and summarised to the following:

- Specification, norms, standards and agreement – it is a requirement by NBRBA

The respondents were asked to indicate the tools they used to conduct inspection at this stage and provide reasons for using the tools. The answers the respondents provided are combined and summarised to the following:

- Specification, norms, standards and agreement – it is a requirement by NBRBA

The respondents were further asked whether they believe that there are benefits at for conducting inspection at this stage, eight of respondents indicated that there are benefits, table 11 shows the results.

Table 11: Benefits of Conducting Inspection at Insulation and Dry Wall Stage

Questionnaires	Respondents	Percentage
Yes	8	29
No	20	71

The respondents, who believe that there are benefits for conducting inspection at this stage, provided the following reason for selecting the answer:

- To ensure quality

The respondents, who believe that there are no benefits for conducting inspection at this stage, did not provide reasons for their belief. The space for an answer was left blank.

4.2.14. INSPECTION AT THE PAINT, TRIM AND FINISHING STAGE

To establish whether during housing construction the paint, trim and finishing stage is inspected, the respondents were asked to respond on several questions regarding their last inspection at a framing and walling stage of housing construction. Table 12 shows that the all respondents inspected finished flooring and wall tie, 71% of the respondents did inspect countertops, final electrical and final plumbing, and 43% inspected the final mechanical.

Table 12: Inspection during a housing construction at paint, trim and finishing stage

Remember your last inspection during a housing construction at a walling stage. Please indicate if whether you inspected the following or not.	Questions	Percentage of Responses	
		Yes	No
	Did you inspect the finished flooring?	100	0
	Did you inspect the countertops?	71	29
	Did you inspect the wall tie?	100	0
	Did you inspect the final electrical?	71	29
	Did you inspect the final plumbing?	71	29
	Did you inspect the final mechanical?	43	57

The respondents were asked to indicate the methods they used to conduct inspection at this stage and provide reasons for using the methods. The answers the respondents provided are combined and summarised to the following:

- Visual method - You need to comply

The respondents were asked to indicate the techniques they used to conduct inspection at this stage and provide reasons for using the techniques. The answers the respondents provided are combined and summarised to the following:

- Visual method - You need to comply

The respondents were asked to indicate the tools they used to conduct inspection at this stage and provide reasons for using the tools. The answers the respondents provided are combined and summarised to the following:

- Visual method - You need to comply

The respondents were further asked whether they believe that there are benefits at for conducting inspection at this stage, all respondents indicated that there are benefits, the reasons they provided for believing this are combined and summarised to the following:

- Delivery quality

4.2.15. EFFECTIVENESS OF THE CURRENT HOUSING INSPECTION PROCESS

Respondents were asked if whether they believe that the current housing inspection process used in the Metropole area is effective. Figure 8 show that the majority of the respondents (69%) believe that it is effective and 29% of the respondents do not believe that it is effective.

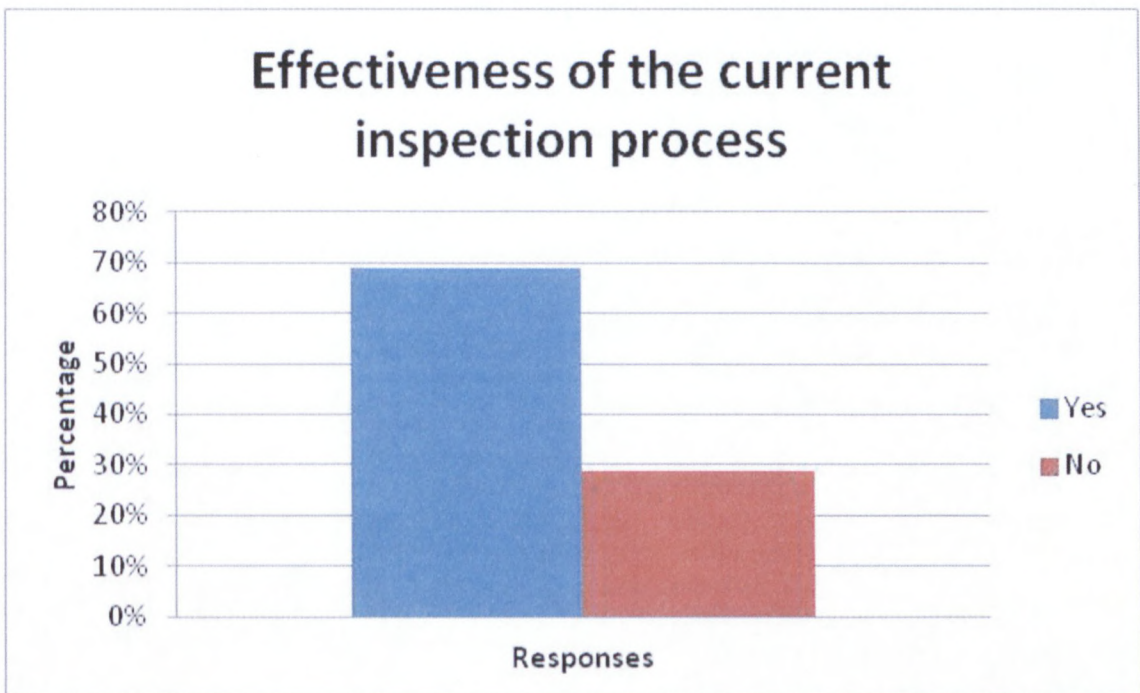


Figure 8: Effectiveness of the current housing inspection process

The respondents who indicated that they believe that the current housing inspection process used in the Metropole area is effective, the reasons they gave are combined and summarised as follow:

- The inspection is conducted based on the norms and standards of the department.
- Three inspections process are conducted for complains. One is done by the building inspector, then by NHBRC inspector and other by department inspector.

The respondents who indicated that they do not believe that the current housing inspection process used in the Metropole area is effective, The reason that all mentioned is that there is no inspection training provided, not by department of Human Settlement.

One respondent did not provide any response to this question. The space was left blank.

4.2.16. ACCOUNTABLE FOR POOR QUALITY

The respondents were asked to indicate their opinion about who should be held accountable for poor quality of low-cost housing in the Metropole area. Table 13 shows the answers provided by the respondents.

Table 13: Accountable for poor quality of low-cost housing

Respondents	Percentage	Answers
12	43%	NHBRC
16	57%	Contractors

Table 13 show that the respondents do not believe that they should be held accountable for poor quality in housing, actually the respondents indicated that believe that NHBRC and contractors should be held accountable.

4.2.17. PERCEPTIONS OF HOUSING INSPECTORS IN REGARD TO THE EXISTING INSPECTION PROCESS

To establish the perception of housing inspectors with regard to the existing inspection process, several statements were presented to which the respondents had to respond on a 5-point Likert scale of agreement where 1=totally disagree, 2=slightly disagree, 3=neutral, 4=slightly agree and 5=totally agree). Table 12 shows the results of the respondents. These perceptions will be link with the above sections of this chapter in the conclusion.

The majority of the respondents (50%) reported that they agree that lack of qualifications in the inspection professional leads to poor inspections, 78% agree that lack of experience in the construction industry leads to poor inspections, 86% agree that lack of technical expertise in the construction industry leads to poor inspections, 64% agree that lack of training for housing inspectors' leads to poor inspections, 50% disagree that the current training provided to inspectors is enough to carry out a successful inspection. While 86% of the respondents agree that housing Inspection ensures compliance with minimum building standards and regulations, 56% disagree that the house inspection forms the core of quality assurance in housing construction, 50% disagree that the housing inspectors are fully aware of their roles and responsibilities, 50% disagree that the housing inspectors do not fulfil their roles and responsibilities, 56% disagree that the housing inspectors are the core for enforcing compliance with building regulation in house construction, 64% disagree that failures of housing inspectors to enforce compliance the building regulation in results poor quality. Also 46% of the respondents indicated neutral on the statement that housing inspection does not ensure that suitable material, 32% agree that housing inspection does not ensure good workmanship, 50% agree that housing inspection does not ensure that quality construction methods are used, 68% agree that housing Inspection ensures the safety and welfare of the residents, 64% agree that lack of effective inspection process contributes to use of poor material in house construction, 82% agree that lack of effective inspection process contributes to poor workmanship in house construction, and 79% disagree that lack of effective inspection process contributes to poor quality in house construction. Furthermore 32% of the respondents agree that housing

Inspection is not important during housing construction, 68% agree that housing inspection is important when the housing construction has been completed.

Table 14: Perception of housing inspectors with regard to the existing inspection process

Statements	1	2	3	4	5
Lack of qualifications in the inspection professional leads to poor inspections.	32		18		50
Lack of experience in the construction industry leads to poor inspections.	22			22	56
Lack of technical expertise in the construction industry leads to poor inspections.	14			14	72
Lack of training for housing inspectors' leads to poor inspections.	18		18	18	46
The current training provided to inspectors is enough to carry out a successful inspection.	50		32		18
Housing Inspection is not important during housing construction.	50		18		32
Housing Inspection is important when the housing construction has been completed.			32	12	56
Housing Inspection ensures compliance with minimum building standards and regulations.			14	14	72
Housing Inspection does not ensure that suitable material.	18		46	18	18
Housing Inspection does not ensure good workmanship.	32		36		32
Housing Inspection does not ensure that quality construction methods are used.	32		18	32	18
Housing Inspection ensures the safety and welfare of the residents.	14		18	18	50
House Inspection forms the core of quality assurance in housing construction.	56		18	18	
Housing Inspectors are fully aware of their roles and responsibilities.	32	18	32		18
Housing Inspectors do not fulfil their roles and responsibilities.	50		32		18
Housing Inspectors are the core for enforcing compliance with building regulation in house construction.	56		18	18	
Failures of housing inspectors to enforce compliance the building regulation in results poor quality.	32	32		18	18
Lack of effective inspection process contributes to use of poor material in house construction.		18	18	32	32
Lack of effective inspection process contributes to poor workmanship in house construction.			18	50	32
Lack of effective inspection process contributes to poor quality in house construction.	29	50	21		

Table 14 suggests that the respondents have different perceptions regarding their functions and impact of their functions to other crucial components and process that form core of the house. The indifferent perceptions of the personnel can impact their ability to function properly either negative or positive.

4.3. CONCLUSION

This chapter presented the findings of the questionnaire surveys carried out from the low-cost housing inspectors in the Metropole. Out of the 40 questionnaires that were distributed to various low-cost housing inspectors and 28 questionnaires were returned. The questionnaire surveys were based on the experience, education, training and knowledge of the low-cost housing inspectors have in the construction industry, the awareness and fulfilment of inspectors' roles and responsibilities, the last inspection that the inspectors did, their perception regarding the contribution that inspection make in use of suitable material, good workmanship and quality construction methods during housing construction. As the data were collected and analysed to establish the competency of housing inspectors and effectiveness of inspection process applied in assuring quality in low-cost housing construction projects in the Metropole. Deductions made from the collected data will be presented in the next chapter together with conclusion and recommendations of the research.

5. CHAPTER FIVE – CONCLUSION AND RECOMMENDATIONS

5.1. INTRODUCTION

From the data collected from the survey and the analysis of the results, this chapter presents the conclusions that are drawn from the findings, and recommendations are made based on these conclusions, along with describing the recommendation for further research.

5.1. CONCLUSION

The research established that housing inspection in general is about improving the quality standards, reduce remedial work in the housing construction industry and ensure health and safety of the workmanship and occupants. However, these objectives can only be achieved by competent housing inspectors, and competent inspectors must be appropriately qualified by virtue of their education, training, experience and contextual knowledge. It is evident that housing inspectors are adequately and appropriately qualified and possessed a level of experience in the construction industry that demonstrates their ability to apply the knowledge and skills gained and applied, refer to section 4.2.2, 4.2.3 and 4.2.7 in the previous chapter. However, even though there is evidence that some of the housing inspectors have undertaken continuous education and training, but the evidence further shows that the continuous education and training that have been undertaken is only on technical aspects relating to construction. Referring to section 4.2.8, of the previous chapter, it is evident that the housing inspectors have not received continuous education and training relating to housing inspection.

Though the housing inspectors possess the appropriate qualification and relevant experience, but due to lack of continuous education and training in housing inspection, a conclusion can be drawn that housing inspectors are not competent enough. As shown in section 4.2.17, table 14, this conclusion is also supported by

respondents view that lack of qualifications and experience in the construction industry and lack of continuous training and education by housing inspectors lead to poor inspection. The respondents further view that the current continuous education and training provided by Human Settlement department to housing inspectors does not equip the housing inspectors well enough to carry out a successful inspection.

Although it is an accepted practice that housing inspectors must accustom themselves with building legislation and code of practice that govern the housing construction industry. The findings in section 4.2.9, give evidence that almost half of the housing inspectors are not knowledgeable of building standards and regulations that they are supposed to ensure and enforce for compliance. Housing Inspection is viewed by the respondents as it ensures and enforces compliance of building standards and regulations. However, the respondents do not view that housing inspectors are the core for ensuring and enforcing compliance of building legislation in house construction and failure of housing inspectors to enforce compliance of the building legislation result to poor quality, referring to section 4.2.17, table 17.

Section 4.2.6 in the previous chapter shows that housing inspectors reported that they are not aware of their roles and responsibilities. The respondents also viewed that the housing inspectors are not fully aware of their roles and responsibilities, and they also do not fulfil their roles and responsibilities, refer to table 14. It is arguably that if the housing inspectors are not aware of their roles and responsibilities that mean the housing inspectors do not execute their responsibilities effectively.

The majority of South African contractors in the housing construction industry are emerging contractors; hence frequently monitoring for compliance with the legislation is very important. Due to housing inspectors' lack of knowledge on building legislation and lack of awareness of their roles and responsibilities, a conclusion can be made that housing inspectors are ineffective in ensuring and enforcing the compliance of building legislations.

The research further recognised that housing inspection is vital to achieve the desired inspection of ensure quality standards, suitable material, good workmanship and right construction methods in the housing construction industry. However, the

respondents have a different view. As show in section 4.2.17, table 14 that though the respondents view that lack of effective inspection contributes to unsuitable use of materials and poor workmanships during construction, but they view that inspection does not ensure that quality construction methods used during construction. Referring to section 4.2.11, 4.2.12, 4.2.13 and 4.2.14, evidence further shows that there are inconsistencies with the inspection conducted in all stages of housing construction among the inspectors, this include methods, tools and techniques used to inspect.

Finally, supported by evidence in section 4.2.11, 4.2.12, 4.2.13 and 4.2.14, and respondents' further view that the current housing inspection process applied in the Metropole area is not effective, refer to section 4.2.17, it can be concluded that the inspection process applied by housing inspectors is ineffective.

5.2. RECOMMENDATIONS

Continuous education and training is the gaining of knowledge, skills and competencies as a result of the teaching of professional or practical skills and knowledge that relate to specific useful capabilities. Continuous education and training has specific goals of improving one's capability, capacity and performance. Noting that the housing inspectors are not adequately trained and educated in housing inspection, a recommendation is made that the Human Settlement department should make provision for continuous education and training relating to inspection and construction to be provided to the housing inspectors.

The building legislations provide promotion of uniformity in the law relating to the construction of buildings and are aimed at ensuring not just quality of buildings, but also the health and safety of the occupants. Though it is an accepted practice that the housing inspectors must accustom themselves with building legislations, evidence has shown that the housing inspectors are not knowledgeable in building legislations. Therefore, it is recommended that the Human Settlement department should ensure and enforce housing inspectors to familiarise themselves with building legislations. This can form part of the continuous education and training programme.

Generally, the roles and responsibilities of housing inspectors range from approving incoming materials by confirming specifications, conducting visual and measurement tests, rejecting and returning unacceptable materials, communicating required adjustments to construction supervisor; to approving finished components of a house by confirming specifications, conducting visual and measurement tests, order re-work; confirming re-work; and also maintains safe and healthy work environment by following standards and procedures; complying with legal regulations. Evidence has shown that housing inspectors are not aware of their roles and responsibilities, nor standard procedure or process and guide for conducting inspection. The results further show that there are inconsistencies with the inspection process applied by housing inspectors. It is therefore recommended that the Human Settlement department review the roles and responsibilities of housing inspectors and established awareness of roles and responsibilities to housing inspectors. Furthermore, review the standard procedures for conducting inspection and established awareness of these procedures to housing inspectors and affected parties.

5.3. FURTHER RESEARCH

During the course of this research it became apparent that inspection process plays a very important role in assuring quality during housing construction. In order for inspection to be effective the person who carries out the inspection needs to be competent. It is accepted profession that on top of education and experience, the continuous education and training is essential to the competence of the any professional, for it continually improve the skills of the professional. However, there is little published research regarding what should form core of continuous education and training for inspectors. Therefore more research is required in this area.

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APPENDICES:

APPENDIX 1: LETTER REQUESTING CONSENT FOR THE PARTICIPATES



Cape Peninsula
University of Technology

13 February 2013

Dear Sir/Madam

Quality Assurance in Low-Cost Housing Construction Projects in the Metropole

My name is Manelisi Rarani, a student at Cape Peninsula University of Technology, and I am carrying out a research in partial fulfilment of my studies in MTech Business Administration in Project Management.

The study is being conducted to determine the extent of quality assurance in low-cost housing construction projects in the Metropole. To facilitate this research, a questionnaire survey is being administered and your voluntary participation is kindly requested.

Your response will be treated with the strictest confidentiality and will only be used for the purpose of this study.

Your valued contribution is greatly appreciated.

Thank you.

Yours sincerely

Researcher: Manelisi Rarani

Student number: 206017960

Cell: 0738373578

E-mail address: Manelisi.Rarani@aurecongroup.com

Supervisor: Stanley Fore

Cell: 0214603516

E-mail address: ForeS@cput.ac.za

APPENDIX 2: RESEARCH QUESTIONNAIRE

QUESTIONNAIRE

The purpose of this questionnaire is to determine the effectiveness of housing inspection process applied by housing inspectors to assure quality in low-cost housing construction in the Metropole.

Please indicate with an "X" if we have your consent to use you as one of our participants in the research. Also note that your identity will be treated with strict confidential.

I consent	<input type="checkbox"/>	I do not consent	<input type="checkbox"/>
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If you have given your consent, please continue with the questionnaire. If you did not give your consent, please discontinue with the questionnaire.

1. Are you currently employed as a housing inspector in the Metropole?

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
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If you have indicated "Yes", please continue with the questionnaire. If you have indicated "No", please discontinue with the questionnaire.

2. How many years of experience do you have in this position? _____ years
3. How many years of experience do you have in the construction industry? _____ years
4. Are you registered professionally as a housing inspector?

Yes	<input type="checkbox"/>	No	<input type="checkbox"/>
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If "Yes", please state the professional organisation you are registered with?

5. Before you become a housing inspector what was your previous occupation?

6. What are your functions as a housing inspector?

SECTION A: EDUCATION, KNOWLEDGE and TRAINING

This section focuses on the education, knowledge and training possess by housing inspectors.

7. What is the highest education qualification that you have obtained? Please give details of your qualification.

Education Level	Details

8. Have you obtained any qualification in the construction industry?

Yes No

If "Yes", please give details of the qualification?

9. Have you undertaken any further training?

Yes No

If "Yes", please specify the training?

10. On a scale of 1-5 what is your knowledge on the following documents listed below? (1-none, 2-slightly knowledgeable, 3-neutral, 4- knowledgeable and 5-extremely knowledgeable) please mark with an "X" where applicable.

Documents	1 None	2 Slightly	3 Neutral	4 Knowledgeable	5 Extremely knowledgeable
Housing Consumer Protection Measures Act (NHBRC Home Builders Manual)					
National Building Regulation (NBR)					
National Building Regulation and Building Standards Act 103 of 1977 legislation					
SABS 0400					

11. Do you believe that the lack of education and training in construction contributes to poor inspection process?

Yes No

Give reason for the above answer.

SECTION B: CONDUCTING HOUSING INSPECTION PROCESS

This section focuses on the inspection process conducted during a housing construction.

Remember your last inspection during a housing construction at a foundation stage.

12. Please indicate if whether you inspected the following or not.

Questions	Yes	No
Did you inspect the trenches?		
Did you inspect the concrete before it was cast?		
Did you inspect the footings?		
Did you inspect the foundation slab?		
Did you inspect the foundation walls?		
Did you inspect the backfill and compaction?		
Did you inspect the underground plumbing?		

13. What methods did you use in conducting the inspection at this stage?

Give reasons for using the methods mentioned above.

14. What techniques did you use in conducting the inspection at this stage?

Give reasons for using the techniques mentioned above.

15. What tools did you use in conducting the inspection at this stage?

Give reasons for using the tools mentioned above.

16. Are there benefits for conducting an inspection at this stage?

Yes	No
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Give reasons for the above answer.

Remember your last inspection during a housing construction at a framing/ walling stage.

17. Please indicate if whether you inspected the following or not.

Questions	Yes	No
Did you inspect the wood or steel framing?		
Did you inspect the exterior walls?		
Did you inspect the interior walls?		
Did you inspect the roof sheathing?		
Did you inspect the exterior trim and sliding?		
Did you inspect the windows?		
Did you inspect the interior and exterior doors?		

18. What methods did you use in conducting the inspection at this stage?

Give reasons for using the methods mentioned above.

19. What techniques did you use in conducting the inspection at this stage?

Give reasons for using the techniques mentioned above.

20. What tools did you use in conducting the inspection at this stage?

Give reasons for using the tools mentioned above.

21. Are there benefits for conducting an inspection at this stage?

Yes	No
-----	----

Give reasons for the above answer.

Remember your last inspection during a housing construction at an insulation and drywall stage.

22. Please indicate if whether you inspected the following or not.

Questions	Yes	No
Did you inspect the wall insulation?		
Did you inspect the dry wall installation?		
Did you inspect the tape and texture?		

23. What methods did you use in conducting the inspection at this stage?

Give reasons for using the methods mentioned above.

24. What techniques did you use in conducting the inspection at this stage?

Give reasons for using the techniques mentioned above.

25. What tools did you use in conducting the inspection at this stage?

Give reasons for using the tools mentioned above.

26. Are there benefits for conducting an inspection at this stage?

Yes	No
-----	----

Give reasons for the above answer.

Remember your last inspection during a housing construction at paint, trim and finishing stage.

27. Please indicate if whether you inspected the following or not.

Questions	Yes	No
Did you inspect the finished flooring?		
Did you inspect the countertops?		
Did you inspect the wall tie?		
Did you inspect the final electrical?		
Did you inspect the final plumbing?		
Did you inspect the final mechanical?		

28. What methods did you use in conducting the inspection at this stage?

Give reasons for using the methods mentioned above.

29. What techniques did you use in conducting the inspection at this stage?

Give reasons for using the techniques mentioned above.

30. What tools did you use in conducting the inspection at this stage?

Give reasons for using the tools mentioned above.

31. Are there benefits for conducting an inspection at this stage?

Yes	No
-----	----

Give reasons for the above answer.

SECTION C: PERCEPTIONS OF THE INSPECTORS IN REGARD TO THE EXISTING INSPECTION PROCESS

This section focuses on the perceptions of the housing inspectors in regard to the housing inspection process.

32. Do you believe that the current housing inspection process used in the Metropole area is effective?

Yes	No
-----	----

Give reasons for the above answer

33. Who should be held accountable for poor quality of low-cost houses Metropole area?

34. Please indicate the extent of your agreement to the statements below? (1-totally disagree, 2-slightly disagree, 3-neutral, 4-slightly agree and 5-totally agree) please mark with an X where applicable.

Statements	1- totally disagree	2 - slightly disagree	3 neutral	4 - slightly agree	5 - totally agree
Lack of qualifications in the inspection professional leads to poor inspections.					
Lack of experience in the construction industry leads to poor inspections.					
Lack of technical expertise in the construction industry leads to poor inspections.					
Lack of training for housing inspectors' leads to poor inspections.					
The current technical expertise required to be housing inspector is enough to successfully carry out an inspection.					
The current training provided to inspectors is enough to carry out a successful inspection.					
Housing Inspection is not important during housing construction.					

Statements	1- totally disagree	2 - slightly disagree	3 - neutral	4 - slightly agree	5 - totally agree
Housing Inspection is important when the housing construction has been completed.					
Housing Inspection ensures compliance with minimum building standards and regulations.					
Housing Inspection does not ensure that suitable material.					
Housing Inspection does not ensure good workmanship					
Housing Inspection does not ensure that quality construction methods are used.					
Housing Inspection ensures the safety and welfare of the residents.					
House Inspection forms the core of quality assurance in housing construction.					
Housing Inspectors are fully aware of their roles and responsibilities.					
Housing Inspectors do not fulfil their roles and responsibilities.					
Housing Inspectors are the core for enforcing compliance with building regulation in house construction.					
Failures of housing inspectors to enforce compliance the building regulation in results poor quality.					
Housing Inspectors are equally responsible with the contractors for the final quality of a house.					
Lack of effective inspection process contributes to use of poor material in house construction.					
Lack of effective inspection process contributes to poor workmanship in house construction.					
Lack of effective inspection process contributes to poor quality in house construction.					

APPENDIX 3: PERMISSION TO CONDUCT THE RESEARCH



**Western Cape
Government**
Human Settlements

PEOPLES HOUSING AND EMPOWERMENT PROCESS

**ENQUIRIES: R Thabatha
EXTENSION: 021 483 2243**

To whom it may concern

**Re: Permission to conduct a research at Human Settlement, People's Housing Process for
MTech Business Administration in Project Management Research- Manelisi Rarani**

We hereby grant permission to Manelisi Rarani to carry out his research on Quality Assurance and Control in the Human Settlement Department, People's Housing Process to in fulfilment of the MTECH Business Administration in Project Management at Cape Peninsula University of Technology (CPUT).

All information generated from this will be treated with confidentiality and is for academic purposes only.

Yours sincerely,



**ACTING DEPUTY DIRECTOR
PEOPLE'S HOUSING EMPOWERMENT PROCESS**

DATE: 26 MARCH 2012

9th Floor, 27 Wale Street, Cape Town, 8001
tel: +27 21 483 4858 fax: +27 21 483 4510

Private Bag X9083, Cape Town, 8000
www.westerncape.gov.za

CAPE PENINSULA
UNIVERSITY OF TECHNOLOGY

